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

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

by

S.J. Rijkenberg, August 1996

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Preface

This report contains the results of the research which has been executed for the purpose of taking a Master of Science degree in International Technological Development Sciences at the Eindhoven University of Technology (EUT), the Netherlands.

The preparations for this research started in March 1995. The field research took place at the branch office of Skanska Jensen International (SJI) in Dar es Salaam, Tanzania, during the period July 1995 until January 1996.

I would like to seize this opportunity to thank all the people at SJI who supported me in the execution of my research. In specific, I would like to thank Mr. Pedersen, contract manager at SJI, who enabled me to make an incredible flight from Dar es Salaam to Iringa. Furthermore, I want to thank Michael Svendsen, project manager, and Ole Vexø, assistant site manager, for their support to this 'shy girl'. They offered me a place to stay in Iringa and a lot of their precious time. Special thanks also to Valery who showed endless patience when it came to the use of her computer during the final period of my stay at SJI.

I also want to thank my parents, whose everlasting support goes as far as a visit to Tanzania. And they even loved every minute of being squeezed in a 'dala dala'! And of course thanks to my brother (and pal) for 'all' those poetic letters which I received during my stay in Tanzania. I hope he ever overcomes his fear for frontiers.

I also want to thank my supervisors at the EUT in The Netherlands, Mrs. Ir. E. van Egmond - de Wilde de Ligny, Dr. P.A. Erkelens and Drs. H. Gaillard. Without them this report might very well have resulted in chaos. In specific I would like to thank Mrs. Ir. E. van Egmond for her precious spare time and for her support with respect to the realisation of my plans for the next year.

Last, but certainly not least, I want to thank Jan for his patience with respect to all the doubts I have had concerning a positive outcome of this research and for all the time he invests in supporting me.

Eindhoven
August 1996

Saskia Rijkenberg

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Acronyms

AC	Africa Construction
BRU	Building Research Unit
CCM	Chama Cha Mapinduzi
CPI	Consumer Price Index
CTB	Central Tender Board
DANIDA	Danish International Development Agency
DKK	Danish Kroner
ERP	Economic Recovery Programme
FINNIDA	Finnish International Development Agency
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GNP	Gross National Product
HDI	Human Development Index
IMF	International Monetary Fund
MECCO	Mwananchi Engineering and Contracting Company
MOW	Ministry of Works
NBAQS&BC	National Board of Architects, Quantity Surveyors & Building Contractors
NBC	National Bank of Commerce
NCC	National Construction Council
NSTC	National Science and Technology Commission
ODA	Official Development Assistance
OTTU	Organisation of Tanzanian Trade Unions
R&D	Research and Development
RPFB	Rolling Plan and Forward Budget
SAP	Structural Adjustment Programme
SJI	Skanska Jensen International
TAMICO	Tanzania Mining and Construction workers union
TANU	Tanganyika African National Union
TBCA	Tanzania Building Contractors Association
TBS	Tanzanian Bureay of Standards
TECCO	Tanganyikan Engineering Contracting Company
Tsh.	Tanzanian shillings
US$	United States dollars
VTSC	Vocational Training and Service Centre
WB	World Bank

Executive summary

This research focuses on productivity improvement at a foreign contracting company (Skanska Jensen International) which operates within the Tanzanian construction sector. The basic definition of productivity is 'the ratio of output produced to inputs used within a given period of time'. The inputs are transformed into output during the so-called transformation process. This process is part of a certain system. Output, inputs, transformation process and system are the four productivity elements. Output and input can be expressed using financial -, physical -, or time units. The former provide the best opportunity for aggregating different inputs. The input does not necessarily have to comprise all inputs used. Based on the above, it results that many different productivity definitions exist. Within a specific environment, the productivity elements will each have to be considered and defined, before the productivity concept can be applied to this environment.

Within the construction environment, considered on the level of the building site, productivity can be defined as 'the ratio of the value of the site output to the costs of the direct input factors, used to realise this output during the production process on site'. This is referred to in this report as 'site productivity'. The value of the site output equals the costs of the direct input factors which, from the viewpoint of a contractor, are needed *at least* to produce this output. The direct input factors comprise labour, materials, equipment and subcontracting.

During the production process a contractor will strive at realising or improving his planned site productivity level. Theoretically speaking, the value of the site output is fixed as soon as the contract between client and contractor has been signed. This means that site productivity improvement by the contractor will have to be realised by a more efficient use of the direct input factors. This requires continuous control of the costs of the direct input factors. A cost control system is thus an important tool for productivity improvement efforts on building sites. Control requires a planning, which can serve as the basis for control. Feedback is required to ensure that the results of the control function are transformed into corrective action whenever necessary. Planning, control and feedback (the TRINITY) form the cornerstones for productivity improvement.

A deviation from the planned site productivity level can be caused by a negative impact of productivity factors on one or more of the productivity elements. This negative impact reveals itself through a bottleneck situation. Productivity factors can originate from the contractor's own organisation (internal productivity factors) and from the actors with whom the contractor, directly or indirectly, has to deal with during the construction process. Moreover, a negative impact can result from productivity factors originating from the physical environment in which the production process of the contractor has to take place (also external productivity factors).

To determine the exact (sources of) productivity factors it is useful to unravel the construction process into actors and functions, which these actors have to fulfill in order to arrive at an efficient construction process. If one or more functions are not performed satisfactorily this may result in a bottleneck situation.

Within a traditionally organised construction project the contractor is not involved in the construction process until the tender phase. This means that many steps, of which the outcome may affect the site productivity performance, have already taken place without the contractor being able to influence this outcome. In general, a contractor should acknowledge external bottlenecks as much as possible before start of his production process and, at the same time, avoid the existence of internal bottlenecks.

The actors involved in the construction process, as it takes place in Tanzania, in many ways fell short in performing their function(s) satisfactorily. Local contractors have in the past shown a relatively bad site productivity performance, which is a result of bottlenecks originating from both the contractors themselves as from the other Tanzanian actors in the construction process. The above situation may have contributed to the presence of foreign contracting companies within the Tanzanian construction sector.

The degree to which a foreign contractor such as SJI is affected by bottlenecks in the Tanzanian construction process is relatively limited, when comparing this with two of its local competitors. Moreover, based on this comparison, SJI seems, at first sight, to impose less internal bottleneck situations to herself, compared to the same two local competitors.

However, more detailed research on one of the construction projects of SJI (the Vocational Training and Service Centre (VTSC) project) reveals that on this project the productivity factors are not controlled to the fullest. This especially applies to productivity factors which originate from the labourers on the site and internal bottlenecks. The lack of control of productivity factors is a result of a limited preparation time for the project. Moreover, the TRINITY at SJI is not satisfactorily from a site productivity point of view. The fact that the existing control procedures were not followed consistently strengthened this unsatisfactory situation.

Recommendations for SJI, which have resulted from the above-presented research are:

1. The current cost control system should be supplemented with a weekly cost control system; this cost control system should be linked with the scheduling system used on site; the basic elements of the weekly cost control system should be standardised and included in the 3T-file.

2. The planning function at the branch office of SJI in Dar es Salaam should be strengthened.

3. Project managers should be fully informed on the position of the project within the company; this should include information on all issues which have played a role in the preparation of the tender and the objectives which, eventually, are to be met by the project.

4. On each project a feedback function should be installed; the precise feedback procedures to be followed should be determined for each project separately; the procedures should be discussed, agreed upon and laid down by the people involved before start of the production process; feedback should take place orally as much as possible, supported by reports.

5. Each project should be concluded with a standard feedback procedure: a debriefing meeting should be organised; a standard report format should be developed which is to contain all project information, relevant for future projects; the reports should be accessible for use by all project managers in the company; a copy of these reports should be spread among the various company departments.

6. A detailed bonus and incentive scheme should be developed involving both labourers and foremen; this system should be used in combination with the weekly cost control system.

7. Project managers should receive a training concerning the Tanzanian operating environment before they start to work on construction projects in Tanzania.

8. SJI should as much as possible participate in projects of which the organisation is based on other organisation forms than the traditional one.

In the epilogue of this report attention is paid to the interaction between micro- and meso-level when it comes to site productivity improvement. Three preconditions should be met to also achieve site productivity improvement on meso level:
- the creation of an enabling operating environment by the government, paying special attention to the research - and education functions;
- the involvement of foreign contractors in the development of the local construction sector through joint ventures, and:
- the organisation of contractors in the Tanzania Building Contractors Association.

Chapter 1

Introduction

The very starting-point of this research was to indicate possibilities for productivity improvement at the branch office of Skanska Jensen International (SJI) in Dar es Salaam, Tanzania. This branch office was established in 1984 by C.G. Jensen, a Danish construction company. However, the Tanzanian construction activities of this company, which in 1994 was one of Denmark's four largest construction companies, already started in 1974.

C.G. Jensen is fully owned by a Swedish construction company: Skanska. Skanska is one of Europe's ten leading civil engineering and building contractors. In 1994 this company operated in 44 different countries all over the world. In 1995 C.G. Jensen and Skanska jointly took over the African activities of another foreign contracting company. At the same time the branch office in Dar es Salaam became part of a new group within the Skanska company: Skanska Jensen International. The African part of this group now has branch offices in Tanzania, Zimbabwe, Uganda and Ghana.[1] The group's head office is located in the United Kingdom.

At the moment SJI is one of the most dominant foreign contracting companies on the Tanzanian construction market. Projects undertaken during the past few years include the rehabilitation and upgrading of hospital buildings, the construction of the Danish embassy building and the construction of factory buildings. During the period in which this research took place, SJI finished its most prestigious project in Tanzania sofar: the Sheraton Dar es Salaam Hotel.

Before the research at SJI in Tanzania could start, it was necessary to obtain more insight into the productivity concept. The literature study conducted for this purpose revealed that a lot of different approaches to productivity exist. The approach chosen in this research has eventually resulted in the formulation of the following problem definition:

> *which adaptations are needed with respect to the cost control system of Skanska Jensen International (SJI), in order to have it serve as a tool for productivity improvement on its building sites in Tanzania?*

How exactly this final problem definition has come about, as well as the meaning of the major concepts included in it, will be explained in the next chapter.

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[1] See also the organisation charts in appendix A.

Chapter 2

Theoretical background

2.1 Introduction

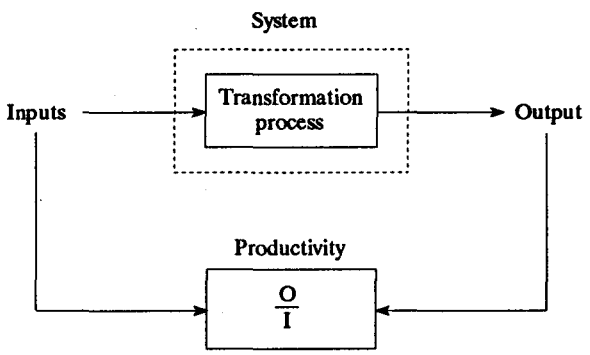
In this chapter we will present the foundation on which the formulation of the problem definition, as presented in the introduction of this report, has been based. First of all, the major general aspects of productivity are discussed. This is followed by a definition of the construction sector. The chapter is concluded by applying the productivity concept to the construction sector.

2.2 Productivity

2.2.1 Productivity definitions

The basic definition of productivity is the ratio of output produced to inputs used within a given period of time.[1] This output-input relation is schematically depicted in figure 2.1. This figure also shows that, besides the input and output, the production system and transformation process are also a part of the productivity concept. Within the framework of this research these four items will be considered as the 'productivity elements'.

Figure 2.1 Basic productivity concept



Source Scott Sink, D. *Productivity management: planning, measurement and evaluation, control and improvement.* 1985, p.3.

Both the numerator and denominator of the productivity ratio are usually expressed in monetary units, since this enables aggregation of different types of inputs and outputs. However, monetary units have the disadvantage that they might be affected by inflation, certainly on the long term. Therefore, when comparing the productivity values of different periods, corrections should be made for inflation, for

[1] Kendrick, J.W. Productivity: why it matters - How it's measured. p.1-1.1. In: Christopher, W.F. et al. *Handbook for productivity measurement and improvement* 1993; Prokopenko, J. *Productivity management. A practical handbook.* 1987, p.3; Scott Sink, D. *Productivity management: planning, management and evaluation, control and improvement.* 1985, p.3; Wassink, A. Produktiviteitsstijging en produktiviteitsmeting in de industrie. 1971, p.30.

example by expressing both output and input in so-called base-period prices. Other possible units include time units and physical units. These both have the disadvantage that they are not suitable for the purpose of aggregating different type of inputs and output. Therefore they are most useful when considering the relation between the output of a system and the contribution of a *single* input factor.

The basic productivity definition is always the same. What changes is the precise meaning of the concepts used in it, based on who defines them, from what perspective and on what level. This results in a wide variety of existing productivity definitions.[2] In the literature the following categories of definitions can be found:[3]
- partial productivity definitions: the ratio of output to a single input (for example labour productivity),
- total factor productivity definitions: the ratio of net output (or value added) to labour and capital inputs,
- total productivity definitions: the ratio of total output to all inputs used.

Each group has its own advantages and limitations. For a detailed overview reference is made to Sumanth (1984).[4] Here only the main aspects will be mentioned. One important limitation of partial productivity definitions is that they may lead to suboptimisations within a production process. For example: raising labour productivity without looking into the overall productivity, which might even decrease because of a relatively faster growing of capital investments compared to labour savings.[5] Partial productivity measures have proved to be too limited to give insight into overall productivity of a system.

Total factor productivity definitions have a similar limitation: they only include labour and capital inputs. Such definitions do not account for the possible impact of material costs on overall productivity. When these costs form a substantial part of the total output costs, this might give a incomplete view on the real situation.[6]

With respect to the outputs and inputs included, total productivity definitions are the most accurate and complete definitions. When used together with partial productivity they give the best insight into the overall productivity situation, as well as into the contribution of the individual inputs to this situation.

To decide on the most suitable productivity definition for a specific situation, the productivity elements of figure 2.1 first have to be defined. The productivity definition forms the basis for any productivity improvement effort. It indicates what has to be measured and in what unit. Based on the measurements, areas for productivity improvement can be found.

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2 See for an overview of productivity definitions: Erkelens, P.A. *Self-help building productivity. A method for improving house building by low-income groups applied to Kenya 1990-2000.* 1991, p.96.

3 Grossman, E.S. How to measure company productivity. p.6-1.1 - 6-1.21. In: Christopher, W.F. et al. *Handbook for productivity measurement and improvement.* 1993; Sumanth, D.J. *Productivity engineering and management.* 1984, p.7.

4 Sumanth (1984), p.9.

5 Meertens, K. *Measuring productivity. A practical approach.* 1985, p.20.
Sumanth (1984), p.151-152.

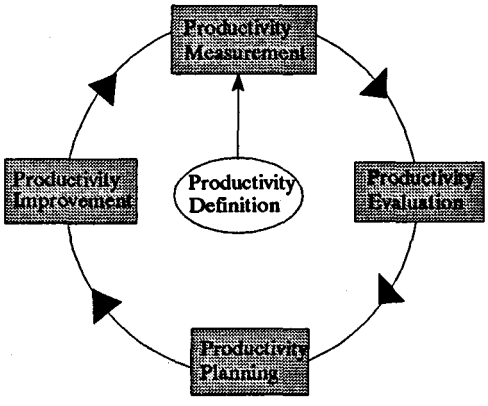
6 Sumanth (1984), p.9.

2.2.2 Productivity improvement

2.2.2.1 The productivity cycle

Each productivity improvement effort has to start with measuring the existing productivity level. The measurement results have to be evaluated. Based on the evaluation a decision has to be taken as to how and to what degree the existing productivity level will be improved (= target). To control if the productivity target is realised, measurement has to take place again, etc. etc. Sumanth (1984) combines these four tasks in a so-called productivity cycle (figure 2.2). Productivity improvement is thus not an independent activity, but linked to other activities. These other activities are a prerequisite in the realisation of a productivity improvement.

Figure 2.2 The productivity cycle



Source Based on: Sumanth, D.J. *Productivity engineering and management.* 1984, p. 48.

In the original cycle of Sumanth no productivity definition is added to the centre of the cycle. However, by doing so, it becomes more clear that the productivity definition chosen forms the basis for further productivity activities.
The productivity cycle represents a continuous process and can be applied to every level (that is: a nation, sector, company etc.). The activities mentioned in figure 2.2 are the responsibility of the management of a production system.[7] Decisions on productivity improvement are thus made on management level.

2.2.2.2 Possibilities for productivity improvement

Based on the productivity ratio, productivity improvement takes place if one of the following five situations occurs (all within a certain period of time):

- output increases, input decreases; (a)
- output increases, input remains constant; (b)
- output increases; input increases at a lower rate; (c)
- output remains constant, input decreases; (d)
- output decreases, input decreases at a higher rate. (e)

These five situations can be realised by different productivity improvement techniques. Based on the components of a production system, these techniques can roughly be categorised into:

- input-based improvement techniques (labour-based, materials-based, equipment-based etc.),
- process-based improvement techniques,

[7] Kendrick (1993); Scott Sink (1985); Sumanth (1984).

- output-based improvement techniques.

Each category comprises many different techniques. They vary from incentive schemes to improved management tools and product simplification. Other, more elaborated categorisations than the above-mentioned, can be found in literature.[8] They will not be further discussed here for reasons of time.

Process-based improvement techniques can focus on two different aspects of the production process: effectivity and efficiency. *Effectivity* is the degree to which the output realised corresponds with or exceeds the planned output. In other words: what is achieved compared to what was planned.[9] According to Wassink (1971) the effectivity of a production process is determined by a number of factors, including quality of management, technical know-how, size of the company, and the state-of-the art of the plant and equipment.[10]

Efficiency is the amount of inputs used to realise a certain amount of output, as compared with the planned amount. Or, in other words: how well resources are used to generate useful output.[11] This concerns all inputs which are directly involved in production.

Effectivity thus focuses on the output realised in a production process, efficiency on the inputs used in the same process. Based on these definitions and the definition of productivity, it can be concluded that productivity could be viewed as being a function of both the effectivity and efficiency of a production process.[12] This implies that an increase in effectivity and/or efficiency results in one of the five above-mentioned options for productivity improvement. Effectivity, for example, increases when:

- a new technology is used, which decreases the production time needed to produce a certain amount of output. This will result in a higher output value within the same period of time.
- less bureaucratic measures are used, which saves time and increases production.

Both possibilities result in an increase of the output, expressed in monetary values. As a consequence productivity will increase (assuming the input remains constant or increases to a lesser extent). This is thus an example of situation b) and c) above.

Efficiency increases if economies with respect to the inputs take place. This can be attained, for example, by:

- substituting labour for capital, which has to result in a decrease of the costs of the direct inputs,
- raising labour productivity, which decreases the number of labourers needed per unit of output.

These two possibilities can result in lower costs of the inputs. If the output remains constant or changes at a lower rate, productivity will increase as mentioned under d) and e).

If both effectivity and efficiency increase by one of the possibilities mentioned, productivity will increase as described under option a).

The past few years productivity and quality have become more and more synonymous. This is based on Deming who states, that 'as quality improves, productivity increases as a result of less rework and better use of all resources'.[13] This will result in lower cost and lower prices. It is important to notice here that quality can be used in different ways. First of all, product-quality, which concerns the quality of the produced output. Second, process-quality, which concerns the quality of *how* the output is

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8 See for example: Sumanth (1984) and Scott Sink (1985).

9 Prokopenko (1987), p.6.

10 Wassink (1971), p.33.

11 Wassink (1971), p.6.

12 Based on: Mali, P. Improving total productivity: MBO strategies for business, government and Not-for-profit organisations, 1978, p.5. In: Sumanth (1984).
Wassink (1971), p.33.
Veld, J. in 't. *Analyse van organisatie problemen.* 1992, p.301-302.

13 Deming, W.E. *De crisis overwonnen.* 1994, p.23.

produced. The quality Deming refers to, concerns process-quality. His approach confirms what has been said in the previous paragraph on the role of effectivity and efficiency in productivity improvement. A higher process quality means a higher efficiency and effectivity level and, as discussed above, this latter results in a higher productivity level.

2.2.2.3 Productivity factors

To improve the effectivity and/or efficiency, and thus the productivity, of a production process, one has to have insight into the precise circumstances under which this process has taken place. Only then one can find out where exactly bottlenecks occur which should be alleviated for the purpose of achieving productivity improvement. Each production process is part of a certain operating environment. Several authors have acknowledged that the inputs and/or outputs of a production process, and thus the productivity, are influenced by factors from this environment.[14] Such factors are called productivity factors. Based on figure 2.1 it follows that these factors can also affect the productivity level by their influence on the production system and transformation process. For, these two elements are also part of the productivity concept. The control of productivity factors should be an important part of any productivity improvement effort. This requires thorough knowledge of the operating environment.

After this brief discussion of possibilities for productivity improvement, the question may rise *why* this improvement is so important. To answer this question one has to understand the benefits which may arise from a productivity improvement. This will be the subject of the next section.

2.2.3 The importance of productivity

The importance of productivity can be made clear by dealing with the benefits that result from its improvement. Depending on the level the productivity concept is applied to, benefits can occur in a whole nation, an sector, a company and/or a single unit within a company. Aggregation of the lower levels results in the national level. This implies that widespread productivity improvement at the lowest level will result in productivity growth on national level.

For a company productivity improvement can result in lower costs per unit of output. This leads to lower prices and consequently a bigger market share and profit. In a competitive environment productivity improvement is essential for the survival of a company.[15]
The same goes for a whole sector or nation: productivity improvement can enhance the competitiveness of an sector and/or nation versus other industries and nations.
On national level other benefits can also occur:[16]

- an increase in productivity means a decrease in the amount of inputs needed per unit of output. This results in more leisure time, increased consumption and conservation of natural resources. This will have a positive effect on the welfare and wellbeing of a nation's people.
- Productivity growth means that more goods and services become available without the payments for inputs having increased to the same extent. For a country this means that more goods and services are available for its people which reduces the pressures for inflation.
- Higher productivity also means a higher profit margin and thus a better return on the capital invested. This is a stimulus for new investments, enhancing overall economic growth and creating more jobs.

The benefits most often mentioned are economic benefits. Sumanth (1984) also mentions the link

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14 Erkelens (1992), p.99.
Hershauer and Ruch (1978), p.115-116. In: Sumanth. (1984).

15 Conway, E.C. Total quality: an integrating concept. p.2-4.1 In: Christopher (1993); Kendrick, J.W. Productivity: Why it matters - How it's measured. p. 1-1.4. In: Christopher (1993); Sumanth. (1984), p.96. Vonderembse, M.A. et al. *Operations management. Concepts, methods and strategies.* 1988, p.769.

16 Vonderembse et al. (1988), p.773-776.

between the productivity level of a country and its political power.[17] Political power and economic power are strongly linked in this respect. When a country is not able to produce certain essential products of its own, it has to depend on foreign sources. Such economic dependence can result in political links (and vice versa). This can be understood by the simple fact that when a person (or country) possessing something another person (or country) very much wants and needs, the former can execute a certain amount of power over the latter. An example of this link between productivity and political power are the developing countries. Their inability to be productive in essential economic sectors, especially in the manufacturing sector, has not only led to a competitive disadvantage on the world market, but also to a disadvantaged position in world politics. Especially in those countries productivity improvement is important in order to strengthen their position towards more developed countries.

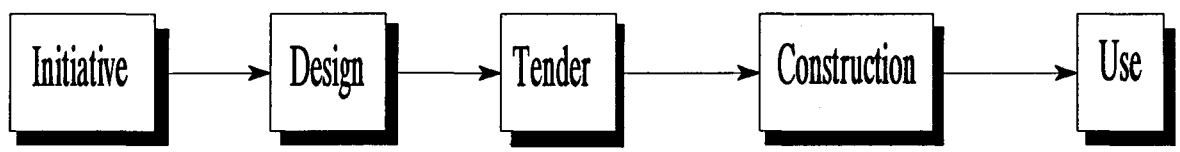
2.3 The construction sector

2.3.1 Definition

As mentioned in section 2.2.1 the precise productivity definition depends on the environment to which it applies. In this report this will be the construction sector. Literature on the construction sector does not show consensus as to how this sector could best be defined. Basically, the construction sector embraces all persons and organisations involved in the construction process.[18] This definition needs some refinement. First of all, the construction process can be unravelled into various phases, as depicted in figure 2.3 on the next page. Focal point of this research will be the construction phase, since during this phase the actual construction by the contractor takes place.

Ofori (1990) states that the construction sector is often defined in terms of the actors and products involved.[19] The main actor in the construction process is the contractor: he is responsible for the actual construction work. This research will also take place from the viewpoint of the contractor. Other actors normally considered a part of the construction sector are the client, consultant (including the architect and quantity surveyor), suppliers, financiers and the government.

Figure 2.3 Phases within the construction process



NOTE In some cases also maintenance, demolition and/or renovation activities (following the use phase) are considered part of the construction process. This research concentrates on new building only. These other activities have therefore been left out from figure 2.3.

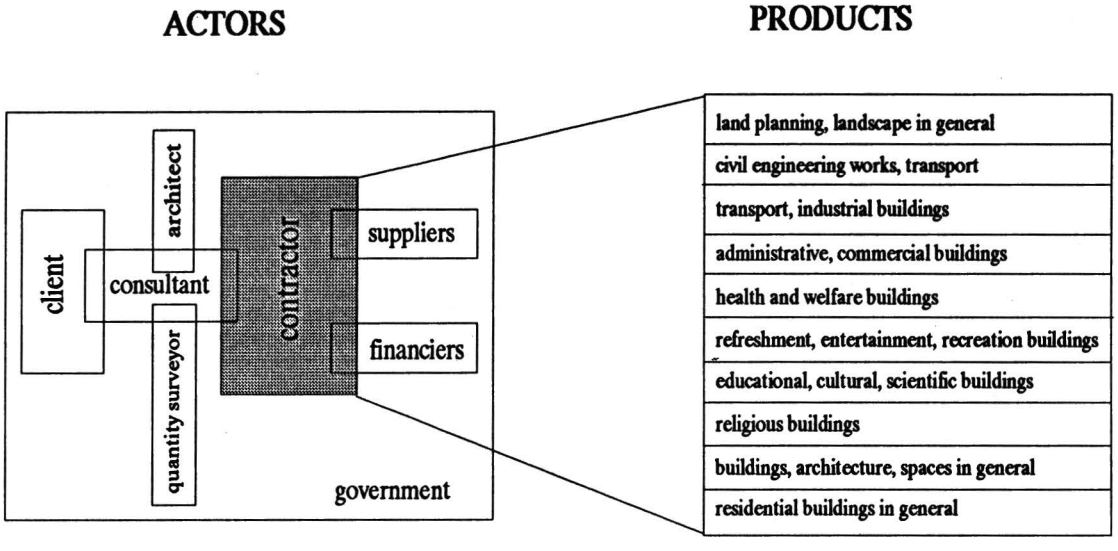
17 Sumanth. (1984), p.22.

18 Tegelaers, M. *Performance upgrading of informal building contractors in Dar es Salaam. A case study into the characteristics and problems of informal small scale building contractors in Dar es Salaam, Tanzania.* 1995, p.6.

19 Ofori (1990) p.20.

The output of the construction process can be of various types. It can range from straightforward buildings to more special items, like bridges, dams etc. Figure 2.4 schematically depicts the actors and products as included in the definition of the construction sector.

Figure 2.4 The construction sector



Source 'Activities' based on: RIBA. *Construction indexing manual.* 1968, p.10.

A third aspect which is important to consider when defining the construction sector (but not mentioned by Ofori) is *who* (what type of contractor) carries out the construction work. In developing countries a lot of construction work takes place by individuals, building for their own purpose. This so-called informal sector can form a very important part, and even the majority of a developing country's national construction activities.[20] Although both formal and informal contractors are part of the construction sector, this research will be focused on the former ones only. This choice is first of all based on the fact that a formal contractor offered me the opportunity to conduct my research within their organisation. Second, including the informal sector as well would require more time than available for this research.

2.3.2 The importance of the construction sector

The construction sector has a crucial role within a country's national economy. This role becomes evident when considering the linkages of the construction sector with other parts of this economy.[21] Backward linkages exist for example with the material and equipment suppliers. Forward linkages exist since the completed construction works stimulate other economic activities. These linkages make the construction sector relatively vulnerable to distortions: factors influencing the performance in a certain economic sector can also influence the performance of the construction sector (and vice versa). But, on the other hand, optimisations in construction performance could contribute to a more overall development of a country, because of its linkages with other parts of the economy. For further details

20 Moavenzadeh, F. *The construction industry.* p.78-79.

21 Moavenzadeh, F. *The construction industry.* p.80-83; Ofori (1990), p.80-83.

on these links reference is made to Moavenzadeh and Ofori.[22]

The linkages of the construction sector can also have a clear impact on an *individual* contractor and his construction activities. For example: a lack of a certain type of material can delay a construction project. In general, the linkages introduce (extra) productivity factors, which may affect the contractor's performance. The linkages and the productivity factors which result from them make the construction sector a relatively vulnerable operating environment for the contractor.

In the previous sections I have discussed the productivity concept and the construction sector separately. In the following section these subjects will be combined.

2.4 Productivity in the construction sector

2.4.1 Different productivity levels

When talking about productivity in the construction sector different levels can be distinguished: sector, company, project and site level. For each level the output and inputs involved differ, which results in different productivity definitions on each level. In appendix B the output and input to be included on each level are mentioned. In this research productivity on site level has been chosen as focal point. First of all, since in section 2.2.3 it was stated that widespread productivity improvement at the lowest level may result in productivity growth on higher levels. Second, productivity studies on, for example, sector level require more time than is available for this research.

2.4.2 General approaches to site productivity

Going through publications dealing with productivity on site level it proves that these are mainly focused on labour productivity, which concerns a partial productivity definition.[23] The preference for this labour-based productivity approach can be explained by the fact that the construction sector is a relatively labour-intensive sector. However, as mentioned in section 2.2.1 partial productivity definitions can lead to suboptimisations. In this case, for example, increasing the labour productivity beyond a certain point, could at the same time lead to wastage of materials, or equipment being wrongly used. With respect to these latter two input factors the productivity may decrease. *All* three input factors should thus be included in a definition for site productivity. The definition to be formulated here should thus be a total productivity definition.

2.4.3 Site productivity defined

As stated in section 2.2.1 a productivity definition can be formulated by defining the concepts of figure 2.1. Within the scope of a construction project, considered on site level and during the production process, this has resulted in the following definitions:

The production system is a single construction site. This system should not be viewed as being independent. It is influenced by larger systems: the project, company, sector and country in which it takes place. Factors within these larger systems influence the productivity performance on the site. The existence of the production system is fixed in time (duration of the production process) and space (geographical location).

The transformation process is the production process which takes place on the site. Since the production process takes place on site, it is also bounded in time and space.

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22 Moavenzadeh F. *The construction industry.* p.83; Ofori, G. (1990), p.91-92..

23 Calvert, R.E. *Introduction to building management.* 1970; Drewin, F.J. *Construction productivity.* 1982; Oglesby, C.H. *Productivity improvement in construction.* 1989.

The (site) output is a building. The client decides upon the quantity of output to be realised as well as its quality level; both quality and quantity are fixed output aspects from the contractor's point of view. It is the contractor's task to determine the most realistic, efficient and effective combination of inputs, which is needed to realise the output as desired by the client. The final choice on this combination of inputs will determine the monetary value of the site output from the viewpoint of the contractor. The total value could be expressed as 'Q(uantity) x P(rice).[24] The Quantity has been fixed by the client; the Price has been fixed after agreement between client and contractor has been reached on this matter. Strictly speaking, the value of the site output can thus not be changed by the contractor.[25]

The input comprises all resources which are directly needed on site in the realisation of the site output. This includes labour, materials, equipment and subcontracting.[26] These are the so-called direct input factors. Since these are different types of inputs, monetary units will be used to aggregate them. Which type of costs exactly are to be included in this case can be found in appendix C.

Based on the above-mentioned definitions for the separate productivity elements, *site productivity* is thus defined here as:

Box 2.1 Site productivity definition

the ratio of the value of the site output to the costs of the direct input factors, used to realise this output during the production process on site

or:

$$\frac{\textit{Value of the site output}}{\textit{Costs } (L + M + E + Sub)}$$

(Where L = labour, M = materials, E = equipment, Sub = subcontracting)

Based on the characteristics of the site output as described above, it is to be concluded that improvement of the site productivity level has to take place by decreasing the costs of the direct input factors. Therefore, productivity could also be defined as:

Box 2.2 Alternative definition for site productivity

the degree to which the direct inputs are used efficiently in the realisation of a predetermined site output, within the available construction period.

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24 Based on: Jong, J. de *Kosten en kostenbewaking in het bouwbedrijf.* 1968, p. 18.

25 This is based on an ideal situation. Later on in this report we will see that the output value does change in practice, due to, for example, changes in the original design etc. However, such changes should be avoided as much as possible when striving at an effective and efficient production process.

26 Apart from procuring labour, materials and/or equipment himself, a contractor can also choose to have a subcontractor execute construction work. In that case the subcontractor arranges the necessary labour, materials and/or equipment. Subcontracting is therefore considered here as the fourth direct input factor used in the production process on site. It can again be unravelled into one or more of the other direct input factors.

2.4.4 Improvement of site productivity: its link with cost control

In the previous sub-section it was stated that the value of the site output is formed by the *estimated* costs of the direct inputs which are needed for its realisation. The estimated or planned site productivity level will thus always equal one. If the project is finished entirely according to plan the ratio still equals one. From the previous section it also results that a site productivity improvement has to be achieved by increased efficiency with respect to the use of the direct input factors. This means a decrease in the costs of these input factors, expressing itself in a site productivity ratio higher than one. If the efficiency decreases, the ratio will be less than one.

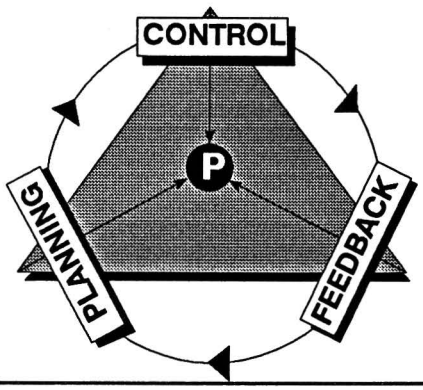
It should be noticed and understood that a deviation from the estimated costs of the direct input factors does *not* affect the value of the site output. That is: if the actual costs of the direct input factors are higher than planned beforehand, this does not increase the value of the site output realised with these same input factors. These higher costs only mean that wastage of input factors has occurred. For: based on his planning, the contractor would have been able to realise the same output with less costs (assuming again this planning is realistic). In case the costs of the direct input factors are below the estimated costs this also does not mean that the value of the site output has suddenly decreased. The lower costs mean that the profit margin of the contractor has increased. The value of the site output can only change when its physical features are changed, for example by making changes to the original design.

To realise or, if possible, optimise the planned site productivity level continuous control of the costs of the input factors used on site is needed. A cost control system is thus an important tool for productivity improvement efforts on building sites.

Based on the data resulting from the cost control system inefficient areas should become clear, and thus potential areas where site productivity improvement could take place. Actual improvement will require detailed insight into the exact causes of the inefficiency. In subsection 2.2.2.3 we mentioned that the influence of productivity factors can be the cause of inefficiencies. This means that in a specific situation it has to be known by which productivity factors the work on site is or could be influenced.

The basis for any control system is the planning made beforehand. Control cannot take place without thorough knowledge of *what* has to be controlled. Effective control also requires feedback: during the project to take corrective measures; after the project to transfer knowledge of the construction environment to new managers and, in this way, continue site productivity improvement in the future. Control and feedback can lead to adjustment of the planning. *Together*, planning, control and feedback form a productivity triangle, essential for achieving optimal site productivity performance on a construction project (figure 2.5).

Figure 2.5 The productivity triangle



The productivity triangle of figure 2.5 can be compared with the productivity cycle of Sumanth, presented in section 2.2.2. Sumanth considers productivity improvement as *part* of the whole productivity process. In figure 2.5 productivity improvement is presented as a *result* of continous planning, control and feedback. The triangle presents these activities as the cornerstones in realising a predetermined productivity level.

In this chapter we have dealt with some basic aspects of productivity. We have indicated the importance of productivity improvement in general and in the construction sector in specific. The use of the productivity concept in construction has been dealt with, resulting in a definition for site productivity. Cost control has been selected as a suitable tool in the attempt to reach site productivity improvement. At the same time, the conclusion was drawn that a discussion on control should also include planning and feedback as well as the prevalent productivity factors. The productivity approach as presented here has eventually resulted in the formulation of the problem definition as presented in the introduction of this report. This problem definition has formed the basis for the research structure, which is presented in the next chapter.

Chapter 3

Research structure

3.1 Introduction

In the previous chapter the theoretical background of the research has been explained. This has resulted in the formulation of a problem definition. This third chapter will explain how this problem definition has been elaborated into a research set-up.

3.2 Aim of research

The ultimate aim to be achieved by this research is:

- *to indicate which adaptatations are required with respect to the cost control system of SJI in order to make it a suitable tool in the attempt to reach productivity improvement on its building sites in Tanzania.*

3.3 Definitions of major research concepts

In the previous chapter already some definitions have been presented of a few major research concepts. A more extensive and complete overview of such definitions can be found in appendix D at the end of this report.

3.4 Research questions

The main research question has been formulated as follows:

- *Which adaptations are needed with respect to the cost control system of Skanska Jensen International (SJI), in order to have it serve as a tool for productivity improvement on its building sites in Tanzania?*

This main question has been unravelled into four groups of subquestions:

a) What are the general characteristics of the construction process? How is the site productivity concept embedded in and affected by these characteristics of the construction process?

b) What are the characteristics of the operating environment in which building projects of SJI in Tanzania take place? To what extent may this operating environment affect her site productivity performance?

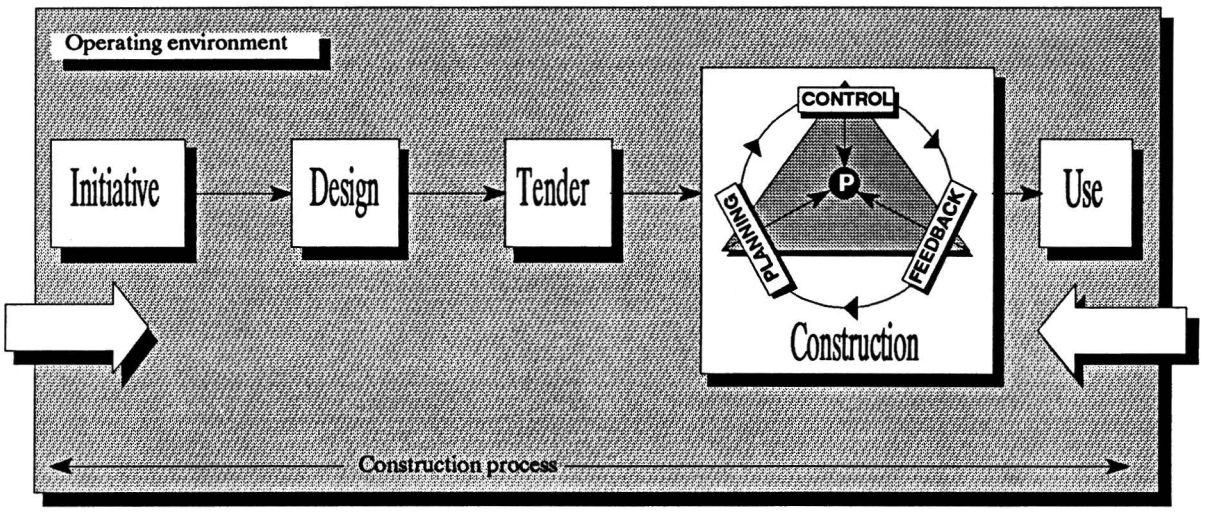
c) Which productivity factors may, in general, affect the productivity elements and thus the site productivity performance? To what extent do these productivity factors apply to SJI and her construction projects?

d) What are the characteristics of the current cost control system used by SJI on its building sites in Tanzania? To what extent is this system useful as a tool in the attempt to reach site productivity improvement?

3.5 The theoretical model

Figure 3.1 can be regarded as the theoretical model of this research. This model logically follows from the theoretical background explained in chapter 2.

Figure 3.1 Theoretical model



3.6 Research methodology

In this section the methodology which is used to answer the research questions is presented. This is done for each group of subquestions separately.

- **a) Characteristics of the construction process / effect on site productivity**

  To be able to answer the first group of subquestions a literature study is conducted concerning the structure and characteristics of the construction process.

- **b) Characterisation of the operating environment and its effect on the site productivity performance of SJI**

  For the purpose of answering the second group of subquestions the operating environment is divided into two levels: national and sector level.

  National level
  Data concerning the national operating environment are taken from:
  - national government policy documents,
  - statistical publications,
  - general publications on Tanzania.

  These publications are gathered both in The Netherlands and in Tanzania.

To obtain data on the sectoral operating environment the following methodologies are used:
- literature study as indicated for the national level, supplemented by:
- interviews with persons directly or indirectly linked to the Tanzanian construction sector. [1]

The above methodologies will result in an overview of the state-of-affairs within the Tanzanian operating environment. As mentioned before, the research takes place at SJI. The effect of the operating environment on an individual contractor and his site productivity performance will thus be focused on this company. However, to get more insight into the position of SJI with respect to other contractors, it was decided to conduct a comparative case study. This case study will, besides SJI, also include (a) local compan(y)(ies). Such a case study will enable us to put the findings with respect to SJI in a more broader perspective. The exact structure of the case study depends on the outcome with respect to the first two groups of subquestions. The discussion of this structure is therefore postponed until chapter 6, where also the results of the case study are presented.

• c) Productivity factors and their effect on construction projects of SJI

To determine the productivity factors, which in general may affect the site productivity performance, a list of productivity factors taken from Erkelens (1992)[2] is used as basis. Based on the results found with respect to subquestions a) and b) this list is adjusted and/or supplemented with other factors.
To determine to what extent the productivity factors affect construction projects of SJI its is necessary to conduct research on site level. Before the start of this research SJI offered one site on which this part of the research could be focused: the Vocational Training and Support Centre-project (VTSC-project) in Iringa.[3]
On the site level data are gathered from:
- company and project documents,
- interviews with people at SJI, both on office and site level,
- interviews with people involved in projects of SJI, other than SJI employees,
- site observations,
- information found with respect to subquestion b), in specific with respect to the comparative case study.

The research on site level may also reveal new productivity factors, which in that case will be added to the already existing list.

• d) Evaluation of the cost control system at SJI

Based on the contents of section 2.4.4 the evaluation of the cost control system also has to include planning and feedback. Considering the available research time, it will not be possible to actually observe how each of these activities takes place at SJI. For example: the VTSC-project already started several months before the start of this research and it is not finished within the six months of this research. This means that information on planning activities which took place before start of the production process, as well as on any feedback which will take place after the project has finished, has to be obtained by interviewing people on procedures followed. Another important source of information are project and company documents.
The usefulness and/or possible shortcomings of the current cost control system will be determined by evaluating the system against the results found with respect to subquestions a), b) and c) as well as with respect to a literature study on cost control systems in general.

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1 An overview of people which have been interviewed can be found in appendix E.

2 Erkelens, P.A. *Self-help building productivity. A method for improving house building by low-income groups applied to Kenya 1990-2000.* 1991, p.142-143.

3 A presentation of this project is postponed until later on in this report.

Chapter 4

The construction process

4.1 Introduction

In chapter 2 the emphasis was put on the construction phase and especially on the production process which takes place during this phase. However, these also proved to be a part of a much larger process: the construction process. Developments which take place during the early phases of this construction process set the framework for the production process. This means that also the site productivity concept is affected by these developments. In this chapter the phases of the construction process will therefore be reviewed in more detail. This will make the entire process more transparent and controllable. It will enable us to obtain insight into possible sources of productivity factors, which may affect the site productivity level of the contractor.

It should be noticed that the approach and phasing of the construction process as discussed in this chapter concerns a *theoretical* approach and phasing. This means that in practice the process may not fully correspond with what is said in this chapter: certain functions may be added, altered and/or left out, more or less actors may be involved etc., depending on certain project-specific characteristics. Moreover, no such thing as *the* phasing of the construction process exists. In the past several authors have dealt with this subject.[1] Each of them chose a different approach to the construction process and, consequently, a different phasing. Also the phasing used here will not fully correspond with one of the phasings mentioned in the literature, although these latter served as a basis for the former.

4.2 Phasing of the construction process

In chapter 2 the construction process was already unravelled into five distinct phases. According to Van het Erve (1994) each phase contains a certain package of functions which have to be executed.[2] The execution of each function is the responsibility of a certain actor in the process. The construction process can thus be further unravelled into process functions and process actors.

4.2.1 Process functions

Figure 4.1 contains the process functions which have to be executed during the various process phases. These are the functions as they will be distinguished within the framework of this research. The first three functions mentioned, policy, research and education, have to take place irrespective of the phases of a construction process. They constitute a basic, necessary framework of objectives, regulations, incentives, knowledge and know-how within which the entire construction process takes place.

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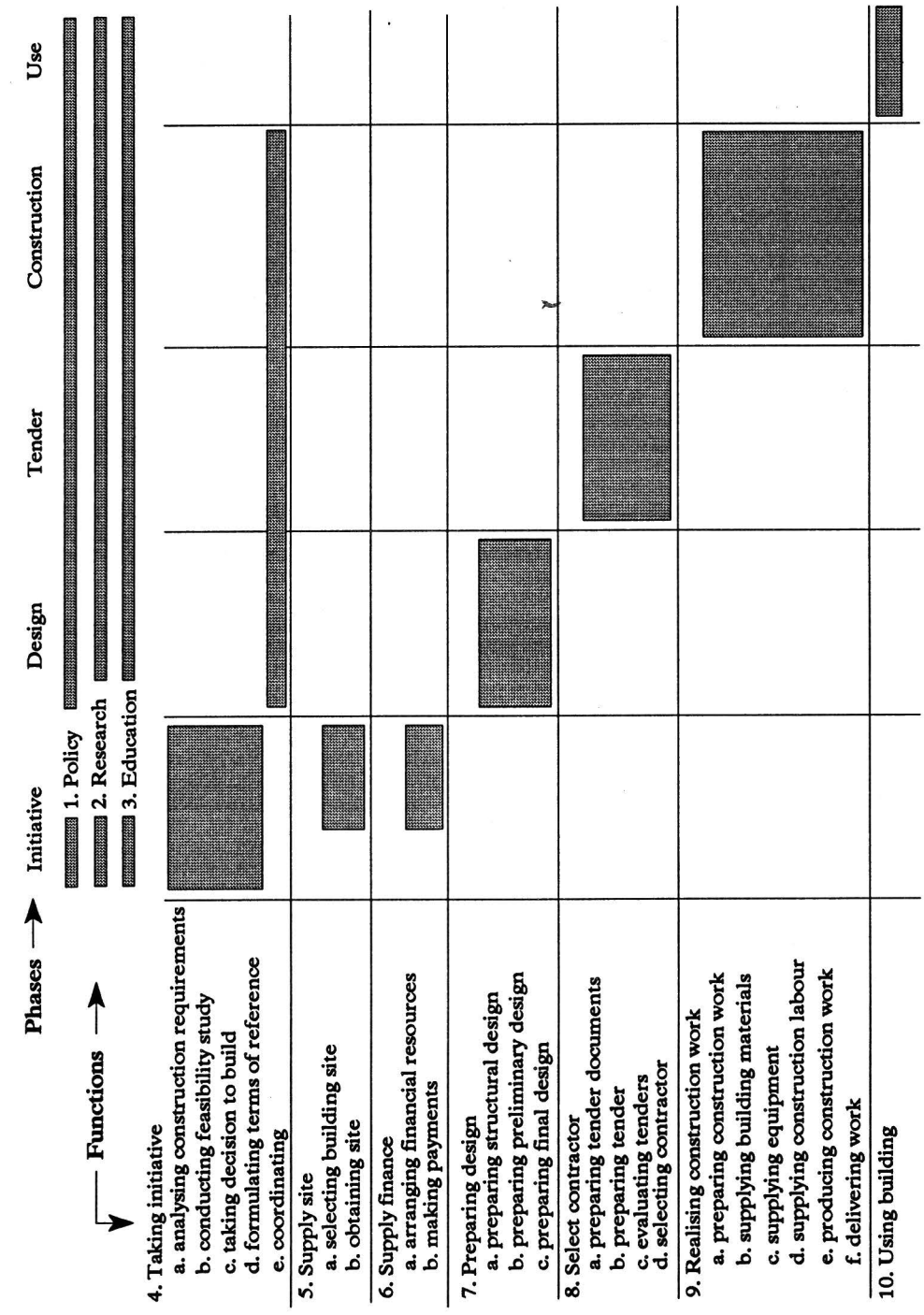
1 Erve, H.J. van het. *Bouwprocesleer.* 1994, p.8-13; Priemus, H. *Volkshuisvesting: begrippen, problemen, beleid.* 1978, p.43-72.

2 Van het Erve (1994), p.30.

Figure 4.1 Phases and functions within the construction process

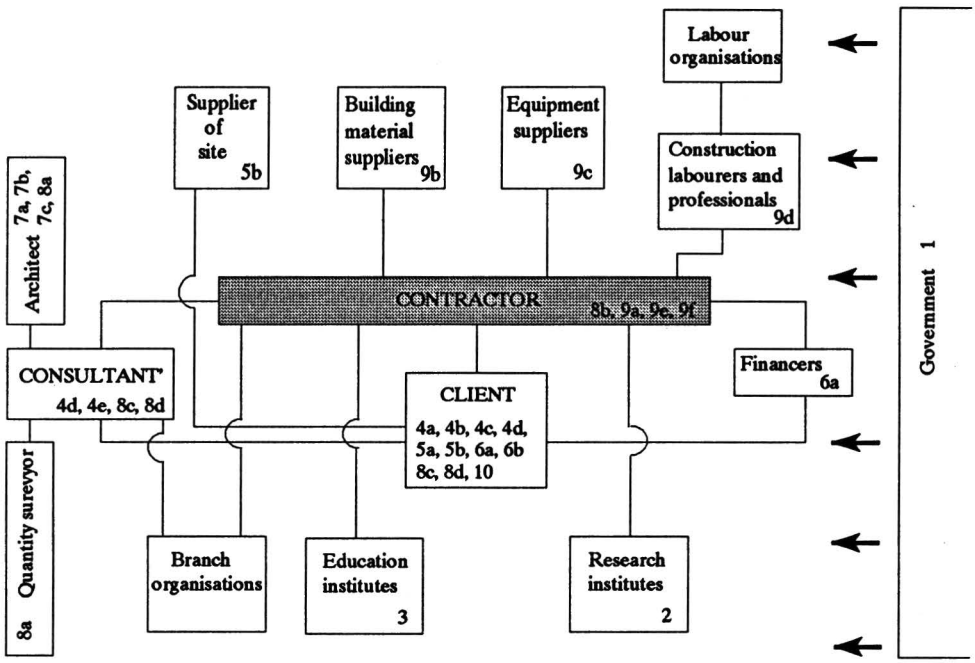


Source Based on Erve, H.J. van het. *Bouwprocesleer.* 1994, p.39; Priemus, H. *Volkshuisvesting: begrippen, problemen, beleid.* 1978, p.63; Maro, W.E. et al. *Construction cost trends and control mechanisms in Tanzania.* 1991, p. 173-177.

4.2.2 Process actors

In chapter 2 actors, who are considered to be a part of the construction sector, have been mentioned. Each of them is involved in the construction process. However, also actors *outside* the sector are, more or less, involved in this process. In figure 4.2 all these actors have been schematically depicted. The numbers in this figure refer to the numbering of functions in figure 4.1. As can be seen labour - and branch organisations have not been assigned a function. These organisations do not have a specific, direct function in the construction process. Their general function is to represent their members (e.g. labourers, contractors, consultants). Through this function they may be involved in the construction process whenever considered necessary by the organisations themselves, their members and/or the government.

Figure 4.2 Actors involved in the construction process



Source Figure 3.1; Format based on: Priemus, H. *Volkshuisvesting: begrippen, problemen, beleid.* 1978, p.62.
NOTE: Architects and quantity surveyors will in the remaining of this report be included in the consultants group and not be considered separately.

4.3 Process functions and the site productivity concept

The functions mentioned in figure 4.1 are each necessary for an optimal construction process. This research is especially focused on function 9e: producing the construction work. During the execution of this function control with respect to the costs of the direct input factors should take place. Planning for this cost control results from the execution of function 9a. The accuratenes and detailedness of this planning is again a result of the functions 1 to 8d. In the remaining of this chapter the possible effect of each of these functions on the site productivity performance of the contractor will be explained. If a function is not executed satisfactory this may create a bottleneck situation with respect to the site productivity performance. A distinction will be made throughout this research between internal and external bottlenecks. The former originate from the contractor's own organisation; the latter from the other actors in the construction process.

4.3.1 Policy
The construction process does not take place in a vacuum. It is part of larger systems, like the construction sector and the national economy. In general it is a government's task to canalise all the various activities which take place within these systems and to create an enabling environment for all the actors involved. This is a prerequisite for any optimal construction process. Moreover, a smaller system like the construction process should contribute to the development of the larger systems of which it is a part. The government should therefore formulate development objectives with respect to the various systems, including their actors and the functions which are to be executed by these actors. Through regulations and incentives the government can try to achieve the desired objectives in practice.

4.3.2 Research
The research function includes conducting research and spreading the research results among potential beneficiaries, including contractors. The research function is essential for alleviating bottlenecks in the construction process and as such a first prerequisite for the optimisation of the construction process. The research function can also directly provide insight into how the site productivity performance during the production process can be improved.

4.3.3 Education
The education function has to provide adequate knowledge and skills on all levels within the construction sector. Also this is a prerequisite for achieving an optimal construction process: only with the required skills and knowledge the actors involved in the construction process can execute their function(s) as optimal as possible. And only if this is the case, the contractor can try to achieve an optimal site productivity performance.

4.3.4 Taking the initiative
This function marks the start of the actual construction process. The most important part of this function is conducting a feasibility study. A thorough feasibility study may prevent financial problems in a later phase of the project. Financial problems can lead to delays in the production process, which negatively affects the contractor and his site productivity performance.

4.3.5 Supplying the site
The site is one of the productivity elements within the site productivity concept. Problems with respect to the site, which have not been solved before start of the production process may thus negatively affect the contractor and his site productivity performance.

4.3.6 Supplying finance
For a contractor timely payments are essential to ensure a timely availability of the input factors and thus to achieve an efficient production process and an optimal site productivity performance.

4.3.7 Preparing the design
The design is the basis for production. From the viewpoint of an optimal site productivity performance of the contractor it is necessary that the design is complete and accurate before start of the production process. Design changes during the production process may lead to wastage of direct input factors (and thus increased costs) and/or delays. Increased costs for the contractor can be compensated by submitting a cost claim, depending on contractual arrangements between client and contractor . However, a longer construction period may negatively affect the site productivity level on other company projects, due to the fact that equipment and labour are not available to these latter projects on time.

4.3.8 Selecting a contractor
The phase in which the contractor is selected is a very important phase from the viewpoint of site productivity. Only from this moment on the contractor can influence his site productivity performance

himself.[3] During the tender phase various contractors compete for the same project by submitting a tender to the client and his consultant. The tender contains the price against which a contractor will realise the construction work. The tender is based on documents and drawings provided by the client and consultant. Core of the contractor's tender is formed by the Bill of Quantities (BOQ). The BOQ contains the basic costs for the contractor of realising the construction work, also called direct costs. On these costs are added all indirect costs as well as a margin for risk and profit. The size of the risk and profit margin very much depends on the characteristics of the operating environment as perceived by a company's management. The most important characteristic in this respect is the degree of competition experienced from other contractors. In case this is high, the profit margin may be lowered for the sake of winning the contract. Whatever the exact characteristics of the operating environment, a contractor should make sure he submits a tender which is realistic in view of his own capacities and capabilities. In case he is awarded the contract, he is contractually obliged to realise the price and construction period as offered in his tender. If he does not succeed, he will suffer the (financial) consequences (affecting his site productivity performance). Only in some cases, which depend on contractual arrangements, he may be financially compensated for a deviation from the planned costs and/or construction period.

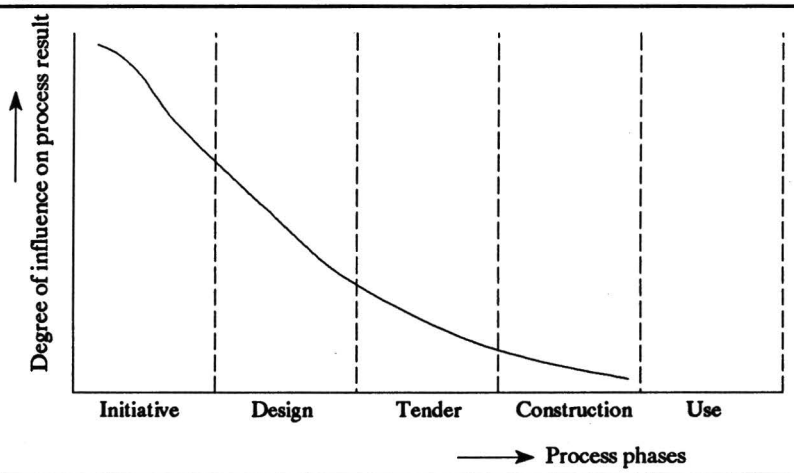
4.3.9 Realising the construction work

To make sure the production process runs efficiently, a contractor has to make preparations. These should include the preparation of a detailed cost planning. Basis for this detailed cost planning is the tender. The cost planning will again be the basis for cost control during the production process. From the viewpoint of an optimal site productivity performance the tender and the cost planning have to be as accurate as possible under the specific circumstances. Only then a sound basis for cost control is obtained.

4.4 Conclusion

Many functions of which the outcome may affect the site productivity performance, are executed before the contractor is involved in the construction process. This involvement does not happen until the tender phase. Figure 4.3 shows that the degree of influence which in this stage of the construction process can still be exercised over the process result is relatively limited.

Figure 4.3 The degree of influence on the process result



Source Erve, H.J. van het. *Bouwprocesleer.* 1994, p.85.

[3] This is based on the traditional project organisation form.

For the contractor this means he has to inform himself on the results of the preceding phases as much as possible. This will especially apply to any information, like drawings and documents on which he basis his tender and further (cost) planning. In general, bottleneck situations in the first phases of the construction process constitute negative productivity factors for the site productivity performance of the contractor. Moreover, the existence of internal bottlenecks may hinder the attempt to limit the impact of external bottlenecks. For example, inadequate education facilities (external bottleneck situation) may fully affect the contractor if he does not provide internal training (internal bottleneck). So, from the tender phase on the contractor has to avoid the existence or coming into existence of any of such internal bottleneck situations.

Sofar we have only discussed general characteristics of the construction process and the effect of these on the site productivity performance of the contractor. In the following chapter we will look at the actors which play a role in the Tanzanian construction process and how they execute their functions within this process.

Chapter 5

External bottlenecks for the Tanzanian contractor

5.1 Introduction

In the previous chapter we discussed the functions and actors which are needed with respect to the construction process from the viewpoint of an optimal site productivity performance by the contractor. This chapter focuses on determining possible bottlenecks, which exist with respect to these functions and actors in the case of a contractor operating in Tanzania. To be able to determine these bottlenecks it was necessary to obtain insight into:

- the national and sectoral operating environment of a contractor in Tanzania,
- the organisations and persons fulfilling the role of actors in the construction process as it takes place in Tanzania.

The results of the research into the operating environment on national and sectoral level can be found in appendices F and G respectively. The organisations and persons involved in the Tanzanian construction process are also dealt with in appendix G. In this chapter the position and role of contractors within the Tanzanian construction sector is first given attention. This is followed by an overview of external bottlenecks which have resulted from the research as presented in appendices F and G.

5.2 The contractors in Tanzania

In this section a profile of the contractors operating within the construction sector of Tanzania is provided. First the structure of the contracting subsector is presented. This is followed by a review of the various types of contractors which are a part of this structure.

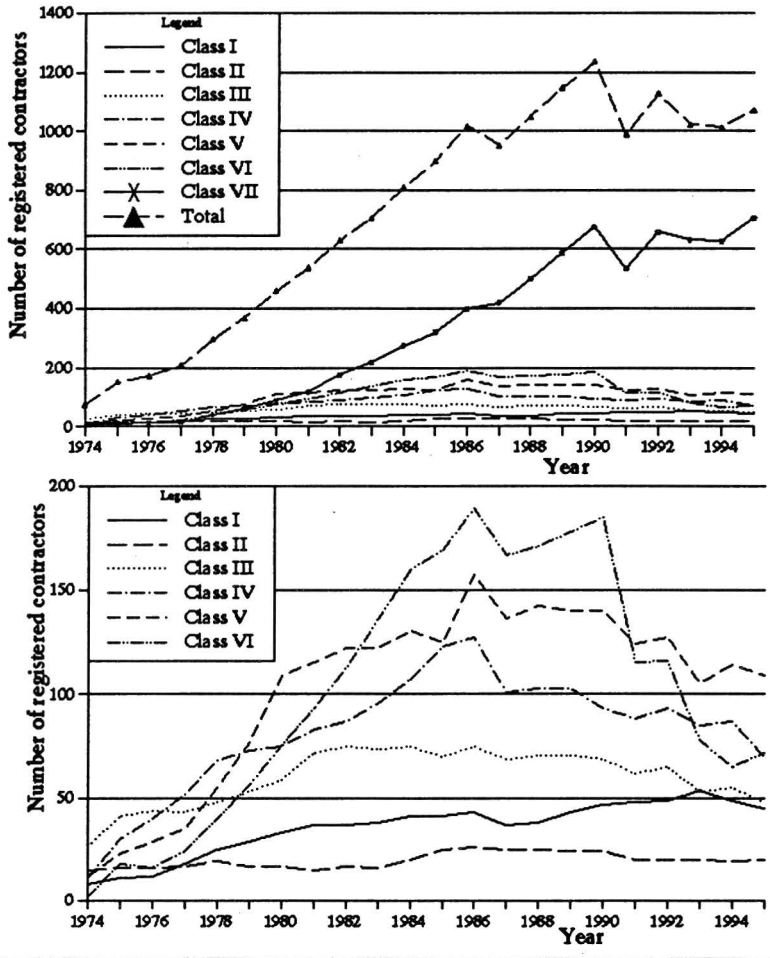
5.2.1 Structure of the contracting subsector

Since 1974 building contractors constructing for public purposes have to be registered with the National Board of Architects, Quantity Surveyors & Building Contractors (NBAQS&BC). The registration system of the NBAQS&BC comprises seven classes. An overview of classification criteria is presented in appendix H.

The first graph in figure 5.1 on the next page gives an indication of the development of the number of registered contractors in Tanzania since 1974. A sharp growth in this number took place during the period 1974 till 1986. After that year a fluctuation in the number of registered contractors is noticeable. This could indicate towards a negative effect of some economic liberalisation measures on the contractors. Class VII has a dominant influence on the total growth pattern due to the relatively large amount of contractors registered in this class as compared to the other classes.

In case class VII is omitted from the first graph, the growth pattern of the number of contractors registered in the other classes becomes more clear (second graph, figure 5.1). This reveals that class IV, V & VI have experienced a much faster growth than the three highest classes. This is not surprising when considering the less strict entry requirements for the lower classes (appendix H). After 1986, these lower classes show a relatively fluctuating and decreasing trend, compared to the higher classes. This indicates that the economic changes affected especially the lower classes.

Figure 5.1 Number of registered contractors (total number and number per class), including (above) and excluding (below) class VII, 1974-1995



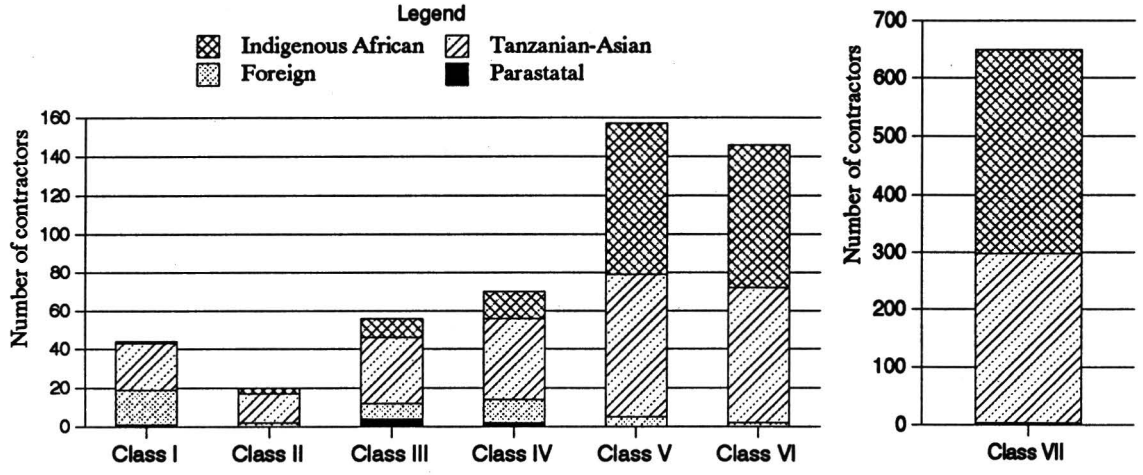
Source National Board of Architects, Quantity Surveyors & Building Contractors, Dar es Salaam, Tanzania.

Figure 5.2 below presents an overview of the number of contractors registered with the NBAQS&BC, according to class and type of company, for 1990. This figure shows that companies of Tanzanian-Asian origin are dominant in the higher classes of the system (class I-III). Foreign companies are especially dominant in class I: they accounted for 40.9% of the total number of contractors registered in this class in 1990. During the period until 1995 this percentile has decreased to 36% (16 on a total of 45).[1] The total number of contractors operating in Tanzania has diminished since the beginning of the nineties (1143 versus 1070). This decrease was especially noticeable in the middle and lower classes (class II, V and VI). Only in class VII, comprising the smallest formal contractors, a growth was experienced (8.6%).

Most registered building contractors are located in Dar es Salaam (1995: 576 out of a total of 1070). In appendix I the distribution of contractors over the various regions is graphically presented for each separate class of the registration system.

1 NBAQS&BC. *Registration list of Architects, Quantity Surveyors & Building Contractors.* Dar es Salaam, December 1995.

Figure 5.2 Overview of registered contractors with the NBAQS&BC, according to class and ownership (1990)



Source Based on figures presented in: Tegelaers, M. (1995), p. 97.
NOTES It should be noticed that this registration system only comprises formal contractors; below the class VII contractors a large group of informal and thus unregistered contractors could be pictured.

5.2.2 Local contractors

In her policy documents the government acknowledges a current lack of contracting capacity among local contractors, particularly for civil works. This, despite the overall growth in the number of registered contractors with the NBAQS&BC. However, the registration system is not a suitable source to base a judgment on the local construction capacity on. An interview with the Registration Officer at the NBAQS&BC revealed several shortcomings in the functioning of the Board. These include restricted legal rights of the Board as well as a limited working area due to a lack of staff. Overall, the Board is currently not capable of fully controlling the contracting subsector, and especially not its quality level.

Projects of local contractors frequently suffer from time overruns and, consequently, also cost overruns.[2] This means that those contractors are not capable of realising their planned site productivity level. Maro et al. (1991) have conducted research into the causes of this relatively bad performance. Some of these causes were found to originate from the contractors themselves, others from their immediate partners in the construction process: the client and consultant.[3] These latter causes, constituting external bottlenecks, will be dealt with in section 5.3. An overview of internal bottlenecks originating from local contractors themselves can be found in appendix J.

Apart from the relatively bad project performance on the short-term, the performance of local contractors is also characterised by a construction process which is becoming less and less efficient on the long term. This judgement is based on the second part of the research of Maro et al. (1991) mentioned earlier.[4] This research covered 27 construction work items appearing in Bill of Quantities (BOQ) of local contractors. The increase in tender rates has been compared with the increase in the

2 The President's office. *The Rolling Plan and Forward Budget for the period 1993/94-1995/96.* 1993, p.52.

3 Maro, W.E. et al. *Construction cost trends and control mechanisms in Tanzania.* 1991, p.131-162.

4 Maro et al. (1991).

costs of basic inputs (together forming the basic rate) for the period 1984 till 1990. In general the difference in tender and basic rate reflects:
- the risks and uncertainties perceived by the contractor (both resulting from the macro-economic and project-specific environment),
- internal inefficiencies of the contractor's organisation.

The results of the research reveal a growing gap between the basic rate and the tender rate for all construction work items included (see appendix K). The gap shows some difference between various construction work items, due to the different origin of inputs used for some items (e.g. local versus imported inputs etc.).

The overall increase in construction costs was already noticed by several researchers in 1977.[5] Maro et al. (1991) mention several macro-economic influences which could have been affecting the tender rates during the eighties:[6]
- the rapid inflation rate and the consequent increase in prices of necessary construction inputs (see also appendix G).
  This factor first of all explains the growth in basic rates. Second, figure F.9 in appendix F shows a fluctuating inflation rate during the period 1983-1993. After a decreasing trend during the period 1988-1990, the inflation currently shows a slightly increasing trend. The uncertainty with respect to exact developments of the inflation (and especially the relatively quick changes in the inflation rate) may cause contractors to cover the risks for inflation to an increasing extent in their tender rates.
- The rapid devaluation of the Tanzanian Shilling (see also figure F.9 in appendix F).
  This brings with it extra risks for the contractor, especially on longer-lasting construction projects. Such risks are very likely to be covered in the tender rates.
- Overruns on the public sector budget.
  This led to delays in payments to contractors on public sector projects, increasing the risks and costs of the contractor. Later on in this chapter it will become clear that the public sector dominates the demand side in the construction sector. This dependence on public sector projects, necessitates contractors to cover the risks involved in such projects in their tender rates.
- The venue of new and profitable businesses after the trade liberalisation.
  It seems more likely that this factor would have a decreasing effect on the tender rate, due to increasing competition among companies. On the other hand, in case this competition causes companies to disappear from the market, this factor may increase the tender rates of the surviving companies.
- A feeling of uncertainty and risk among contractors after the Tanzania-Uganda war (1979).
  Such political situations may cause contractors to cover the perceived risks and uncertainties in their tender rates.
- Introduction of levies, tightening of taxation system, lower productivity level.
  No insight has been obtained in the exact changes in levies and taxation during the period concerned. The taxation system has been restructured as part of the economic reforms. Several authors confirm the lower productivity level.[7]

5.23 Public sector contracting

From the late sixties on the government has dedicated a crucial role to the public sector, including a role in the construction sector (see also appendix G for background information on this).

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5 Ministry of Works. *Local Construction Industry Study.* 1977, p.99-100.

6 Maro et al. (1991), p.101/102

7 Komba, S.C. *An ad-hoc evaluation of the level of performance of the construction sector in Tanzania. A report submitted to the World Bank.* 1988, p.73; Ministry of Works (1977), p.100.

In 1970 this resulted in the first parastatal contracting organisation: the Mwananchi Engineering and Contracting Company (MECCO). This company was to play a central role in the development of the local construction sector, as well as in the execution of government construction contracts. At the late seventies MECCO was one of the largest contractors in the country. Currently, as is the case with many parastatal companies, MECCO suffers from a variety of problems. A discussion of some of these problems is postponed until chapter 6.

Some of the construction requirements of the government are realised by in-house resources: force account brigades.[8] Such brigades are under direct control of the Ministry of Works (MOW) and form the most direct way in which the government acts as a contractor.

The role of the public sector as a contractor is and always has been rather limited, despite government's intentions in the past (appendix G). This is shown in table 5.1 below, which covers the period 1983-1993. The data in this table give an indication of the contribution of private and public formal construction activities to annual construction GDP. It can be concluded that public construction activities fall far behind those of the private sector, even before the economic reforms of the late eighties.

Table 5.1 Contribution of public and private formal construction activities to yearly construction GDP 1983-1991

	1983	1984	1985	1986	1987	1988	1989	1990	1991
Share of public construction activities (%)	5.0	7.0	4.4	0.6	0.6	13.7	1.6	1.5	2.2
Share of private construction activities (%)	95.0	93.0	95.4	99.4	99.4	86.3	98.4	98.5	97.8

Source Bureau of Statistics. *National accounts of Tanzania 1976-1993.* p.27.
NOTES Data in the table are based on GDP at current prices.

5.2.4 Foreign contractors

Foreign contractors are most of all dominant on large and technically complex projects, which usually are civil work projects.[9] This is due to two reasons:
- a lack of capacity and expertise among local contractors,
- conditions of bilateral donors concerning the use of a contractor from their country of origin.

Figure 5.3 (next page) gives an overview of the number of registered foreign contractors in Tanzania for the period 1974 till 1995. This figure does not show a major increase in the amount of these contractors operating in Tanzania after the economic liberalisations. On the contrary: the strongest increase in foreign contractors is noticeable in the period *before* these liberalisations. For the period after 1986, the number of foreign contractors shows a decreasing trend since 1992. Account should be taken here of the fact that the NBAQS&BC has 'cleaned' its records at the end of 1995, causing the sudden decrease. Still, more foreign contractors than local contractors disappeared from the records.

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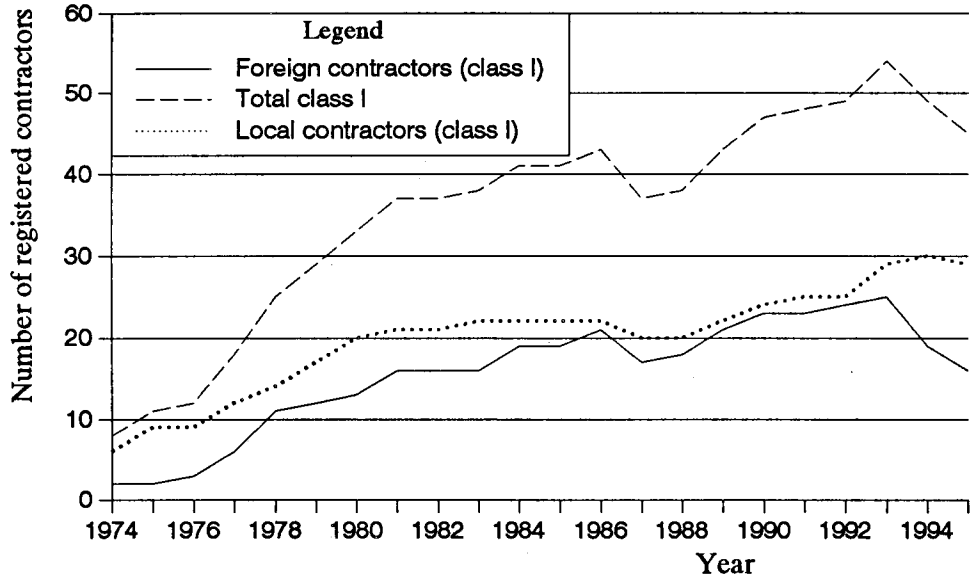
8 Force account brigades = a government-owned construction unit which is not managerially and financially autonomous.

9 Ministry of Works. *National Construction Industry Development Strategy.* 1991, p.11.

This may be a result from the preferential treatment which the government and multilateral donors are giving to local contractors since the beginning of the nineties.[10]
The share of foreign contractors in the total number of registered class I contractors has been decreasing steadily since 1974, indicating that the number of local class I contractors is increasing faster compared to the number of foreign contractors. In first instance the sudden decrease in the number of contractors after 1986 seems to indicate towards a negative influence of the economic reforms. However, considering the growth after 1987 the decrease may very well be a result of another 'cleaning' of the records of the NBAQS&BC.

Figure 5.3 Number of registered foreign contractors in class I, 1974-1995



Source NBAQS&BC. *Registration list of contractors as per 31 December 1995.* Dar es Salaam, 1995.

5.3 External bottlenecks

Sofar we have discussed the position and role of various types of contractors within the Tanzanian construction sector. In this section an overview of bottlenecks is provided which a contractor in Tanzania might have to deal with. This concerns external bottlenecks. That is: bottlenecks which originate from actors in the construction process, other than the contractor.

The external bottlenecks have been presented in table 5.2 on the next two pages. They are classified according to the actor 'responsible' for them. For the first two actors, the client and consultant, bottlenecks resulted from research of Maro et al. (1991). This research only included *local* persons and organisations. The other bottlenecks have resulted from sector policy documents of the national government of Tanzania. Where ever possible, causes of the bottlenecks, mentioned in the same publications, have been included in table 5.2.

[10] Based on interview with Mr. Malyi form the Central Tender Board, Dar es Salaam. See also appendix E.

Table 5.2 External bottlenecks

EXTERNAL BOTTLENECKS

Client (local = public sector)

Initiative phase

- Inadequate + inaccurate initiation
  Cause: lack of capacity; lack of time; no feasibility study conducted
  (--> lack of funds, late payments, changes design in later stage of project --> delays + increased costs)

Design phase

- Inadequate judgment quality + suitability design
  Cause: too little expertise clients
  (---> poor design, low quality standard ---> design changes / variations in later stage ---> extra unanticipated costs)
- inadequate site acquisition
  Cause: -
  (---> delays and extra costs)

Tender phase

- Inadequate preparation of project brief, design + tender documents
  Cause: lack of time + expertise
  (---> high tender costs contractor ---> overall cost increase client)
- Inadequate contractor's choice
  Cause: unsuitability existing tendering procedures
  (---> acceptance of lowest, but unrealistic bid ---> unanticipated extra construction time and extra costs in later project stage)

Construction phase

- Late payments to contractor
  Cause: inadequate or no feasibility study conducted; late approval certificates consultant
  (---> delays + increased costs for contractor---> cost claims client)

Consultant

Design phase

- Inadequate or no cost estimate + poor design
  (---> inappropriate, expensive design ---> design changes later stage ---> delays + increased costs)

Tender phase

- inadequate preparation of project brief, design + tender documents,
  (--> may result in inadequate tenders contractors)
- lack proper framework evaluation tenders; lack of expertise; too little evaluation time
  (--->wrong advise to client on most suitable contractor)

Construction phase

- late submission detailed design drawings
  (---> delays for contractor + extra costs)
- numerous instructions due to inadequacy of working drawings
  (---> delays and thus extra costs)
- inadequate construction supervision by designer
  (In combination with drawing problems may result in mistakes in work ---> rework ---> cost increase)
- poor quality of supervision by consultant on site
  (---> low standard of work contractor, too late observing cost and time related problems by consultant)
- unbalanced relation between consultant and contractor
  (---> dominance of contractor, --> e.g.. high number of approved cost claims)
- lack of promptness and seriousness in dealing with payment certificates
  (→ late payments → lack of funds → delays + increased costs)
- delays and confusion about roles and responsibilities due to incorporation of nominated subcontractors
  (May result in inefficiency, delays due to uncoordinated time schedules and thus increased costs)

(Table 5.2 continued)

Government
- Lack of coordination in sectoral planning
  Cause: non-existence of intersectoral planning system
  (→ non-implementation or delayed completion of government projects)
- Inadequate availability of foreign exchange
  Cause: lack of foreign exchange- earning activities (e.g. export)
  (→ delays + cost increase; choice of low-quality local products → low quality work)
- Inadequate physical infrastructure
  (→ delays + increased costs on projects)
- Macro-economic constraints
  Cause: consequences and effects of economic liberalisation measures;
  (→ high inflation, devaluation Tanzanian Shilling → financial burden for construction sector)
- Lack of suitable + consistent tender documents and procedures
  Cause: 'Automatic' use of foreign system
  (→ inadequate evaluation of tenders → wrong choice contractor → bad project performance)
- Inadequate + uncoordinated registration of contractors
  Cause: lack capacity registration institutes; registration responsibility with different organisations
  (→ unprofessional contractors operating on market → bad performance → bad 'image' local construction industry)

Research institutions
- Inadequate research activity into bottlenecks construction process
  Cause: lack coordination; lack of funds; lack of stimulation R&D
  (→ continuation bottleneck situations and resulting effects on site productivity performance contractor).

Education institutions
- Inadequate construction personnel, qualitatively + quantitatively
  Cause: Education institutes not adjusted to market demands
  (---> lack enough and qualified personnel / labourers)
- Lack of supervisors with adequate management skills
  Cause: Education institutes not adjusted to market demands
  (→ wrong management practices on projects → time- and cost overruns)

Suppliers
- Lack local materials, products + equipment
  Cause: lack production capacity, lack raw materials, lack foreign exchange for import of machinery
  (→ delays + increased costs)
- Lack of imported materials to cover local shortage
  Cause: lack of foreign exchange
  (→ delays + increased construction costs)

Financiers
- lack financing facilities for contractors
  Cause: government control + restrictive government measures financing sector
  (→ lack of funds on part of contractors → financial problems → delays)
- high interest rates and strict loan conditions
  Cause: high inflation rate
  (→ increases costs financing for contractor)

Branch organisations
- indication of low activity level
  Cause: -
  (→ lack of control tool for government → may hinder implementation of certain government measures)

Labourers / labour organisations
- Lack of incentives for workers
  Cause: - (could be due to lack of knowledge on how to motivate labourers or lack of willingness of companies to provide better conditions)
  (→ lack motivation → low speed and quality of work →> relatively long construction times + increased costs)

Source Maro, W.E. *Construction cost trends and control mechanisms in Tanzania.* 1991, p.133-148; Ministry of Works. *National Construction Industry Development Strategy.* Dar es Salaam, 1991/1995.

5.4 Government policy towards alleviating the external bottlenecks

With respect to the construction process it is the government's task (among others) to create an enabling environment in which the contractor can run an efficient production process. This means the government has to focus on alleviating any external bottlenecks which may hinder such an efficient production process. Only in 1991 the Tanzanian government first formulated a comprehensive policy for the construction sector. In this policy several measures were introduced involving all the actors in the construction process. These measures will briefly be presented here and judged on their merits where possible.

5.4.1 The consultants

To develop the local consulting capacity the government tends to establish a reward and sanctioning system for all contractual performance of consultants. Also training courses on project management will be provided for consultants. Joint ventures between local and foreign consultants have to stimulate the development of the former ones.[11] However, no indication has been found as to how the government expects to implement these measures in practice, nor as to what extent they have been implemented already.

5.4.2 The clients

Since the government is the major client in the construction sector (see also appendix F, section F.5.1), measures to improve the functioning of the client in the construction process have been included under the heading 'government'.

5.4.3 The branch organisations

In the 1991 construction sector policy of the government branch organisations are acknowledged as being a useful tool in the implementation of policy measures and as such they should be stimulated as much as possible.[12] However, no measures were included how this should take place in practice.

5.4.4 The government

Current measures of the government to improve her own functioning in the sector include the following:[13]

- the planning system of the government will be improved; this measure focuses on improving the government's role as a client as well as as a coordinator; this is to be achieved by the following adjustments to the current planning system:
  * all information necessary for the government to prepare an effective planning will be compiled on a central basis. This will include information on construction capacity, resource availability, price and bidding trends etc.
  * all government plans and programmes will have to indicate particularities on the construction component needed to realise them. This has to provide more insight into future demand which will be placed on the construction sector and the resources which will be needed to fulfill this demand. Guidelines will be formulated for the various ministries which can be used for the realisation of this measure in practice.
- All project proposals will be required to identify total resources necessary to ensure project completion. This will be a prequisite for project approval and should avoid bottlenecks during the construction process, originating from a lack of resources.
- A resource balancing system will be introduced by which resource requirements can be quantitatively analysed and most advantageously committed to projects of economic priority.

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11 The President's Office. *The Rolling Plan and Forward Budget for the period 1994/95-1996/97.* 1994, p.50.

12 Ministry of Works (1991), p.28.

13 Ministry of Works (1995), p.18.

- The Ministry Of Works will be strengthened to more effectively fulfill its coordinating function.

5.4.5 The research institutes

With respect to research in the construction sector the government has formulated four objectives:[14]

- increase of local research activities
  * strengthen existing R&D institutions;
  * encourage an optimal use of local expertise by providing incentives to local R&D personnel and by striving at the participation of local experts in studies and research activities of the government and of parastatal organisations;
- coordination of research activities
  * establish and strengthen interlinkages between research institutions: on sectoral level a coordinating role is given to the National Construction Council (NCC)[15]; on national level this role is the responsibility of the National Science of Technology Commission (NSTC);
  * the NCC and the NSTC will be used by the government to periodically obtain insight into on-going research activities;
- dissemination of research findings
  * establish and strengthen financial mechanisms;
  * establish a data bank which will contain all information relevant to the construction sector. This information has to be available to all actors operating in or linked to the construction industry, both in rural and urban areas.
- financing of research activities:
  * to commit the private and parastatal sector to the financing of research activities, the government intends to provide fiscal incentives to those actors in case they participate in such activities;
  * of the increasing funds which are being allocated to Science and Technology, an increasing part will be allocated to the construction sector.

5.4.6 The education institutes

With respect to the availability of construction personnel, the government has formulated the following specific measures to improve the current situation:[16]

- expand and strengthen existing local training facilities to ensure an adequate output of trained personnel at all levels;
- expatriates shall be employed only where no local professionals are available; at the same time expatriates will be obliged to train local staff;
- foreign-funded construction projects executed by foreign consultants and contractors will be used to provide training for Tanzanian professionals;
- a training levy is charged for each construction and development project as a contribution towards a fund for training within the construction sector;

5.4.7 The labour organisations

Although the government acknowledges the lack of motivation among personnel in the construction sector, no explicit measures have been found. The same goes for the role which labour organisations could play in this respect.

5.4.8 The building materials suppliers

To alleviate the bottlenecks of shortages of both local and foreign materials the government aims at the

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14 Ministry of Works (1995), p.29-31.

15 The National Construction Council is an organisation which falls under the responsibility of the Ministry of Works and which plays a crucial role in the development of the local construction sector. Its functions include advising the Ministry, formulating policy for the sector, conduct research into construction-related matters etc. More information can be found in appendix F, section F.5.4.

16 Ministry of Works (1995), p.26.

following:[17]
- establishment of new and strengthening of existing material production centres on a decentralised basis. This measure especially applies to the production of some basic items, such as tools, cement, bricks, ceramics.
- allocate foreign exchange to the importation of materials which are not locally obtainable.

To bring the construction sector more towards a situation of self-sufficiency when it comes to the materials component, the government will focus on the following:
- promote the use of suitable, naturally occurring materials and stimulate the local production of these materials;
- educate people in the industry on the use of local materials.

5.4.9 The equipment suppliers

To ensure a more adequate availability of construction equipment in the industry in the future, the government intents to take the following measures:[18]
- optimisation of the local manufacturing of tools, equipment and spare parts by strengthening the existing manufacturing facilities and by establishing new ones;
- adequate allocation of foreign exchange to ensure the import of essential equipment and spare parts;
- encouragement of contractors, through the execution of contracts, to acquire and build up their own fleet of equipment;
- train contractors in the optimal utilisation and maintenance of their equipment;
- establish equipment hire facilities.

5.4.10 The financers

As a result of the economic liberalisations the number of available financial institutes is increasing. In 1991, the first two foreign banks started operating in the country.[19] However, specific measures to alleviate the negative effects of strict loan conditions and high interest rates on contractors are totally lacking. On the contrary, due to the inability of the government to structurally bring down the inflation rate, the interest rate is likely to remain on the current level.

5.5 Conclusion

On sector level the Tanzanian operating environment seems to impose many (external) bottlenecks on contractors when it comes to achieving an optimal site productivity performance. All these bottlenecks may have contributed to the relatively bad site productivity performance of (some) local contractors in the past. This may again have contributed to the presence of foreign contractors on the Tanzanian construction market: from a client's point of view a bad site productivity performance is also not preferable.

In chapter 4 we stated that it is the government's task to create an enabling environment. Or, in other words, to alleviate and/or remove the impact of external bottleneck situations. In her current policy document for the construction sector the Tanzanian government acknowledges that many bottleneck situations exist with respect to this sector. However, many of the same problems were already acknowledged in the study on the construction sector, conducted on behalf of the Tanzanian

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17 Ministry of Works (1995), p.25.

18 Ministry of Works (1995), p.27.

19 The President's Office. *The Rolling Plan and Forward Budget for the period 1994/95-1996/97.* 1994, p.4.

government in 1977.[20] When we compare both documents it *seems* that little structural improvement has taken place. A more definite conclusion would require more indepth research into the past and present situation and the impact which government measures have had. Still, basing ourselves strictly on the current policy document for the construction sector, some aspects appear which may hinder structural changes in this sector:

- the number of measures proposed is numerous and cannot possibly be given attention at the same time; the government does not seem to set clear priorities with respect to the many problems which are to be tackled; no distinction is made between short-term, medium-term and long-term policy measures;
- in many cases the government limits herself to intentions; the government does not always seem to translate these intentions into concrete action programmes; the setting of realistic, quantitative milestones to be achieved within a certain period of time is almost entirely lacking; also little is indicated with respect to a follow-up concerning the various proposed measures.

As long as the above situation remains to exist the government efforts to create an enabling environment for contractors may be hampered. This sets demand to the ability of a contractor to still operate as efficiently as possible under the prevalent circumstances.

The local contractors seem to be clearly affected by the bottleneck situations within the construction sector. Still, foreign contractors, including SJI, have to operate in the same physical and socio-economical environment as local contractors. The question which remains here, thus, is: to what extent is a foreign contractor like SJI affected by the same external bottlenecks? This question will be dealt with in the next chapter.

[20] Ministry of Works. *Local Construction Industry Study.* Dar es Salaam, 1977.

Chapter 6

Effects of external bottlenecks: results of the comparative case study

6.1 Introduction

In the previous chapter an overview of external bottlenecks has been presented, which may have a negative effect on the site productivity performance of contractors operating in Tanzania. In this chapter attention will be paid to the (possible) effects of these bottlenecks on SJI as a foreign contractor. In chapter 3 we already indicated that for this purpose a comparative case study would be conducted, including local contracting companies as well. In the same chapter a discussion of the exact structure of this case study was postponed until this chapter. Therefore, section 6.2 will first explain this structure. Subsequently, section 6.3 will present the results of the case study.

6.2 Structure of the comparative case study

6.2.1 Selection of the companies

The objective of the case study is to obtain insight into the extent to which external bottlenecks within the Tanzanian operating environment affect a foreign company like SJI. By including one or more local companies as well, the results concerning SJI can be placed in a more extensive framework.

With respect to the selection of local companies, which would be included in the case study, the decision was made to only include local *class I* contractors in the research. This would avoid class differences to have influence on any differences which would be found between SJI and the local companies. Based on the principles of the registration system all class I companies can compete for the same type of projects. The comparison would in this case take place between potential competitors and thus provide a first indication of the gap which might exist between the local contractors and SJI.

From chapter 5 it has become evident that two types of local contractors can be distinguished within the Tanzanian construction sector: local public and local private contractors. For reasons of time it was decided to only include one of each type. Since MECCO is the only public contractor registered in class I, this company could be directly selected. The choice of a local private class I contractor had to be given more attention. An introduction letter, explaining the intentions of the case study, was send to ten randomly selected local private, class I contractors. The first company which responded positively was selected to be included the comparative case study.

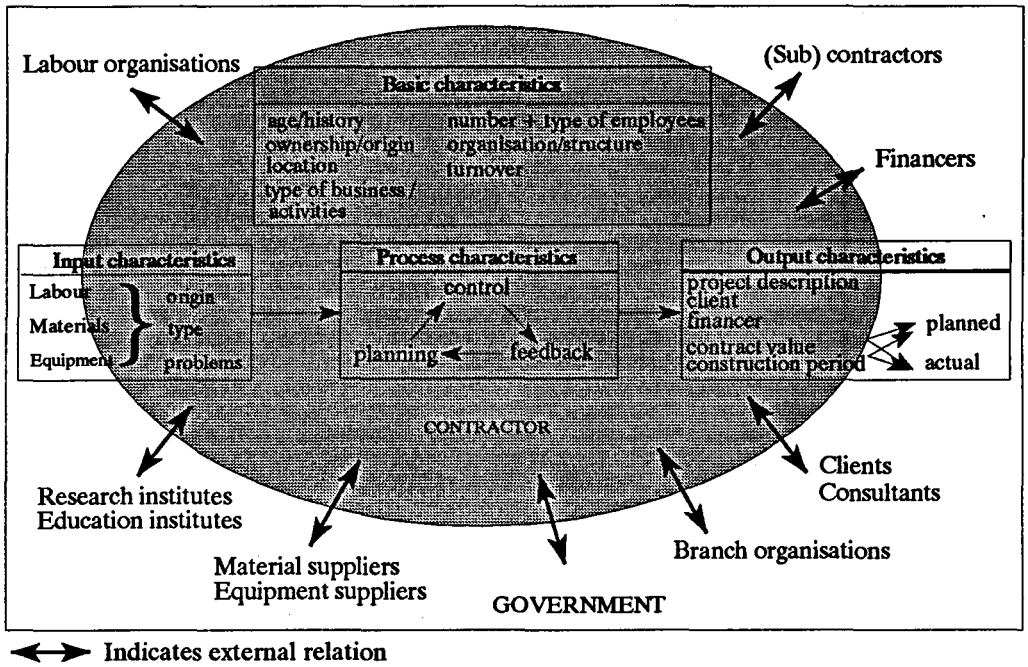
6.2.2 Subjects covered in the case study

The subjects which eventually have been included in the comparative case study have resulted from the findings as presented in chapter 4 and 5 of this report. These subjects are schematically depicted in figure 6.1 below. The external relations characteristics will provide insight into the link between each contractor and the sources of external bottleneck situations (and thus of productivity factors). Besides these characteristics, the degree to which a company is eventually affected by the external bottlenecks also depends on:

- the type of direct input factors used,
- the degree to which planning, control and feedback take place,
- the type of output which usually has to be realised by the company.

The subjects mentioned in figure 6.1 have been elaborated into concrete questions using: 'Gaillard, H. *Industrial organisations in developing countries. A measuring instrument for research and evaluation.* Eindhoven University of Technology, 1992.' The results of this can be found in appendix L.

Figure 6.1 Overview of subjects covered in the comparative case study



Since SJI was the host company of a large part of the research, most (detailed) data could be obtained from this company. Also, more insight existed into the course of things in this company. This should be noticed throughout this chapter. The other two companies, especially the local private one, proved to be reluctant to provide information on some sensitive subjects. This resulted in sometimes limited data. For all three companies it goes that no records were kept concerning completed projects. This also hindered the collection of accurate and complete data for this case study.
Appendix L contains an extensive overview of all the data collected on each company. This chapter only contains the major results of the comparative case study.

6.3 Presentation of the companies

6.3.1 Skanska Jensen International - Tanzania branch (SJI)

A first description of SJI has already been given in the introduction of this report. Here I will only present some new basic facts. The current activities of SJI are limited to construction activities. The company is not specialised in a certain type of construction work, although most projects executed in the past concern building works projects. Unlike the other two companies, SJI also undertakes turnkey projects, which means she is responsible for the entire construction process, from design to completion.

Manufacturing activities in the company's workshop are meant for supply to own projects. In contrast with the other two companies no diversification has sofar taken place in the Tanzanian activities of SJI, nor does this intention exist for the future. Instead, it has strongly expanded its construction activities,

as indicated earlier, by taking over another major foreign contracting company operating in the country. Together with this take-over a new head office, joining the foreign activities of Skanska and C.G. Jensen, was established in the United Kingdom. It is the intention that in the future this head office takes over the function of the C.G. Jensen office in Denmark with respect to the Tanzania branch of the company. This function includes the supply of necessary materials and equipment, financial assistance, etc.

6.3.2 Mwananchi Engineering Contracting Company (MECCO)

MECCO was established in 1964, with a majority share of the Mwananchi Development Corporation.[1] Before that time it was known as TECCO (Tanganyikan Engineering Contracting Company), a private company. In 1970 the government obtained 40% of the shares of MECCO. Thirteen years later, in 1983, MECCO obtained the parastatal status and was re-established as a corporation. Having this status MECCO has the following functions (among others):[2]

- develop activities as a building and civil engineering contractor;
- to promote the development of the construction and allied (sub-)sectors, and in line with this:
- to participate in, sponsor or encourage the establishment of national ventures for the development of the construction and allied (sub-)sectors. This should be in line with development plans of the government with respect to these (sub-)sectors.
- to cooperate with any person or organisation within or outside Tanzania who/which is engaged in activities that are in line with MECCO's functions.

Until now MECCO has concentrated on the first function only.

The parastatal reforms which currently are going on in Tanzania will also affect MECCO in the near future. Discussions are going on as to the best strategy to follow on the way to MECCO's privatisation. These discussions especially focus on the share which the government will have to take in the new company in order for it to survive the reform measures. Without any government interference it would loose its preferential treatment on government projects. As we will see in section 5.4.1, these projects currently constitute the major part of its construction activities.

MECCO has diversified its activities strongly over the years. Besides a construction unit the company also comprises six production units, which manufacture various building materials and products. These units are meant for providing materials for the various projects as well as for producing products for sale.

6.3.3 Africa Construction (AC)[3]

Africa Construction started its construction activities in Tanzania in 1930 as a partnership, founded by private persons of Indian origin. In 1950 the company was incorporated as a private limited company. The owners and managers of the company are still of Indian origin with the British nationality and registered as Tanzanian residents. As a consequence the company has strong links in the United Kingdom, both in the field of supply of materials and equipment, and financing.

Africa Construction has various workshops which manufacture wooden, metal and precast products for its own projects. The company wants to expand its activities towards mining, agriculture and tourism in the near future, due to increasing competition in the contracting business.

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1 This Corporation constituted the economic wing of the then ruling TANU party (see also appendix F, section F.3). This change in ownership was the beginning of direct political influence within MECCO.

2 Taken from company brochure of MECCO, 1994, p.7.

3 'Africa Construction Ltd.' is a fictitious name on request of the management of the company concerned.

6.3.4 Competition among the three types of companies

The management of SJI states to experience competition of local contractors as the strongest competition on the market. According to SJI herself, this competition is a result of the lower prices which local companies can offer, due to their lower quality standards. This competition has caused SJI not to compete anymore for projects for which many local contractors also tender. Furthermore, much competition is experienced by SJI from other foreign companies operating in Tanzania. SJI indicates to experience no competition from public contractors such as MECCO.

MECCO and AC both experience much competition from other local contractors (with no foreign management links). AC mentioned that local companies with a (partly) foreign management and foreign companies increase the competition in the case of foreign-funded companies. Public construction companies, such as MECCO, cause competition according to AC, due to the preference given to such companies by the government in case of government projects.

AC mentions the high competition of the moment to be one of her major problems. This has caused this company to look for other profitable activities.

6.4 Differences in impact of external bottlenecks

6.4.1 The clients

The government is the major client in the Tanzanian construction sector (see appendix G, section G.5.1). This means that many contractors depend on government projects. The projects which SJI has realised since the start of its construction activities in Tanzania in 1974, almost all involve a foreign client and/or financier; no government projects are part of SJI's portfolio. AC's portfolio of the last two years contains both foreign-funded and government projects. MECCO's portfolio of the last two years is dominated by government and parastatal projects. The difference in type of clients implies that the external bottlenecks originating from the client (=public sector) as listed in table 4.2, will affect MECCO most. SJI seems to be least affected by them.

A very severe bottleneck originating from local, public sector clients are the late payments. All three companies judge the promptness with which foreign clients pay interim certificates to the contractor as better compared to these public sector clients. In her annual performance report of 1994 MECCO attributes the relatively bad financial performance on her construction projects, during the preceding financial year, to late payments by some of her (public sector) clients. On the average, payments were more than 4 months late during that year. Also AC mentions the late payments of the government to be one of the major problems of the moment. Considering, the high interest rates in Tanzania (almost 40%), this is a considerable disadvantage towards a foreign company like SJI. There is no indication that the rates are going down in the near future (see also figure F.9, appendix F).

Both MECCO and AC judge the fairness of public sector clients also as less satisfactory than that of foreign clients. MECCO makes the same judgement when it comes to the clients' receptiveness towards suggestions of the contractor on design and construction issues. Such suggestions may contribute to a more efficient and effective production process.

The conclusion has to be that a foreign company like SJI has a major advantage over a local company as MECCO, when it comes to the type of clients of both companies. The same goes for AC towards MECCO, although to a lesser extent.

6.4.2 The consultants

Differences in the impact of bottlenecks originating from the consultant cannot be indicated, due to a lack of insight into the type of consultants MECCO and AC usually work with. From SJI it has become clear that on many of the foreign-funded projects also a foreign consultant is involved. No general

information on the performance of foreign consultants is available either. Together, this makes a final conclusion with respect to all three companies difficult. Still, if we assume that, due to the government's intention to stimulate the local construction sector, on the majority of government projects local consultants are used, the conclusion should be that the frequency with which the two local companies have to deal with bottlenecks originating from local consultants, is higher than in the case of SJI. This especially applies to MECCO versus SJI.

6.4.3 The branch organisations

Not one of the three companies indicated to maintain any contacts with the Tanzania Building Contractors Association (TBCA). This again indicates towards a relatively low activity level of this association (see also appendix G, section G.5.3). It seems that the use of this association by the government as a tool for policy implementation is limited.

6.4.4 The government

Discussion of the effect of bottlenecks originating from the government will take place for each major bottleneck separately.

6.4.4.1 Lack of coordination in sectoral government planning

The lack of the government to coordinate the demand side of the construction sector has in the past led to non-implementation and delays on government projects.[4] A contractor will in general be able to shift the cost-increasing effect of such delays, wholly or partially, on the client by submitting a cost claim. This means that his site productivity performance on the project concerned is not directly affected. Still, the site productivity performance on *other* project may be affected, due to the fact that equipment and labour are longer deployed on the former project.
Since MECCO depends for a large extent on government projects, she will, of the three companies under consideration, in practice experience the effects of this bottleneck most often.

6.4.4.2 Lack of foreign exchange

A lack of foreign exchange may prevent timely import of materials and/or equipment. The effects of this are delays and a lower quality of work in case low-quality local substitutes are used. The former directly leads to increased costs and thus to a worse site productivity performance. The latter may lead to the same situation when the contractor has to redo the work. However, this all depends on who is to be blamed for the lack of foreign exchange: the client or the contractor. In the former case the contractor can again submit a cost claim. But the delays may again affect the site productivity performance on other projects, as described in the previous subsection. Moreover, problems arising from the use of low-quality substitutes, although approved by the client/consultant, may negatively affect a company's image towards future clients.
The above-described situation will, again, affect MECCO most, compared to the other two companies. A company like SJI has a clear advantage here, because of the backing of a foreign head office when it comes to financial matters. Secondly, she is partly or sometimes even fully paid in foreign exchange on all its major projects. This is a combined result of:
- the condition which SJI makes in this respect before accepting a project,
- the dominance of foreign clients/financiers in her portfolio, who are better able to pay in foreign exchange than local, public sector clients.

6.4.4.3 Inadequate physical infrastructure

The physical infrastructure embraces the transport network as well as water and electricity facilities. It may be clear that all three companies under consideration here have to deal with this bottleneck situation and its possible effects. All three companies possess several generators to cover the electricity cuts (see list equipment appendix L). They also all possess transport equipment. Only for SJI the age of the various equipment items is known. AC did not want to provide information on this subject.

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[4] Ministry of Works. *National Construction Industry Development Strategy.* 1991, p.17.

MECCO acknowledges the outdated equipment fleet to be one of her major internal problems. The conclusion should thus be that SJI has a better position in this respect, compared to MECCO.

Another major advantage of SJI is its use of air transport. SJI uses this mean of transport on inland projects, both for materials, small equipment items and higher (expatriate) project personnel. With none of the other two companies this was found to be the case. It may be clear that this difference makes SJI rather flexible towards the other two companies.

6.4.4.4 Bottlenecks resulting from the macro-economic situation

On macro-economic level, bottlenecks for the contractor result from the rapid inflation rate and the establishment of realistic exchange rates. Background information on both subjects can be found in appendix F, section F.7. The effects of resulting bottlenecks on the three companies are discussed below.

Bottlenecks resulting from the rapid inflation rate

The inflation rate is *partly* responsible for the increase in prices of construction inputs. How strong these increases can be even on an individual construction project, can be made clear by taking one project of SJI as an example: the Vocational Training and Service Centre Project. On this project the tender price for cement was 2600 Tsh. per 50 kg bag; a year later, when the project was half finished, the price already amounted to 3850 Tsh per 50 kg bag. Another example are the labour wages: in July 1995, the government suddenly increased the minimum wage from 10,000 Tsh. per month to 17,500 Tsh. per month.

To reimburse the contractor for such price increases during construction time, fluctuating contracts have been introduced. The use of these contracts is common practice in Tanzania. With these contracts the full risk of price changes is put on the client's shoulders. For the calculation of price fluctuations frequently use is made of the so-called price fluctuations formula of the National Construction Council (NCC) (see appendix M). This formula predicts a general price fluctuation factor based on price changes in the direct inputs (labour, materials and equipment). For the material component the most regularly used materials are used: cement, reinforcement, aggregate, asbestos roof sheets (!), softwood, emulsion paint etc. Based on the assumption that most projects in Tanzania involve labour-intensive pouring work, only formwork is included for the equipment component. The NCC also made the assumption that the share of each item in the total project costs is the same on each project (that is: no account taken for construction method used).

From the viewpoint of the client the NCC-formula has several disadvantages:
- clients of projects on which one or more of the materials included in the formula are not used, may still have to reimburse the contractor for price changes of these materials,
- the formula is entirely based on Dar es Salaam prices. Price changes in inland regions may not be the same (e.g. due to a lower demand). This may lead to a too high reimbursement on inland projects.

Fluctuating contracts in general, as well as the use of the NCC-formula in specific may be very unattractive for the client. It may lead to unanticipated costs and, consequently, financial problems, late payments and disputes with the contractor. These again can lead to delays, resulting in the consequences for the contractor's site productivity performance as described earlier. So, despite the previously mentioned advantage of a fluctuating contract for the contractor, it may also result in some negative situations for him.

Going back to the three companies, it proves that SJI always works under a fixed contract, whereas AC and MECCO use fluctuating contracts. The reason why SJI is willing to work on a fixed contract under the current economic conditions is the fact that she is paid in foreign currency on most of her projects. The exchange rate, valid at the moment a contract is signed, remains fixed during the whole duration of the project. In this way SJI can, indirectly, cover the price-increasing effects of inflation on

construction inputs.[5] Moreover, on the long-term the inflation and devaluation together may also positively affect SJI compared to its local competitor. An example which substantiates this statement is elaborated in appendix N of this report.

Local companies, especially not those which depend on government projects such as MECCO are not able to cover the inflation as described above for SJI and they will thus relatively more often rely on fluctuating contracts. Based on the above discussion, SJI could be more attractive from a client's point of view. However, the conditions which SJI makes with respect to payment in foreign exchange and the fixed exchange rate used in this case, may make this contractor relatively expensive for many (especially local) clients. Moreover, through its use of fixed contracts SJI is not compensated for price increases which result from other factors besides inflation. Fluctuating contracts, based on the NCC formula, include all price increases, whether resulting from inflation or other factors.[6] This indicates that the use of a fixed contract also has some disadvantages.

The choice between a fixed and fluctuating contract also depends on the origin of a project's inputs. SJI indicates to more frequently import building materials and products, as compared to AC and MECCO. Through imports from countries where the average inflation rate is much lower than in Tanzania, a company may suffer less from the influences of the high Tanzanian inflation rates during construction. This gives it a better position to use fixed contracts.

Bottlenecks resulting from the establishment of realistic exchange rates
The result of the establishment of realistic exchange rates has been a rapid devaluation of the Tanzanian currency, making import for local contractors more and more expensive. With respect to the site productivity performance on a specific project, currency devaluation which takes place during the construction period may lead to higher costs of imported direct inputs. The devaluation may thus negatively affect the site productivity performance of the local contractors. For a foreign contractor like SJI the devaluation has no effect when it comes to the level of import prices, since they do not buy foreign currency by selling Tanzanian Shillings. However, SJI will become more and more expensive for local clients, since this company requires payment in foreign exchange. With a too strong devaluation of the Tanzanian currency a company like SJI might loose potential clients.

6.4.5 The research institutes

As a foreign company SJI has the advantage that it can make use of knowledge and know how from her head office abroad (which again has the backing of a world-wide construction company), as well as from foreign research institutes in her country of origin. This will limit the effect of the inadequate research activities within the Tanzanian construction sector on her site productivity performance. AC and MECCO indicate to maintain contacts with the local research institutes, but not with any foreign institutes.

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5 Through the fixed exchange rate SJI guarantees herself a fixed yield in foreign currency on her projects, despite the devaluation of the Tanzanian Shilling during the construction period of these projects. At the same time, this fixed exchange rate on her projects, in combination with the devaluation, enables her to obtain more Tanzanian shillings per unit of foreign currency earned during the project. In this way she can cover price increases, which have resulted from the inflation in the country. To determine the degree to which this exactly is the case, a more indepth analysis of the relationship between exchange rate and inflation is required. However, such an analysis is beyond the scope of this text. However, if we assume that the exchange rate developments fully cover the inflation, the conclusion could be that SJI, through its use of a fixed exchange rate, is able to fully cover the price increases which result from inflation.

6 As an example of this we use the previously mentioned price increase of cement again, as it occurred on the VTSC-project of SJI (see main text, previous page). The price increase based on Tanzanian currency, amounted to 48%. This is far above the inflation rate during that year (estimated on 23%). Local contractors, using a fluctuating contract, will still be covered for the whole 48%. For SJI, this will not be the case, since she uses fixed contracts.

6.4.6 The education institutes

With respect to the shortage of, especially, qualified local professionals and supervisors a striking difference is noticeable between AC and MECCO on the one hand and SJI on the other. The latter only employs expatriate project managers and supervisors, whereas the other two employ no expatriate employees at all. The expatriates of SJI are all employed from the foreign head office, proving that the backing of such an office is a buffer against shortages of local personnel.
However, all three companies mention problems with respect to the management capabilities of their project managers / supervisors. Even SJI. This seems to limit the positive effect of employing foreign personnel for SJI. Still, more indepth research into the knowledge and skill level, as well as into the functioning of managers and supervisors at each company will be necessary, before drawing a firm conclusion on the effect of bottlenecks, which originate from local education institutes.

It is striking that SJI does not seem to train any local people as a project manager, despite the government regulations in this respect.[7] This again has a negative effect on the site productivity concept when considered from a sectoral point of view.

6.4.7 The labour organisations

In table 4.2 labour organisations are said to be responsible for a lack of incentives within the Tanzanian construction sector. Of course this also depends on the contracting companies with which the labour organisations negotiate. For the three companies included in the comparative case study it was not possible to look into detail in the wages and conditions offered and the effect of these on the labourers on their sites. According to TAMICO, the labour organisation for construction labourers in Tanzania, foreign contractors are more cooperative to negotiate with the labour organisations and they tend to pay better wages to local labourers as compared to local ones.[8] Assuming a positive relation exists between the wage level and conditions offered by a company on the one hand and the motivation and working speed of labourers on the other, this may lead to the conclusion that foreign companies would suffer less from the bottleneck 'lack of incentives' in the Tanzanian construction sector.

6.4.8 The building material and equipment suppliers

With respect to local suppliers of materials and equipment, SJI's judgement is generally lower than that of the other two, local, companies. In the case of foreign suppliers, SJI is especially more content on the prices of materials than the local companies. Three possible causes can be mentioned for this:
- SJI can depend for her foreign materials on her foreign head office, which has a thorough network of suppliers,
- due to the fact that the mother company also has to purchase materials and equipment for projects of other branch offices, it is in a better position to negotiate lower prices (bulk purchase),
- the rapid devaluation of the Tanzanian shilling has made import for local companies relatively more expensive.

For SJI the above situation positively affects her site productivity compared to the two local companies.

SJI indicates to more frequently import, as compared with the other two companies. Whether or not imported materials are used depends on characteristics of the project under hand (type of design, quality standards used etc.). Considering the type of clients SJI has, this might indicate that on foreign-funded projects relatively more imported materials are used. Specific evidence for this results from the VTSC-project (see also appendix P): on this project a contractual clause was added, stating that all materials and equipment used had to be 100% of Danish origin. It might be clear that in this way the

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7 For every expatriate employee which is employed by a company, a local person has to be trained within the same company. This is based on statements of the administrative manager at SJI and policy documents of the Ministry of Works (1991).

8 Based on interview with mr. P. O'chieng Olum of TAMICO. See also appendix E.

local building materials industry is not stimulated and, consequently, neither are the efforts of the national government to alleviate bottlenecks originating from this actor in the construction process.

6.4.9 The financiers

The striking difference here is that SJI arranges her financial needs through her foreign head office. In this way she can avoid the high interest rates of Tanzania and, consequently, the negative effect which this may have on her site productivity performance. AC experiences this interest rate to be one of the major problems, which she is currently experiencing. MECCO does not mention it to be a problem. However, considering this company's dependence on government projects and the frequency of late payments by public sector clients, it seems likely that MECCO is affected more by the high interest rates than a company like SJI.

6.5 Internal bottlenecks

In chapter 4 we stated that internal bottlenecks may hinder the attempt to limit the impact of external bottlenecks. Detecting company factors, constituting an internal bottleneck situation, requires thorough and independent research in all three companies. For the two local companies this has not been possible, due to a limited amount of time available for this part of the research. Here, only some first differences with respect to the direct input factors used by each company, as well as with respect to how they manage their production process, can be indicated.

6.5.1 Input characteristics

6.5.1.1 Labour

With respect to the labour component all three companies indicate to experience bottlenecks.[9] Most striking is the lack of management capacities among project managers and supervisors. In chapter 2 (section 2.2.2.1 and 2.4.4) these capacities were found to be crucial in the endeavour to reach site productivity improvement. To alleviate this bottleneck within the labour component, a company could train its personnel itself and/or provide guidelines on how to manage a project. SJI has an official guideline for the entire construction process, from the tendering stage until the realisation and completion of a project. This guideline allocates responsibilities and provides instruments and tools for the execution of these responsibilities (see also appendix Q). Of the other two companies MECCO is the only one with a guideline, but this is restricted to a theoretical approach to project management. It does not provide any clear tools or instruments, nor does it clearly allocate responsibilities when it comes to planning and control. At AC a guideline is lacking. The supervisors on site are given little to no responsibility when it comes to planning and control. These functions are fulfilled by three Project Directors in the head office. In this way spreading of management skills among the company's site supervisors is thus hindered. Overall, it seems that SJI provides the best tools to alleviate this bottleneck, contributing positively to its site productivity performance.

6.5.1.2 Equipment

One of the major problems MECCO experiences at the moment is a lack of equipment, both for building and civil works. Due to this, MECCO looses a lot of contracts, weakening its financial position, which again hinders the procurement of new equipment. This situation thus constitutes a vicious circle for the company. Especially when one considers the extensive and relatively new equipment fleet of SJI, MECCO's lack of equipment is to be considered as an internal bottleneck. AC mentions the high interest rate to be a constraint in the investment of new equipment.

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[9] The contact persons at the MECCO head office, used during the execution of this case study, indicated to only experience problems with project managers and supervisors. However, the project managers on one of MECCO's sites indicated also problems with respect to the skills and knowledge level of labourers.

The advantage of SJI towards the other two companies when it comes to a modern equipment fleet, may result in SJI being able to finish its projects relatively more quickly. When we look at the output characteristics of each company (appendix L) it proves that at SJI the average production value per month is a lot higher as compared to the other two companies (592 million. Tsh. per month versus 21.7 and 22.5 million for MECCO and AC respectively). Of course, other factors but the available equipment fleet may affect this difference (location of project, complexity of work, available labour input etc.). Still, the difference is considerable and provides a first indication on production speed. A faster completion time, in general, may positively affect the costs level of the direct input factors and thus the site productivity performance. Moreover, the direct input factors are available sooner for use on other projects.

6.5.2 Process characteristics

Based on table IV-1 in appendix L SJI seems to have formalised and standardised the organisation within the company, as well as the planning and control procedures, most. First of all, SJI prepares organisations charts which indicate the link between the project and the various departments in the branch office. This contributes to clearness and effectiveness. AC also prepares these charts, but they were not found at MECCO. Moreover, the offices of the two local companies tend to strictly control the activities on their construction sites, whereas the SJI-office limits itself to an advising and supporting function. At MECCO it was acknowledged that her link between the office and the site is bureaucratic and has a delaying effect on the progress on site. SJI, in this respect, is much more flexible, which seems to be more appropriate in an environment with a relatively high uncertainty as to the availability and quality of inputs etc.

The guidelines of SJI mentioned in subsection 6.5.1.1 seem to provide better tools for planning, control and feedback considered from a site productivity point of view. Forms and procedures are formalised and standardised more than in the case of the other two companies.

Remarkably enough all three companies included in this comparative case study say to use (basic) bar charts as scheduling technique. None of them indicates to use a more sophisticated technique such as network scheduling. In 1984 a survey was carried out in Tanzania on the range of projects undertaken and the planning and scheduling techniques employed for their control.[10] The results of this survey revealed that most local companies included, used the bar chart technique. Only some foreign companies, working on very large projects, were found to use network scheduling techniques. For the three companies under consideration here, this situation does not seem to have changed. Even a foreign company like SJI prefers the use of bar charts, even on a large and complex project as the Sheraton project. However, SJI does make use of computer-packages when it comes to planning, scheduling and control. None of the other two companies has computers at its disposal for these activities. The use of computer packages gives SJI an advantage when it comes to planning capacity for large and complex projects. The relatively smaller planning capacity at the two local companies may constitute an internal bottleneck for their site productivity performance on larger and complexer projects.

6.6 Conclusion

External bottlenecks, originating from the environment in which the construction process in Tanzania takes place, seem to affect AC and MECCO more than a foreign company like SJI. This mainly is a result of:

- the difference in type of clients,
- the link of SJI with a foreign head office.

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[10] Morgan, P.R. and J. Bakari. Bar-charts to CPM - construction scheduling and Tanzania. In: *International Journal for Development Technology,* vol. 4, 79-91 (1986).

Based on the former, MECCO seems to be more affected by bottlenecks in the operating environment than AC.

SJI also seems to suffer to a lesser extent from internal bottlenecks in the field of input characteristics and process characteristics. In combination with the lesser impact of external bottlenecks this gives SJI a competitive advantage over the two local companies, included in this case study. Still, more indepth research is needed to draw a definite conclusion on the existence of any internal bottleneck situations at SJI. This will, among other things, be dealt with in the next chapter.

Chapter 7

Site productivity at SJI: productivity factors and cost control

7.1 Introduction

In chapter 5 and 6 the operating environment in which construction projects of SJI in Tanzania take place, has been presented. The (possible) impact of bottlenecks, originating from this environment, on SJI has been indicated as much as possible, based on a comparison with two local competitors.

This chapter will pay attention to the site productivity concept as applicable to SJI. First an overview of productivity factors is provided, which in general may affect the site productivity performance of a contractor (section 7.2). The degree to which these factors affect SJI is dealt with in appendix O. In section 7.3 the cost control system as used by SJI on its construction projects is presented. Finally, in section 7.4 a conclusion with respect to both the productivity factors and the cost control system as applicable to SJI is presented.

7.2 The productivity factors

7.2.1 Methodology used

To determine the effect of productivity factors in the case of SJI and the VTSC-project first a list with possible productivity factors had to be prepared. As basis for this list use has been made of the Ph.D thesis of P.A. Erkelens.[1] Productivity factors as presented in this publication were reviewed on their possible impact on the site productivity performance. This first list was supplemented with 'new' factors. These 'new' factors have resulted from insight obtained during this research concerning:

- the construction process in general (chapter 4);
- the operating environment of contractors in Tanzania (chapter 5 and 6).

In table 7.1 all the factors found are schematically presented and categorised. This table does not have the purpose to be exhaustive. Probably, many more productivity factors exist, which have not been included in this table. Still, the table provides a first insight into some major factors and can be seen as a first hold in the effort to control these factors.

In appendix O the specific contents of each factor is presented in more detail. In the following subsection the classification of productivity factors as used in table 7.1 will be explained, before presenting the table itself.

7.2.2 Classification of productivity factors

In chapter 2 (and appendix D) productivity factors have been defined as being factors which influence one or more of the productivity elements. In the case of site productivity these elements are the direct input factors, the site output, the site and the production process. Factors causing a site productivity difference by influencing the direct input factors and/or the site output, are called *direct* productivity factors. Factors causing a site productivity difference by influencing the site and/or the production

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1 Erkelens, P.A. *Self-help building productivity. A method for improving house building by low-income groups applied to Kenya 1990-2000.* 1991, p.142-143.

process, are called *indirect* productivity factors.

Factors can originate from various sources:
- the contractor's own organisation,
- other actors involved in the construction process,
- the physical environment.

Factors resulting from the former source are called *internal* productivity factors. Factors resulting from any of the two other sources are called *external* productivity factors.
More than one actor may be involved in a certain productivity factor. A factor may also affect more than one productivity element. In those cases a factor has been included in the table more than once.

Table 7.1 Productivity factors

Productivity element → / Source ↓	Direct productivity factors: Input: Labour	Direct productivity factors: Input: Materials	Direct productivity factors: Input: Equipment	Direct productivity factors: Input: Subcontracting	Direct productivity factors: Output	Indirect productivity factors: Site	Indirect productivity factors: Production Process
Contractor	Site accidents Labour conditions Quality tender Foremen meeting Degree planning Degree control Degree feedback	Storage methods Waste materials Knowledge where to buy materials Import materials Testing materials Quality tender Degree planning Degree control Degree feedback	Storage methods Import equipment Maintenance Source equipment Quality tender Degree planning Degree control Degree feedback	Subcontractor meeting Quality tender Degree planning Degree control Degree feedback	Design changes	Site lay-out	Labour conditions Storage methods Philosophy PM Experience PM Availability expats Position project Availability infor. Correct orders Foremen meeting Subcontr. meeting Accidents on site Knowledge where to buy materials Import materials + equipment Maintenance Testing materials Relation consult.-contractor. Knowledge on contract Link site - office Project organ.
Labourers	Motivation Health conditions Stealing materials	Stealing materials	Knowledge how to use equipment				Motivation Absenteeism Stealing materials Knowledge how to use equipment Cultural elements

(Table 7.1 continued)

Productivity element → / Source ↓	Direct productivity factors: Input: Labour	Direct productivity factors: Input: Materials	Direct productivity factors: Input: Equipment	Direct productivity factors: Input: Subcontracting	Direct productivity factors: Output	Indirect productivity factors: Site	Indirect productivity factors: Production Process
Other contractors	Competition	Competition	Competition	Competition Use subcontractor			Use subcontractor
Client/consultant	Quality tender documents Quality drawings Type of project organisation	Quality tender documents Quality drawings Type of project organisation	Quality tender documents Quality drawings Type of project organisation	Quality tender documents Quality drawings Type of project organisation	Quality tender documents Quality drawings Type of project organisation Design changes		Quality tender documents Quality drawings Foreign donor Relation cons.-contractor. Type of project organisation Late payments
Branch organ.							
Government	Site accidents Change in labour costs Labour conditions						Import materials / equipment Availability expats Degree corruption Infrastructure Government measures
Research institutes							
Education institutes	Degree of skills + knowledge Availability skilled labour	Availability skilled labour	Availability skilled labour	Degree skills + knowledge Availability skilled labour			Degree skills + knowledge Avail. skill. labour

(Table 7.1 continued)

Productivity element → / Source ↓	Direct productivity factors: Input: Labour	Direct productivity factors: Input: Materials	Direct productivity factors: Input: Equipment	Direct productivity factors: Input: Subcontracting	Direct productivity factors: Output	Indirect productivity factors: Site	Indirect productivity factors: Production Process
Education institutes	Availability qual. supervision	Availability qual. supervision	Availability qual. supervision	Availability qual. supervision			Availability qual. supervision
Labour organisations	Change in labour costs Influence labour organisations Labour conditions						Strikes Labour conditions Influence labour organisations
Material suppliers		Change material prices Quality materials					Quality materials Reliability supply Availability materials
Equipment suppliers			Change in equipment prices Quality equipment				Reliability supply Availability equipment Availability spare parts Quality equipment
Financiers							Interest level Loan conditions Availability financing
Environment	Environmental conditions	Environmental conditions	Environmental conditions			Environmental conditions Size building site Vulnerability site	Environmental conditions

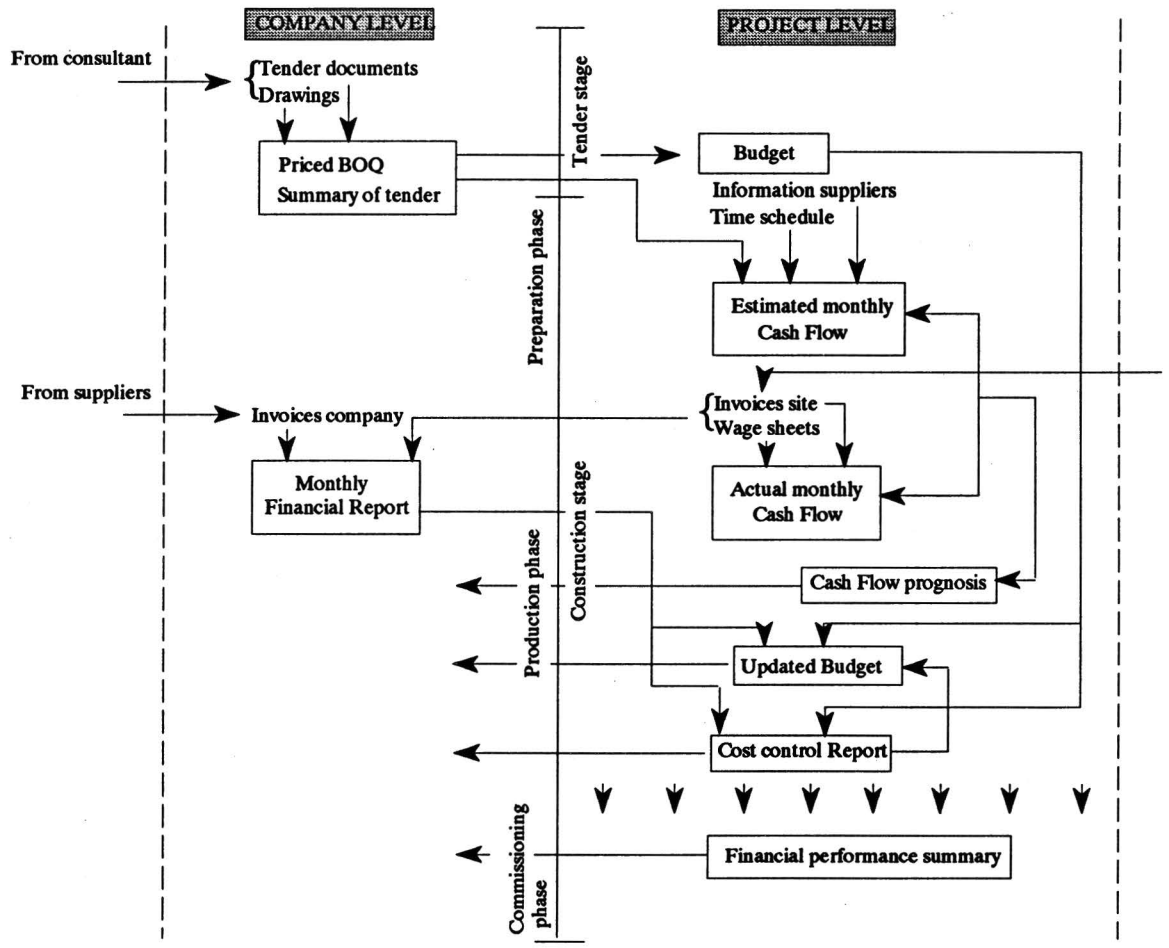
7.3 The cost control system at SJI

Research into the cost control system as used by SJI on its construction projects had to be restricted to one project: the Vocational Training and Support Centre project (VTSC-project). Detailed information on this project can be found in appendix P. In this section the features of the cost control system as it was used on this project are presented. The principles of this system have been laid down in the so-called 3T-file of the company. This file has been developed internally at the Swedish mother company of SJI and is meant as a guideline for all employees involved in the construction processes of the company. A more detailed presentation of the principles of the 3T-file can be found in appendix Q.

7.3.1 The information aspects

Appendix R contains an overview and explanation of major documents and forms as they have been found to play a role during the tender phase and construction phase of the VTSC-project. Some of the documents and forms have also been included in the schematic representation of the information aspects of the cost control system.

Figure 7.1 Information aspects of the cost control system at SJI



The basis for cost control during the construction phase was the priced Bill of Quantities (BOQ) and the summary of tender as prepared during the tender phase. Based on these two documents and the first time schedule of the project, an overview of monthly cash flow (appendix S, figure S.1) needed on

site was prepared before start of the production process. This overview *only* contained those costs which were to be payable on site. Other costs were paid by the branch office or foreign head office (imported items) and were thus not included in the cash flow overview. During production the actual cash flow spent was determined based on all the invoices and wages paid during that month. The combined overview of estimated and actual cash flow was the major control tool for the project manager when it came to the costs which were payable on site. Once every three months a cash flow prognosis for the remaining construction period was send to the branch office.

During the production phase, a financial report was prepared at the branch office on a monthly basis, containing all costs of the project sofar (appendix S, figure S.2). The input for the preparation of this report came from the various departments in the branch office itself, the foreign head office and the site. For the site, this monthly financial report was a tool in the preparation of the cost control report (appendix S, figure S.3). The purpose of the cost control report is to compare the estimated contract sum with the expected final contract sum, based on the cost development sofar. This thus is a tool for total financial control of the project. The cost control report was also send to the branch office. The same goes for the updated budget, which is prepared on the basis of the previous budget, the monthly financial report and the cost control report.

In general, all documents prepared during the construction phase of any project are based on a 9-points numerical coding system. This coding system is the same for all project, both inside and outside Tanzania. Within this system each project is assigned a unique number. Figure S.4 in appendix S contains the coding system as applying to the VTSC-project.

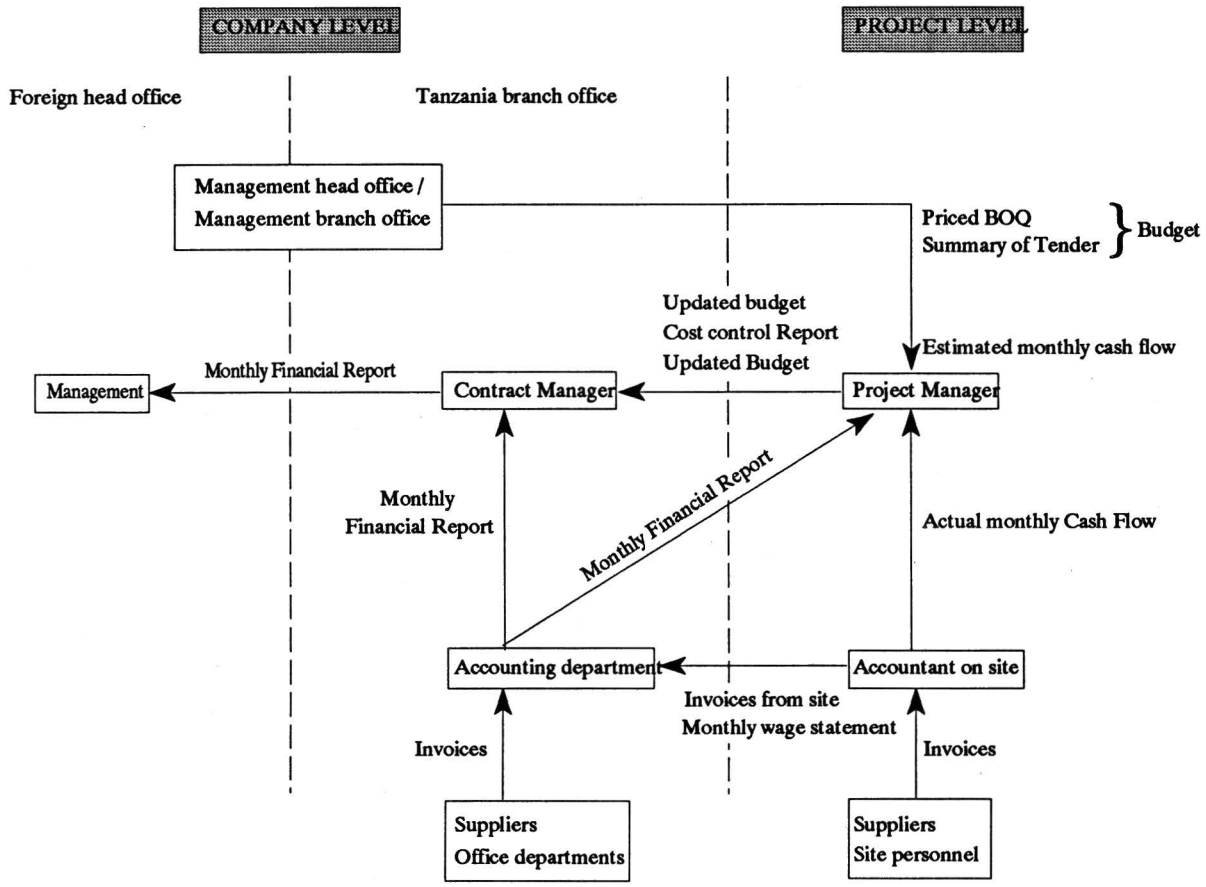
A monthly valuation of work carried out is done by the quantity surveyor on site. The valuation is send to the branch office, which takes care of submitting a payment claim to the consultant. The branch office also takes care of the formulation of cost claims, if any occur. The site should for this purpose use the so-called delays & disruption schedule (appendix S, figure S.5) and send it timely to the office. This schedule is to be used to lay down any information relevant for the formulation of a cost claim. On the VTSC-project it occurred twice that the information required by the office for setting up a cost claim was too late. No insight was given into the cost effect of this, but in general it goes that this negatively affects the site productivity level.

7.3.2 The organisation aspects

Figure 7.2 on the next page shows the organisation aspects of the cost control system as applicable to the VTSC-project. The tendering activities for the VTSC-project took place at the head office in Denmark. This is standard procedure for large projects (that is: tender sum approximately 1 million Danish Kroner or above). The reason behind this is, first of all, that little quantity surveying capacity is available at the branch office in Tanzania. Secondly, it is easier in view of the collection of prices of imported materials and equipment, which normally constitute an important part on SJI's projects. The level of the final tender sum which is submitted to the client is usually decided upon by both head and branch office management.

After the contract for the VTSC-project was won, the project manager was involved in the project. From that moment on he was in charge of the entire project. Before start of the production on site he prepared the cash flow estimate, based on the BOQ and summary of tender as obtained from the company's management. During the production process information on the actual monthly cash flow situation was prepared by the accountant on site. The accountant was responsible for payment of wages and of invoices received on site. Every month the accountant sent monthly wage statements and invoices to the accounting department at the branch office. Together with other invoices received, this department prepared a monthly financial report. The report was send to the site, the contract manager at the branch office and the foreign head office.

Figure 7.2 Organisation aspects of the cost control system at SJI



The project manager was supposed to sent an updated budget and cost control report to the contract manager every second month, as well as a cash flow prognosis every third month. In practice this did not happen. Instead, the cash flow overview (estimated versus actual) was sent to the contract manager on a monthly basis.

7.4 Conclusion

From the contents of this chapter it proves that many productivity factors exist, of all kinds and sources. Not all these factors do affect SJI to the same extent, nor will they affect all SJI's projects to the same extent. The former already became evident from chapter 6. On the VTSC-project it proved that especially productivity factors originating from the labourers as well as from SJI herself relatively strongly affected the project. Little time was available / taken on this project to properly plan and prepare the production process. Consequently, the impact of especially internal productivity factors proved to be larger than necessary. The basis for this inadequate planning has been laid during the

tender phase. First of all, the construction period and contract value agreed upon with the client proved to be unrealistically, considering the circumstances under which the project had to take place. Second, the BOQ and drawings proved to contain mistakes. These two aspects, together with a too limited preparation of the production process, have resulted in a relatively strong impact of productivity factors on this project.

To be able to successfully tackle external productivity factors, SJI needs to deal with the internal productivity factors first. The most crucial ones in this respect are 'degree of planning', 'degree of control' and 'degree of feedback'. On the VTSC-project these have all found to be insufficient. The cost control system, used during the production process, was too rough to provide proper insight into the site productivity performance and productivity factors affecting this performance. Within this system it was not possible to determine where (geographical location) and when exactly a deviation from the planned cost took place.

Since detailed control was not exercised, detailed planning and feedback during the production process were also lacking. The lack of detailed planning was partly caused by a lack of standard data which could be used for this purpose. This again is the result of:
- limited planning capacity available within the branch office,
- no registration of productivity figures for the purpose of use on future projects,
- no structural feedback from the site to the persons responsible for planning and estimating.

A lot of planning on site proved to be based on feeling and experience.

Feedback after project completion has proved to hardly exist at SJI. As soon as a project is finished one goes to the next, without considering how the experience on the finished project could be used on the new one. Adequate, structural feedback after project completion is entirely lacking at the moment.

The conclusion has to be that at SJI the productivity factors are not dealt with in a structural way. Currently, the importance of long-term improvements in this field is not acknowledged by SJI. Short-term thinking dominates the activities of the company. That is: a project is to be finished on time at the lowest costs with the desired quality level. How this could be achieved as optimally as possible, both on the short- and long-term, is not given enough and full attention at the moment.

Recommendations which have resulted from the above conclusions are presented in the next chapter.

Chapter 8

Conclusions and recommendations

8.1 Introduction

In chapter 2 a cost control system was selected as a crucial tool in the attempt to reach site productivity improvement. This control system should be linked with planning and feedback. Moreover the productivity factors should be controlled as much as possible to provide a solid basis for the cost control function. The productivity factors prevalent during the production process on site, depend on the way the construction process has taken place up until that moment and the operating environment in which the entire construction process takes place. The above has schematically been depicted in the theoretical framework of figure 3.1.

In this chapter conclusions and recommendations are presented which resulted from the research, based on the above theory, at SJI. Throughout the report conclusions have been presented with respect to the various parts of the research. Although these subconclusions have served as input for the final conclusions and recommendations, they will not be repeated in this chapter.

8.2 The TRINITY: planning - control - feedback

Cost control has been the focal point in this report. Therefore, the first recommendation in this section purely concerns the cost control function, followed by recommendations with respect to the other two functions, as they were found to take place at SJI.

8.2.1. Control

The current cost control system of SJI is not in every respect an effective tool in the attempt to reach site productivity improvement. A distinction should be made here between direct and indirect costs (see also appendix C). Especially with respect to the former cost type the cost control system is considered here as unsatisfactory. The direct costs are directly incurred by the construction activities on site. They could thus be directly allocated to a specific part of the site output. In doing this, it will become more clear *where* and *when* a possible cost deviation with respect to the direct costs has occurred. For: the construction activities are linked to a certain geographical location on the site and they have been scheduled in time. Allocating the direct costs to the various construction activities will thus contribute to more effective feedback.
The current cost control systems does not provide this possibility with respect to the direct costs. The direct costs are aggregated per direct input factor, instead of considered per (major) construction activity. Moreover, control takes place on a monthly basis, which limits the effectiveness of feedback concerning a cost deviation which took place, for example, at the beginning of the month. Based on the above, the following recommendation has been formulated:

Box 8.1 First recommendation

The current cost control system should be supplemented with a weekly cost control system; this cost control system should be linked with the scheduling system used on site; the basic elements of the weekly cost control system should be standardised and included in the 3T-file.

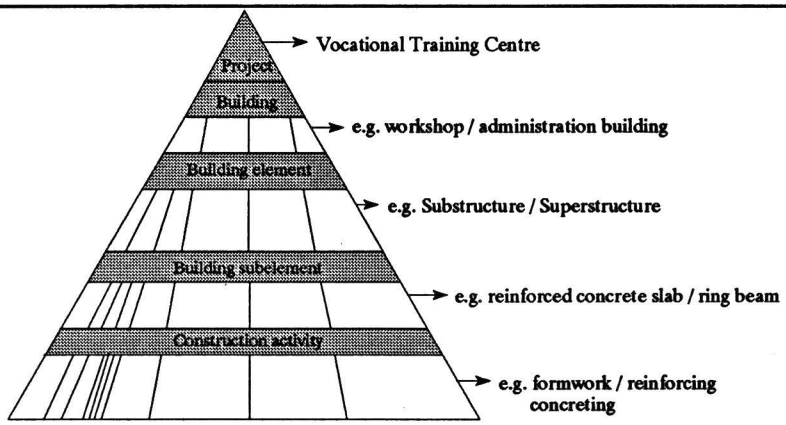
The principles of a weekly cost control system are explained in appendix T. It is recommended to link the weekly cost control system to the scheduling system on site, since this latter system contains the construction activities as they are to take place in time. By linking both systems more clear and direct insight can be obtained in the development of the costs of the direct input factors in time.

The weekly cost control system should in first instance be used *on the site* only. Cost reporting to the office could still be based on the existing system (as long as is made sure that this system is actually being used and also that it is being used in the right way). In this way the *total* cost control system (= current system supplemented with a weekly system) will meet the requirement of 'management by exception'.[1] That is: only that cost information is provided to a certain person within the system, which he/she needs from the viewpoint of his/her task in the system. This contributes to the efficiency of the cost control function.

The basic elements (e.g. coding system, standard forms and reports) of the weekly cost control system should be included in the 3T-file, since this file is the handbook for project managers at SJI. In this way it can be made sure that the system, on the long run, becomes a standard cost control tool for all projects. If managers can make use of the same cost control principles for each project this will take less time and effort, contributing to effective use of the system and efficiency within the company.

The weekly system should be incorporated within the current system as much as possible. This will limit the number of changes which have to be made with respect to this system. Less changes will increase the acceptability and use of the new system. The link between both systems should be made with the coding system. For the weekly cost control system a coding system based on construction activities will be required. This requires the site output to be unravelled into smaller units up until the level on which quantities of direct input factors are determined. This operation will result in a Work Breakdown Structure (WBS).[2] In general, the smallest unit within such a WBS will be a separate construction activity such as excavating, reinforcing, concreting etc.. The basic idea of a WBS is schematically depicted in figure 8.1. The examples included in this figure apply to the Vocational Training and Service Centre project of SJI. Each construction activity should be assigned a code. The coding system resulting from this should be compatible with the coding system of the current cost control system (see also appendix S). Separate research is required to set up this coding system, setting out from the requirements as described in this paragraph and the already existing coding system.

Figure 8.1 Basic idea of a Work Breakdown Structure



1 Pilcher, R. *Project cost control.* 1985, p.339.

2 Ahuja, H.N. *Successful construction cost control.* 1980, p.20-22; Kavanagh, T.C. et al. *Construction management. A professional approach.* 1978, p.240-241.

8.2.2 Planning

Currently the basis for cost planning (that is: the preparation of the tender) is laid at the foreign head office. This brings with it a relatively lengthy communication line between the sites in Tanzania and the planning department at this head office, responsible for the tender preparation. Still, from the viewpoint of effective control this communication is crucial and should take place on every project. Information on any mistakes in the tender as well as cost data concerning the direct input factors should be fed back to the planning department. Only then accurate and realistic tenders on future projects can be prepared. During this research no evidence has been found which indicated towards structural feedback from the sites to the planning department. This may be caused by the previously mentioned lengthy communication line. Based on this, the following is recommended:

Box 8.2 Second recommendation

The planning function at the branch office of SJI in Dar es Salaam should be strengthened.

By following this recommendation, the communication line is shortened, which may positively affect the effectiveness of feedback from the site to the planning department. Since this recommendation may involve considerable organisational changes, further research will be needed on this matter.

Project managers are responsible for the preparation of a more detailed project planning as soon as the contract of a project has been won. The project manager will base this planning on the tender. Combing this with the situation as found in this respect at SJI, the following recommendation has been formulated:

Box 8.3 Third recommendation

Project managers should be fully informed on the position of the project within the company; this should include information on all issues which have played a role in the preparation of the tender and the objectives which, eventually, are to be met by the project.

With respect to project managers Briner and Geddes (1988) state that if they are to be successful they need to understand the context within which the project objectives have been set.[3] The tender which, on construction projects, contains the project objectives (expressed in time and costs), is influenced by the degree of competition a contractor experiences. On the VTSC-project of SJI this was found to have led to a relatively low contract value and construction period, with the consequences for the effectiveness of the cost control function. Eventually, it is up to the company's management to decide upon the level of both value and period in light of the entire company performance. Other aspects than mere profit may play a role in taking this decision. For example, a very small profit margin on a certain project may be accepted just to beat the competitors and/or because a profit on other projects covers for this small profit margin. It is not part of this research to make any recommendations with respect to the issues which play a role in setting the contract value and construction period during the tender phase. Still, from the viewpoint of an optimal site productivity performance, the management of

[3] Briner, W. and M. Geddes. Understanding the Big Picture: how to ensure that all the project team understand why they are there and for whom they are doing it. p.233. In: *From conception to completion. Proceedings of the 9th world congress on project management.* September 4th - 9th: Glasgow, 1988, p.233-240.

SJI should bear in mind the consequences of these issues for cost planning and cost control. Especially on a project with a small profit margin tight planning and control may be crucial to limit any losses as much as possible. Since the project manager will eventually be responsible for the cost performance on a project, he should be informed on the underlying issues, which played a role in the determination of the contract value and construction period. Moreover, the company should give all the support it can to the project manager in charge, before and during the production process.

8.2.3 Feedback

Feedback comprises both feedback during the production process and feedback after the production process has been completed. The former type of feedback depends on the size, type, complexity and duration of the project.[4]

With respect to the VTSC-project little feedback was found to exist between the branch office and the site during production. Cost documents were not always send to the branch office as required according to the company's cost control procedures. In general, this may hamper effective feedback from the branch office to the site. The following recommendation has been formulated with respect to this situation:

Box 8.4 Fourth recommendation

On each project a feedback function should be installed; the precise feedback procedures to be followed should be determined for each project separately; the procedures should be discussed, agreed upon and laid down by the people involved before start of the production process; feedback should take place orally as much as possible, supported by reports.

Each project has unique features when it comes to size, duration, complexity etc. Based on this different projects require different feedback procedures. Nygren and Paulson (1988) suggest the following in this respect:[5]

- complex projects with a high priority for the company require feedback during the entire project duration with an interval of two weeks;
- less complicated projects with a relatively low priority should receive intensive feedback at the beginning of the project in order to ensure that all the direct input factors are available and that the construction work can start; feedback during the project should preferably take place once every month.

So, the feedback procedures (e.g. frequency, subjects, communication methods) should be ascertained per project. The people involved should be informed timely on these procedures in order for the feedback function to effectively support the control function.

As part of the feedback procedures regular meetings are recommended. During these meetings any irregularities found in the tender documents can be presented. The cost performance can be discussed and, at the same time, both parties (that is project - and branch office management) could provide feedback to eachother. Such monthly meetings may result in more effective feedback from the branch office to the site than is currently the case. Moreover, with the regular feedback given during this meetings project managers may also feel they are supported by the branch office.

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4 Based on: Nygren, H. and Paulson, C. Follow-up - everybody is talking about follow-up, but very few put enough effort to it p.866. In: *From conception to completion. Proceedings of the 9th world congress on project management.* September 4th - 9th: Glasgow, 1988, p.865-871.

5 Nygren and Paulson (1988), p.866.

On some occasions the meetings should include all project managers in the company. In this way an exchange of information and experience can take place, which may contribute to the problem solving capacity of the project managers. In an environment such as the Tanzanian, this capacity was found to be one of the crucial requirements for project managers.

In general, more use should be made of experience gained on projects in the past. Currently nothing is done with the valuable experience gained on the various projects. However, such feedback can form a crucial input for the planning function, both during the tender phase and during the construction phase. This has led to a fifth recommendation:

Box 8.5 Fifth recommendation

Each project should be concluded with a standard feedback procedure: a debriefing meeting should be organised; a standard report format should be developed which is to contain all project information, relevant for future projects; the reports should be accessible for use by all project managers in the company; a copy of these reports should be spread among the various company departments.

The project management, the branch office management, as well as all heads of departments involved in the project, should participate in the debriefing meetings. The meetings could provide the branch office management with more insight into the management capacity of its project managers as well as into any bottlenecks on office level, which require attention.

SJI should introduce standard feedback reports, which are to contain extensive information on subjects like:

- project characteristics: e.g. organisation structure, site lay-out used, storage method used, links with the office etc.
- labourers: what problems were experienced with the labour on site; how were problems solved;
- client / consultant: how was the relationship with the client and consultant; what problems did occur and how were these solved?
- suppliers: what materials and equipment were available in the surroundings of the site; what was their quality and price; how reliable were the suppliers?
- local authorities: how did the contact with local authorities take place; which contact persons were used; how was the relation with these persons; which problems did occur; how were these problems solved?
- environment: what were the climatic and soil conditions; how did they affect the work?
- cultural aspects: were any specific customs found to exist among labourers in the region, affecting the work in any way?
- labour organisations: what was the position of labour organisations in the area; did contacts with these organisations take place; who were the contact persons; did any problems occur; how were these problems solved?

The standard format of the feedback report should be included in the 3T-file. The reports should be easily accessible to any project manager. They can be used by new managers to get acquainted with the scope of work encountered on construction sites in Tanzania. The availability of information on suppliers and relevant organisations in regions where projects took place in the past will avoid that managers have to find out everything again based on nothing. This could save time during the preparation of the production process. Moreover, the use of such information could lead to a more realistic planning, which again will positively contribute to the effectiveness of the cost control system.

For the feedback reports to be effective, it is necessary that they are filled in accurately. This requires

trust on the part of the project managers that no negative measures will result from the feedback information for them personally. This again requires a good relationship between the project managers and the branch office management. This can be realised by providing sufficient feedback and support during the production process.

8.3 Productivity factors

The TRINITY of planning, control and feedback not only applies to the costs of the direct input factors, but also to the productivity factors which may influence the site productivity performance. In chapter 2 we stated that thorough planning, control and feedback may contribute to limiting any negative impact of productivity factors. As such, they are also productivity factors themselves (see also table 7.1). Thus, by first tackling these three productivity factors, not only their own negative impact on the site productivity performance is limited, but at the same time the negative impact of other factors may be limited. By already considering these other productivity factors before start of the production process (=planning), suitable and timely measures may be taken for their control. Pure external productivity factors (e.g. available physical infrastructure, quality level of local materials, interest level) are hard to control by SJI. This control will be limited to including their role on a certain project in the feedback report (see also section 8.2.3). As mentioned, the heads of department should receive a copy of these reports. In case their department is responsible for maintaining regular contacts with one of the actors, who is responsible for the negative impact of an external productivity factor on a certain project, they could, based on the contents of the feedback report, take necessary action. For example at SJI this could apply to the administration/accounting department and the labour organisations.

Since the control of pure external productivity factors proves to be limited, this means that SJI should control any internal productivity factors as much as possible (since these may again affect the degree of impact of external productivity factors, see also chapter 4, section 4.4). Any control measures in this respect should as much as possible be supported on company level. That is: by providing tools, guidelines and taking measures with respect to internal productivity factors, on company level, these factors may be tackled in a more structural way. Moreover, by including the impact of guidelines, tools and/or measures, as applicable to a certain project, in the feedback reports, a foundation is laid for tackling productivity factors on the long-term.

A very crucial tool should be provided with respect to the labourers working on construction sites of SJI:

Box 8.6 Sixth recommendation

> *A detailed bonus and incentive scheme should be developed involving both labourers and foremen; this system should be used in combination with the weekly cost control system.*

This recommendation requires separate research into the effects of bonuses and incentives on the working speed of labourers on construction sites of SJI. Data for this research could be gathered by the various quantity surveyors of SJI on her sites. This was already done by the quantity surveyor on the VTSC-project on his own record. Such activities should be stimulated and formalised more in the future by the branch office management. A database should be installed which is to contain the above mentioned data.

A bonus and incentive scheme can support the weekly cost control system, which was recommended earlier. Cooke and Jepson (1979) discuss the principles of this combination in their publication on cost

control for construction firms (see also appendix T, page 157).[6] By linking this bonus and incentive scheme to the weekly cost control system (which again is linked to the scheduling system), an optimum between construction period and construction costs can be achieved.
Currently, a maximum monthly bonus amount is set per labour type (see also appendix P, enclosure III). The use of bonuses is based on feeling and experience of the project management. The proposed bonus and incentive scheme will provide a more reliable basis to decide on the use of the bonus and its exact level. Moreover, registration of the bonuses provided and their effect on the working speed can again be a valuable input for the planning function with respect to future projects.

A separate incentive scheme should be developed with respect to highly skilled labourers, especially foremen. Currently, little is done at SJI to tie these labourers and foremen to the company. Still, on the VTSC-project they proved to be very valuable. Training of such people by SJI is currently limited based on the argument (provided by the branch office management of SJI) that, as soon as these people have finished their training, they will leave to work for other contracting companies which will offer a better pay. Based on this one should look into the possibilities of setting up a longterm incentive scheme for highly skilled labourers and foremen.

Eventually, the control of the productivity factors, as well as the control of costs will be the responsibility of the project manager. Project managers are thus crucial persons when it comes to achieving an optimal site productivity performance. Control of the productivity factors requires insight into:
- the construction process as it took place up until the moment that the company won the project,
- the operating environment.

A recommendation for SJI with respect to the former aspect can be found in box 8.3.

The operating environment within which projects of SJI in Tanzania take place has proved to be dynamic and uncertain. With respect to project managers this operating environment requires creativity. The branch office management of SJI in Dar es Salaam experiences that many project managers, who start to work in Tanzania for the first time, lack the right management capacities. At the same time, no training or preparation period is provided for these project managers. Based on this the following recommendation has been formulated:

Box 8.7 Seventh recommendation

> *Project managers should receive a training concerning the Tanzanian operating environment before they start to work on construction projects in Tanzania; they should be instructed on the use of the 3T-file and especially the planning, control and feedback procedures included in this file.*

This training should include the overview of productivity factors as presented in table 7.1. Next to that, the project managers should be thoroughly trained in a right and consistent use of the 3T-file. Currently this file is not consistently used on all projects. Moreover, as already indicated in section 8.2.3, the feedback reports could in the future play a crucial role in preparing project managers for their job. The feedback reports, supplemented with debriefing meetings could provide the branch office management with insight into the management capacities of its project managers.

Finally, considering the effect of the first few phases of the construction process on the site productivity performance of a contractor, the following recommendations has been formulated:

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6 Cooke, B. and W.B. Jepson. *Cost and financial control for construction firms.* 1979, p. 105-106.

Box 8.8 Eight recommendation

SJI should as much as possible participate in projects of which the organisation is based on other organisation forms than the traditional one.

Examples of these other organisation forms are the building team and turnkey organisation. In the case of both organisation forms, and especially in the case of the latter, SJI would be able to affect his own site productivity performance much sooner than is currently often the case. The company has, through its links with the foreign head office, the capacity to also execute projects under turnkey arrangements (for example: the Sheraton project). It is acknowledged that as a contractor SJI might not be in a direct position to determine the project organisation form. Still, with some regular clients she could discuss and advocate the principles of other organisation forms, as well as with several organisations within the Tanzanian construction sector (NCC, Ministry of Works, University of Dar es Salaam). This could contribute to more knowledge on alternative project organisations forms among potential clients in the sector.

Chapter 9

Epilogue: preconditions for the interaction between micro and meso level in achieving site productivity improvement

Site productivity improvement means a more efficient use of direct input factors, which expresses itself in lower costs. This may contribute to an increased profit margin for the contractor. Moreover, if the contractor is able to realise the production process on site in an efficient manner, this will have a positive impact on his image among potential clients. This again may contribute to a strengthening of his position on the construction market. However, the contractor does not operate in a vacuum and, consequently, for an optimal site productivity performance in every respect, he eventually depends on developments which take place on higher levels in his operating environment. Not all the productivity factors which may affect his site productivity performance can be solved by himself. With respect to some factors measures have to be taken on meso and sometimes even macro level. These measures are the responsibility of the government. The government should alleviate the negative impact of the productivity factors. She has to create an enabling environment in which the contractor can achieve an optimal site productivity performance. In the case of the Tanzanian operating environment we have seen that many aspects deserve attention in this respect. Long-term focal point should be to develop and strenghten the research and education functions. The links between research and education institutes on the one hand, and the other actors in the construction process on the other, should also be strengthened to ensure a spin-off from these former institutes. This will provide the foundation for a more long-term improvement of the operating environment for contractors. On the short- and middle-term, attention should be focused on stimulating and supporting the other actors, such as the contractors themselves, the consultants and the suppliers of materials and equipment.

In chapter 2 we stated that productivity improvement on micro level, if widespread, may contribute to productivity improvement on meso level. Also according to chapter 2, site productivity improvement can be achieved by an efficient use of the direct input factors. Thus, site productivity improvement on micro level will eventually contribute to achieving efficiency on meso level. And this again is part of the development objective of the Tanzanian government:[1]

'to develop an efficient and effective, self-sustaining construction industry that is capable of meeting the diverse needs for construction, rehabilitation and maintenance of all building and civil works.'

In general, an interaction with respect to the site productivity concept is thus noticeable between the meso and micro level. However, this does not mean that a balance exists between both levels when it comes to the way in which site productivity improvement is to be achieved. For example, in the case of SJI and the Tanzanian construction sector, the former may prefer the use of foreign materials if this is better from a site productivity point of view. The government strives at stimulating the local building materials industry and may thus prefer the use of local materials. From a government's point of view a balance will have to be sought between stimulating site productivity improvement on micro level and, at the same time, meeting the development objectives on meso level. For the Tanzanian construction sector, this requires a more intensive integration of the role of the government as a coordinator and client. In general, the client in the construction sector determines what exactly will be constructed. Construction by the contractor has to take place according to the desires and specifications of the client. Being the major client in the sector, the government is in a very attractive position to implement certain policy measures through its role as a client. Currently this integration of both roles of the

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1 Ministry of Works. *National Construction Industry Development Strategy*. 1995.

government is limited to preferential treatment measures for contractors during the tendering phase.[2] Examples to strenghten this integration in the future are: the government could stress the use of certain materials, or the choice for a certain construction method etc. For this purpose she could require cooperation between the contractor on the one hand and materials producers and/or research institutes on the other.[3] In this way a more coherent sector organisation will be attained, where several actors together contribute to the development of the local construction sector.

Within the framework of this research we especially paid attention to site productivity improvement at a foreign contracting company: Skanska Jensen International (SJI). The question may arise to what extent, in this case, the local construction sector of Tanzania benefits from this improvement. From the comparative case study (chapter 6 and appendix L) it appeared that SJI maintains very few links with the local construction sector. She seldom works as a subcontractor. Participation in joint ventures in the past all involved other foreign contractors and not local ones. The only contact with local contractors takes place in case a local subcontractor is used. Evidence of other forms of cooperation between SJI and local contractors has not been found.
With respect to contacts with other actors, besides contractors, the only contact worth mentionable is the one with the University of Dar es Salaam (Department of Civil Engineering). This contact includes the provision of practical training positions by SJI for University students as well as assistance provided by SJI to the University on construction-related issues. The University also maintains contacts with local actors in the construction sector, which may stimulate an indirect transfer of knowledge etc. from SJI to the local construction sector.
Striking was that no contact was found to exist between SJI and a crucial organisation in the Tanzanian construction sector such as the National Construction Council (NCC). SJI even experiences the NCC not to be cooperative towards her.

To realise a spin-off from the site productivity performance of foreign contractors (like SJI) to the local construction sector, these foreign contractors will need to be more directly involved in the development of the local construction sector. Currently the Tanzanian government is especially trying to protect local contractors from a too strong competition from foreign contractors.[4] In several developing countries such protectionist policies have been used.[5] However, the value of such policies is doubted by several authors.[6] Some of them argue that such protection measures are hard to lift. Whatever the case in this respect, it is argued here that no barriers are built between foreign and local companies. In a country like Tanzania foreign contractors have proved to be needed on large and technically complex projects. The government should acknowledge and allow this, and, at the same time, implement policies which enable local contractors to benefit from the presence of the foreign contractors. One way of doing this is by setting up joint venture between both type of contractors. Such joint ventures are also by Ofori (1991) judged as a suitable way in 'nurturing the local contractors, while necessarily engaging the services of foreign firms for the large and sophisticated projects'.[7]

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2 For example: the tender sum of foreign contractors is increased with 7.5% before evaluating all, local and foreign, tenders.

3 Based on: Ofori, G. Programmes for improving the performance of contracting firms in developing countries: a review of approaches and appropriate options. p.32. In: *Construction Management and Economics*, 1991, 9, 19-38.

4 See [2].

5 Ofor (1991), p.27.

6 Ofori (1991), p.27.

7 Ofori (1991), p.26.

In Tanzania joint ventures between foreign and local contractors are stimulated by a preferential treatment, but under the current circumstances foreign contractors have sofar not proved very willing to participate in them.[8] To turn this situation, it is suggested here that the government selects certain major public sector projects for participation of both foreign *and* local contractors only. In the case of these joint venture projects use should be made of the building team concept, instead of the traditional project organisation concept. Within this former concept, the major actors in the construction process (client, consultant and contractor) are already working together in an early stage of the project.[9] Both foreign and local contractors should be incorporated in the building team. The former for instance as the main contractor and the latter as a subcontractors, depending on company characteristics.

The above approach would give the following advantages:
- designers in the team could make use of the technical expertise of the foreign contractors, contributing to the choice of a more efficient and effective construction method;
- foreign and local contractors can complement eachother. That is: foreign contractors could transfer knowledge on e.g. management and construction techniques on to local contractors. The latter could transfer knowledge on e.g. local conditions, local customs and regulations etc.

As mentioned before, foreign contractors have sofar proved to be unwilling to participate in joint ventures. Ofori warns that, eventually, such participation has to be voluntary and cannot be forced upon by the government.[10] To make foreign contractors interested to participate in the case of Tanzania, it is thus essential to stress the advantages for them. First of all, this advantage comprises the use of local contractors' knowledge on the Tanzanian situation. Second, foreign contractors are allowed on government projects.
In first instance it may be necessary to develop separate construction packages within one and the same project, for the foreign and local contractor. This will make the foreign contractors (partly) independent from the local contractor. This may increase the foreign contractor's willingness to participate. In case such projects prove to be a success, such a rigorous division may not be necessary in the future.
To stimulate the whole undertaking, the government should assure enough financial resources during the entire construction time and avoid late payments. If not enough finance is available locally, a project proposal could be submitted with a foreign donor. The latter might be willing to participate, since on the one hand the local construction sector is stimulated, but at the same time he can bring in a contractor of his country of origin.

From an optimal site productivity point of view it is also suggested here to organise the contractors operating in the Tanzanian construction sector more explicitly in the Tanzania Building Contractors Association (TBCA). The TBCA should fulfill a more crucial role in the construction sector. It should become the central representing body for the contractors in the country. Its main priority should be to unite and represent these contractors towards all other actors in the sector, especially the government and its subsidiary bodies. To perform effectively in light of the objective to reach a more enabling environment, TBCA should also be provided with detailed information on its members. This information should come from these members themselves. The supply of the information could be made a precondition for membership. The information to be provided by each contractor should include: ownership, main area of construction activity, financial company data, annual reports, personnel and equipment available, past and present projects under hand and other, related data.

The collected information could be used to advise the government on the future development of the

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8 Based on interview with Mr. Muhegi of the National Construction Council. See also appendix E.

9 Erve, H.J. van het. *Bouwprocesleer.* Eindhoven University of Technology, 1994, p.40-42.

10 Ofori (1991), p.26.

local construction capacity. This could help the government again to provide contractors more insight into future demand developments in the sector. This insight will give contractors more certainty as to future possibilities. This again can stimulate investment on the part of these contractors, contributing to a self-sustaining and developing industry. Since the government is the major client in the sector it is her task to make a realistic planning of the future demand. Current efforts of the government to improve her planning system (chapter 5) contribute to the achievement of this.

Information on future demand developments should result from:
- central registration of projects started, completed or abandoned on a yearly basis,
- government budgetary developments,
  (this should also prevent late payments on future government projects)
- donor budgetary developments with respect to the Tanzanian construction sector..

The former information source should contain more than merely starting and completion dates. Registration of the type of inputs used, construction method used etc. could also provide insight into qualitative demand developments. This again could contractors provide indications on the development of their personnel and equipment fleet. Moreover, it could provide educational and research institutes with an indication in what direction to develop their programs.

This central registration could best be executed by the NCC, being the central government organisation in the sector with direct links to the Ministry Of Works. The NCC and the TBCA be stimulated to exchange demand and supply information.

The above preconditions, creating an enabling operating environment, involving foreign contractors in the development of the local construction sector and organising contractors in the TBCA, should, altogether, contribute to a more satisfactory site productivity performance from a sectoral point of view.

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Appendix

A

Organisation charts of SJI

Figure A.1 Organisation chart 1

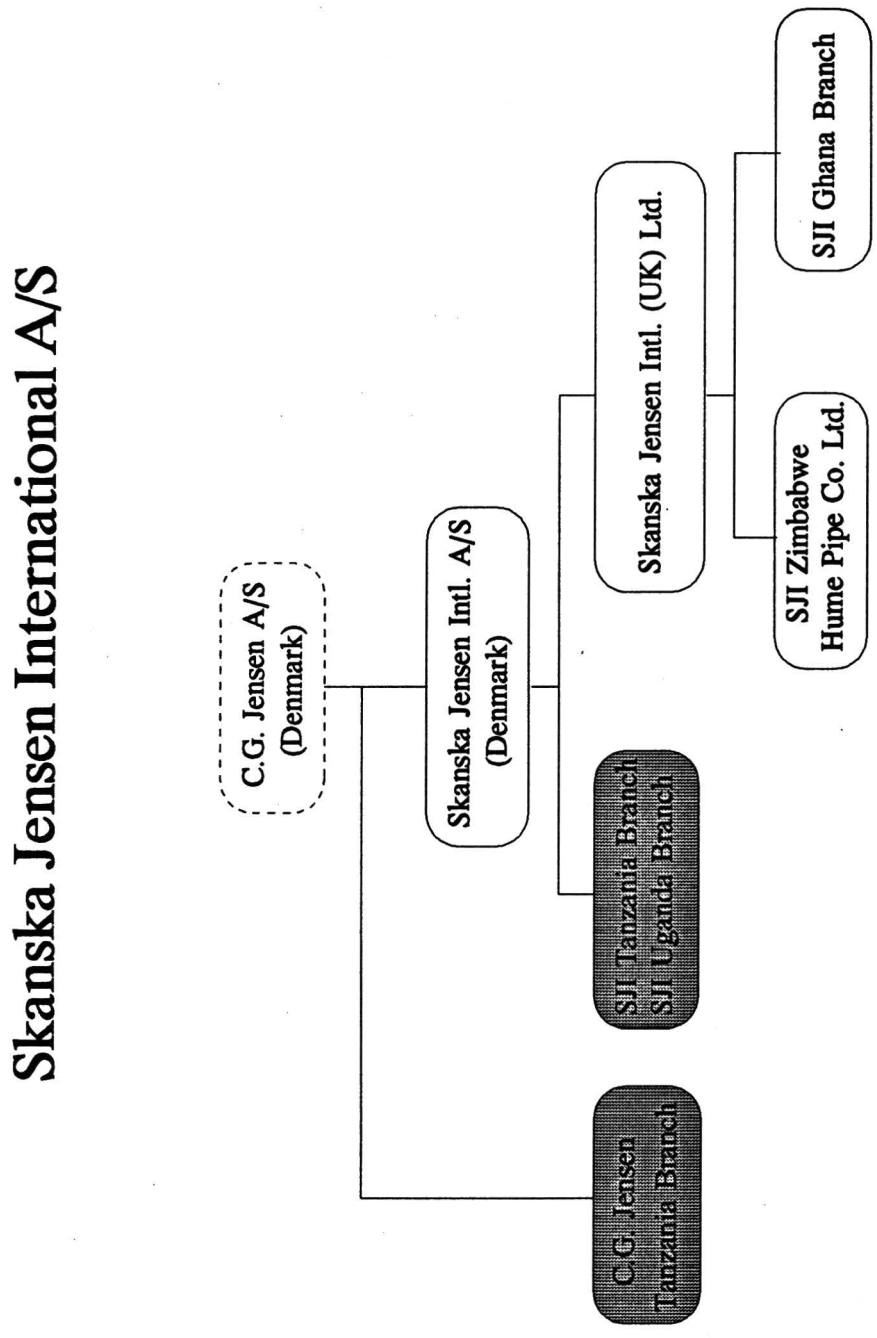


Figure A.2 Organisation chart 2

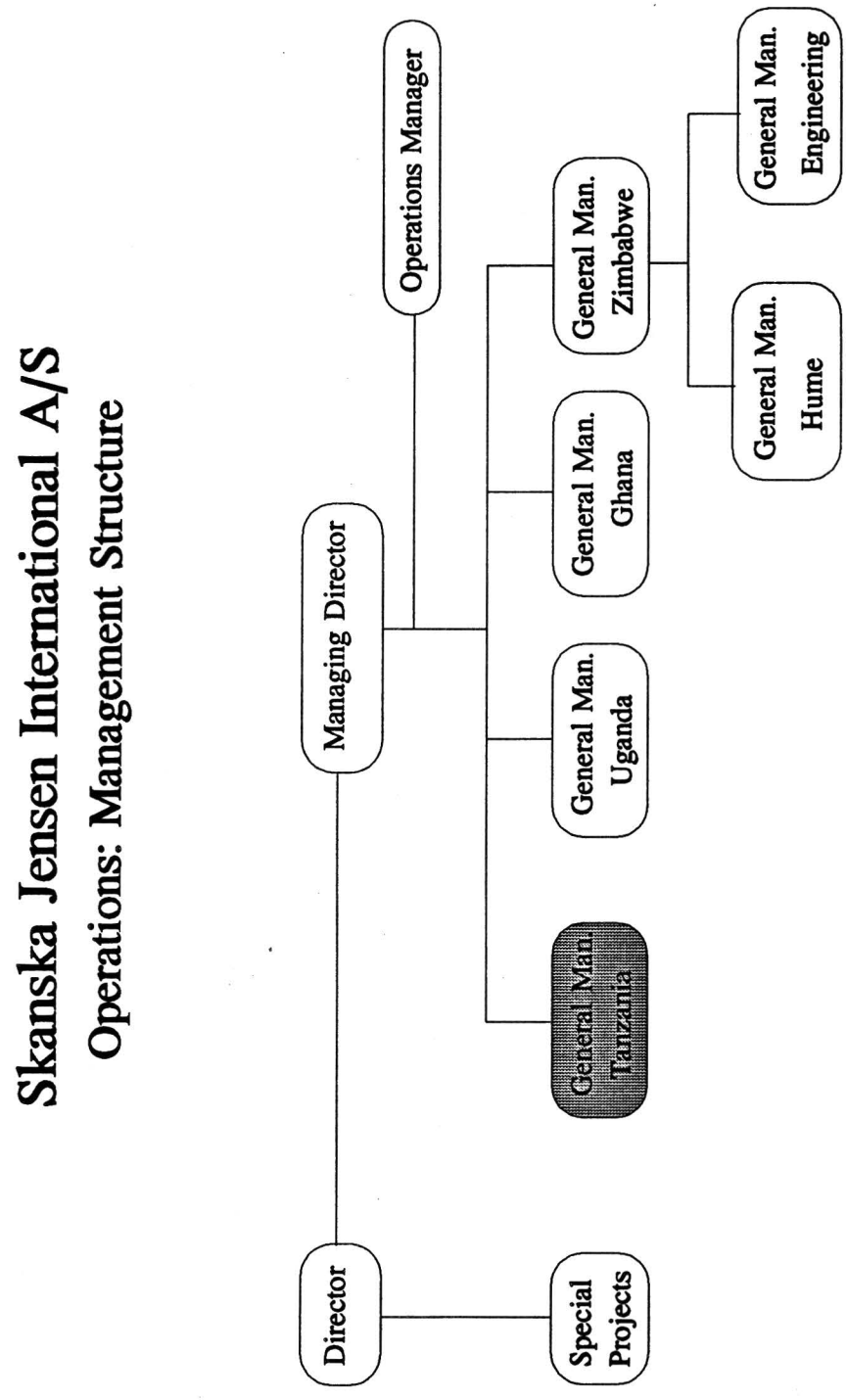
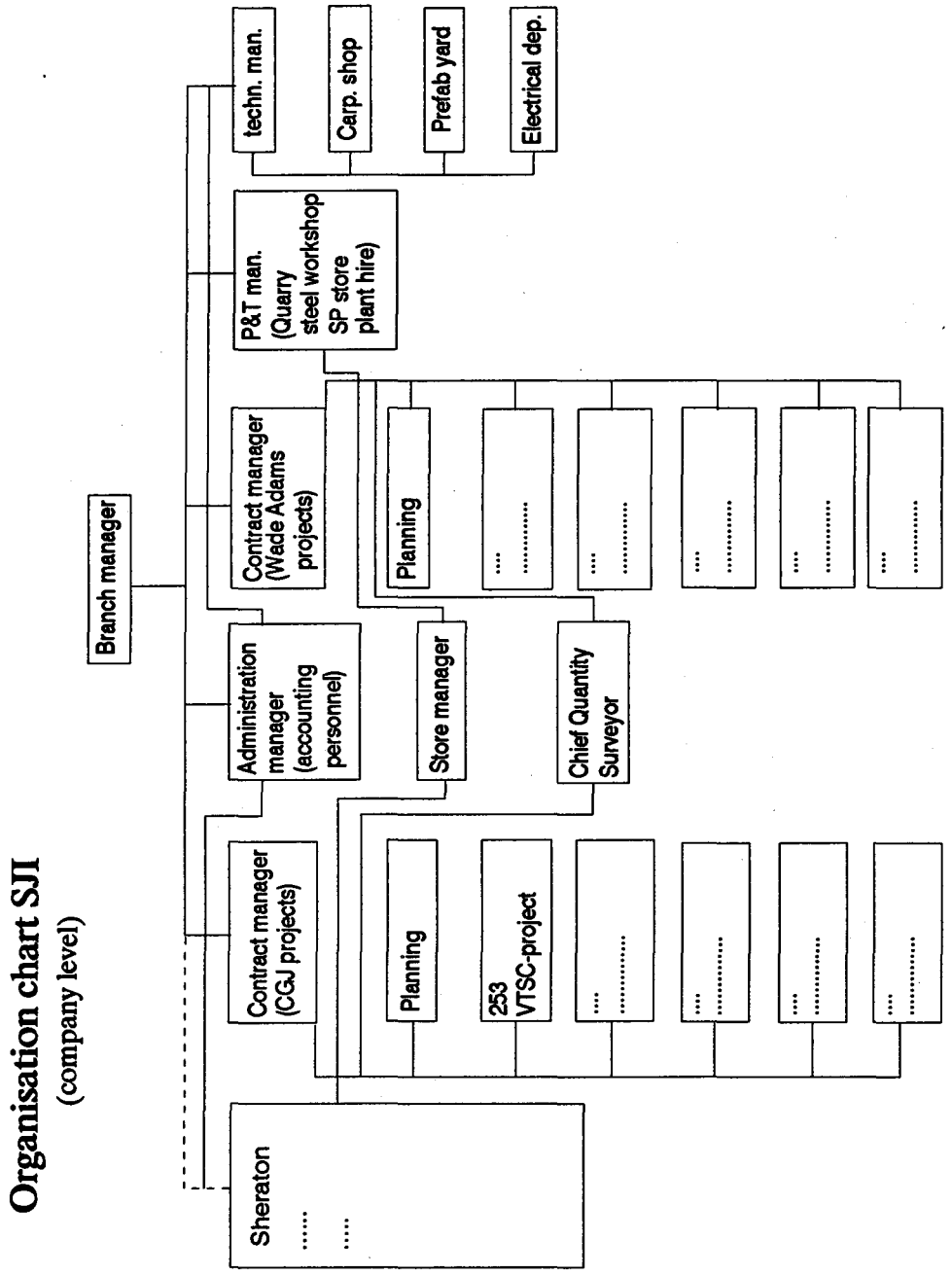


Figure A.3 Organisation chart 3



Appendix **B**

Productivity levels

In table B.1 below is indicated what is to be included in the output and input when discussing productivity on different levels within the construction sector. This table serves to give an *indication* of the differences with respect to the output and input on these various levels. It is not the intention to present an exhaustive table on the subject.

Under 'input' all inputs are mentioned which are relevant on the level concerned. Depending on the choice of using single factor or total (factor) productivity, one can decide which inputs to include. Some examples on how to measure and express the output and inputs are included. These were taken from:

- Weber, S.F. and B.C. Lippiatt. *Productivity measurement for the construction industry.* 1983, p.2-4;
- Erkelens, P.A. *Self-help building productivity. A method for improving house building by low-income groups applied to Kenya 1990-2000.* 1991, p. 96.

Both the output and inputs can be expressed in monetary, time or physical units, keeping in mind the (dis)advantages of each unit type, as presented in section 2.2.1 of chapter 2.

Table B.1 Productivity on different levels in the construction sector

Level	Output	Input
Sector *(= aggregated productivity of all construction companies operating in the sector)* Usefulness: - compare sector with other sectors in national economy; - compare sector with construction sector of other countries; - evaluate sector performance in time; evaluate against sector policies.	Total value of all construction activities in a country *(e.g. value of receipts)*. N.B. Subcontracted work not to be included to avoid double counting	All input factors which are used in the realisation of construction work. Includes all employees which earn their subsistence in the construction sector (including for example architects, quantity surveyors). Inputs to be included: all labour *(e.g. total hours worked, total number of employees, total salaries paid)*, materials *(e.g. value of output minus value added to purchased goods and services by a firm's production processes)*, equipment *(e.g. total machine hours used, total rental costs paid)*, management, consultancy, design *(e.g. total salaries paid for these three services)*.
Company *(= aggregated productivity of all projects of a company)* Usefulness: - compare company with other contracting companies; - evaluate company's performance in time; evaluate it against company goals.	Value of all construction work of a company in a certain period *(e.g. aggregated contract sums received)*. N.B. Company activities other than construction not to be included in the output.	All inputs used by a company, in the office and on the various sites, with respect to the various construction projects. This includes project management, office personnel, materials, equipment, site labour. N.B. Only those office departments to be included which are involved in construction work.
Project Usefulness: - evaluate project's performance against project goals; - compare project productivity with that on other company projects;	Total value of project *(e.g. total contract value, value added of building production)*.	All inputs used in the realisation of a project, on and off site. This includes: construction and non-construction labour *(e.g. total number of labourers on site, total wage costs)*, materials *(e.g. total weight or volume of materials used)*, equipment *(e.g. machine hours, total equipment costs)*, subcontractors, costs of inputs (personnel) used on office level.
Site *(= part of productivity value on project level)* Usefulness: - evaluate site performance in time	Total value or quantity of construction work executed on site. Monetary units most suitable *(e.g. contract value of site work only)*, because physical units may not be the same for all construction activities. Physical units suitable when considering site productivity for a single activity only. *(e.g. m^3, m^2 etc.)*.	Only input factors used on site to be included: labour, materials, equipment and subcontracting. Same units as suggested above can be chosen from on this level.

Appendix C

Costs within the site productivity concept

C.1 Introduction

Costs constitute a crucial concept within the site productivity definition of chapter 2. Therefore, this appendix, first of all, discusses the meaning of this concept in more detail. Second, the various types of costs incurred during the construction process are explained, considered from the contractor's point of view. As we will see not all these costs are to be included in the site productivity concept. Subsequently, the various costs incurred by the use of the direct input factors labour, materials, equipment and subcontracting are dealt with.

C.2 Definition of costs

No single, unambiguous definition exists for the word 'costs'. In general, costs are the sacrifices a person or organisation has to make in order to achieve a certain predetermined goal. However, the *exact* definition depends on the position and characteristics of this person or organisation. That is: the definition depends on from whose perspective costs are considered. According to Cooke and Jepson (1979), costs thus have 'an objective element, which is interpreted in the context of a series of subjective judgements about risks, returns and value'.[1]

Within the scope of this research costs are considered from the viewpoint of the contractor. However, the costs of realising one specific construction work do not necessarily have to be exactly the same for *every* contractor, nor do they always have to be the same for an individual contractor. Costs vary:

- *from country to country*
  The costs directly or indirectly arising from the use of direct input factors during the production process, will not be the same in every country. Unit prices of the direct input factors may change (e.g. variance in wage level or material prices) as well as the conditions under which production will take place (e.g. soil conditions, climate, availability of infrastructural facilities).
- *within a country*
  Even within one country the costs of constructing a specific type of building, may vary according to the exact place where the building is constructed. Certain regions may bring extra costs for the contractor, due to, for example, a longer distance from his head office (extra transport costs), different soil conditions per region etc.
- *from company to company*
  Cost variations between companies are caused by variations in:[2]
  * degree of mechanisation: the proportion in which labour and equipment are used respectively. One company may choose a labour-intensive construction method, where another chooses a more equipment-intensive method. This choice will depend on company characteristics (availability of equipment), but also on country characteristics (prices of both labour and equipment).
  * degree of organisation: to what extent is a company able to organise the production process efficiently?

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1 Cooke, B. and W.B. Jepson. *Cost and financial control for construction firms.* 1979, p.1.

2 De Jong, J. de. *Kosten en kostenbewaking in het bouwbedrijf.* 1968, p.9-10.

Besides cost variances in space, costs can also change over time. Input prices will change over time, for example due to the overall inflation in a country. Since the level of inflation may change from country to country, so may again the cost variance over time per country. Finally, internal developments *within* one specific company can cause a cost variance over time for this company.

De Jong (1968) defines costs as all sacrifices necessary in the realisation of a certain output.[3] Unnecessary sacrifices are not part of the costs: they constitute wastage. However, not all wastage should automatically be considered as an unnecessary sacrifice. Even under 'ideal' circumstances, some wastage may occur. This waste level should, however, be kept to a minimal. The degree to which a company is able to minimise its wastage level, determines its competitive position towards other companies on the market.

Within the framework of this research, the costs definition of De Jong is only suitable as definition for the *estimated* costs. In chapter 2 we stated that these estimated costs are assumed to be based on the most realistic, efficient and effective construction method from the viewpoint of the contractor. The estimated costs thus only include the *necessary* sacrifices, based on as little wastage as possible within the contractor's capacity and capability. However, in practice construction may not take place as efficiently and effectively as anticipated, due to a variety of productivity factors. Wastage may occur. This wastage has to be included in the calculation of the actual costs. If not, an inaccurate picture of the *actual* costs situation will result.

Based on the above a distinction has to be made between estimated and actual costs when defining the costs concept within the framework of this research. For estimated costs the following definition will be used:

> *the monetary value of all sacrifices, which, according to the contractor, have to be made at least, in order to realise the site output in an efficient and effective manner.*

For actual costs the following definition will be used:

> *the monetary value of all sacrifices actually made by the contractor in the realisation of the site output.*

C.3 Types of costs for the contractor

The price paid by the client to the contractor is the tender sum agreed upon between both parties during the tendering stage. The contractor's costs are only a part of this tender sum. The difference between his costs and the tender sum consists of an allowance for risk and profit.[4] If the share of the costs within the tender sum becomes smaller this thus means that the margin for profit and risks becomes larger.

The contractor's costs do not constitute a homogeneous group. That is: different types of costs can be distinguished. De Jong (1938) and Poortman (1993) make the following cost distinction:[5]

- *work costs*
  These are costs which can be directly linked to the production on site. Based on this characteristic

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3 De Jong (1968), p.9.

4 Maas, G.J. (ed.). *Uitvoeringstechniek 2.* 1993, p.28.

5 De Jong (1968), p.25-27; Poortman, E.R. In: *Uitvoeringstechniek 2.* 1993, p.28.

work costs are also referred to as direct costs.[6] Direct costs can be unravelled into labour-, material-, equipment - and subcontracting costs. For calculation of the direct costs the basic formula C(osts) = Q(uantity) x (unit)P(rice) could be used.[7]

- *site costs*
  These include costs of preparing, maintaining and dismantling the production system: the site. Site costs are costs which are incurred to enable the (efficient) use of the direct input factors on site. Included in the site costs are:
  - wage and salary costs of personnel and labour *not* directly involved in production on site (e.g. foremen, supervisors, accountant, quantity surveyor, watchmen etc.). The level of these site costs usually depends on the length of the production process.
  - Costs of water, electricity and telephone, insurance, costs of catering, transport costs etc.
  - Costs of supply and removal of office containers, connection to the electricity and water supply system. These costs usually occur once-only.
- *company costs*
  This refers to costs made on company level for the benefit of production on site. These costs have to be divided among all the projects which a company undertakes at a specific moment. Company costs are incurred as soon as the contractor becomes involved in a project.

Ahuja (1980) and Pilcher (1976) combine the site and company costs as described above, under the heading indirect costs.[8] This is based on the fact that both costs types cannot be linked with a specific part of the site output. Ahuja also considers interest, contingencies and escalation as indirect costs.[9] However, considering the different nature of all the items included (site- and company-related), a distinction as used by Poortman and De Jong is judged here as being more appropriate and clear. Moreover, contingencies and escalation are, strictly spoken, not part of the contractor's costs. They are part of the margin which a contractor includes in the tender sum to cover for any risks. In case this margin is used, wholly or partially, they form a cost for the contractor.

Figure C.1 on the next page gives a schematic representation of the structure of the tender sum, including the various types of costs.

C.4 Costs and site productivity

In chapter 2 we stated that the costs, which arise from the use of the direct input factors are subject of control within the site productivity concept. These costs include the previously mentioned work costs (referred to henceforward as direct costs) and site costs. Company costs are not to be included in the site productivity concept. They are part of a larger system: the contractor's company. They are part of the company's function and not of the site's function. Control of the company costs is not the responsibility of the management on site, but of the company management.

In the remaining of this section attention is given to direct and indirect costs for each direct input factor included in the site productivity definition.

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6 Ahuja, H.N. *Successful construction cost control.* 1980, p.43; De Jong (1968), p. 42; Pilcher, R. *Principles of construction management.* 1976, p.200.

7 De Jong (1968), p.18.

8 Ahuja (1980), p.43; Pilcher (1976), p.200.

9 Interest: costs to be paid by the contractor in case external project financing is needed.
Contingencies: allowance for any unforeseen occurrences.
Escalation: allowance for possible price increases of labour, materials and/or equipment.

Figure C.1 Structure of the tender sum

Tender sum							
Costs						Risk margin	Profit margin
Direct costs				Indirect costs			
Labour costs	Materials costs	Equipment costs	Subcontracting costs	Site costs	Company costs		

Source Based on Maas, G.J. (ed.). *Uitvoeringstechniek 2.* 1993, p. 28.

NOTE The sections within the table have not been drawn to scale. Their proportion may change according to specific project conditions.

C.4.1 Labour

Direct costs within the labour component are the wage costs of the direct labourers only (used in production). The costs of indirect labour on site (foremen, supervisors and managers, quantity surveyor and accountant on site, etc.) are part of the site costs. Any costs resulting from specific employment conditions (like costs of transport, costs of food etc.) will also be considered site costs here. Since the employment conditions may change from country to country and from company to company, so may thus the exact contents of this part of the site costs.

C.4.2 Materials

The direct costs within the material component are formed by the unit price times the quantity bought, for each material. Any site costs linked to the material component are costs of transport and costs of storage of the materials on site.

C.4.3 Equipment

The equipment component in general comprises various type of items:[10]

- large equipment items, such as a crane, a concrete mixer;
- auxiliary equipment items such as formwork;
- small equipment items, which refers to tools.

Another possible distinction is the distinction between direct equipment and indirect equipment. The former are those items directly used in production. This includes auxiliary, small and some of the large equipment items. Indirect equipment only refers to large equipment items. Examples of the latter are office and storage containers.

The direct costs within the equipment component are calculated as quantity used times unit price. The quantity can be expressed in hours or pieces, depending on the type of equipment concerned. Depending on the source of the equipment the unit price can be an hourly rental rate or the sales price per unit. Direct costs only involve *direct* equipment items, just like in the case of direct labour. Rental costs and/or the sales price of indirect equipment items are part of the site costs. Other site costs resulting from the use of equipment are costs of transport of the equipment to the site, costs of fuel and electricity.

C.4.4 Subcontracting

The direct costs of the subcontracting component is the amount of money which the main contractor has to pay to the subcontractor. Depending on the contents of the subcontracting component, these

[10] De Jong (1968), p.20.

costs cover the costs of labour, materials and/or equipment supplied by the subcontractor. Costs of any of these direct input factors *not* supplied by the subcontractor himself, but by the main contractor, are not part of the subcontracting costs. These costs can again be divided into work costs and site costs, as described above.

The price which is agreed upon between a subcontractor and the main contractor can be a fixed sum or a price per unit of work.[11] In the latter case the subcontracting costs can vary with the amount of work carried out by the subcontractor. Such a price requires more control on the part of the main contractor than in the case of a fixed price.

[11] De Jong (1968), p.25.

Appendix D

Definitions

Construction process: embraces all the procedures and actions from the initiative of a client until the moment the constructed work is put into use by this client.

Construction phase: includes all activities related to the preparation of the construction work, the construction work itself and the settling of the work.

Operating environment: the socio-economic and geo-physical climate in which a contractor operates.

Productivity factors: factors which influence one or more of the productivity elements. Through this influence they can cause a difference between the estimated and the actual site productivity level.

Productivity elements: in general: inputs, output, system and transformation process; in case of site productivity: direct inputs (labour, materials, equipment, subcontracting), site output, building site and production process.

Labour: all human effort, skills and knowledge which is employed by the main contractor and involved in the realisation of construction work on site.

Materials: all structural materials, building materials and building products which are combined on the building site to form the site output and which are obtained by the main contractor from the supplier.

Equipment: all large equipment items, auxiliary equipment and tools which are obtained by the main contractor and directly used in the production of the site output.

Subcontractor: a construction organisation which is not an independent party in the contract with the client, but which is under contract directly to the main contractor. Under this contract the subcontractor executes part of the construction work. The subcontracting component consists of those labour, material, and/or equipment inputs which are supplied by the subcontractor himself.

Site output: the building work which is to be realised on the building site during the production process by the transformation of direct input factors.

Production process: the transformation of direct input factors into the desired site output, which takes place on site.

Building site: geographical location where the production process takes place.

Efficiency: the amount of direct input factors used to realise a certain amount of output as compared to the planned amount of these input factors, both expressed in costs.

Cost control system: all information and organisation aspects which, together, have the purpose to control the costs of the direct input factors used on site during the production process and, in this way, to control the site productivity level.

Planning: the process of setting targets and objectives and of formulating a plan on how to attain these targets and objectives.

Feedback: the process of drawing conclusions from data resulting from a control system, translating these conclusions into corrective action whenever necessary, and informing the responsible persons on the desired action.

Estimated costs: the monetary value of all sacrifices, which, according to the contractor, have to be made at least, in order to realise the site output in an efficient and effective manner.

Actual costs: the monetary value of all sacrifices actually made by the contractor in the realisation of the site output.

Appendix E

List of interviewees

Mr. Abdallah
(Labour Office, Ministry of Labour)
5 July 1995

Mr. P. O'chieng Olum
(Chairman of TAMICO)
19 July 1995

Mr. Mamiro
(NCC)
2 August 1995

Mr. Muhegi
(NCC)
2 August 1995

Mr. Nkinga
(Chief Engineer, Ministry of Works)
2 August 1995 / 18 December 1995

Mr. Malyi
(Central Tender Board)
3 August 1995

Mr. Kitainda
(Central Tender Board)
18 August 1995

Mr. Mlinga
(University of Dar es Salaam, Faculty of civil engineering)
12 October 1995 / 6 November

Mr. Rweyemamu
(Director Mechanical Engineering Services, PEHCOL)
2 November 1995

Mr. Likumbo
(NCC)
2 November 1995

Mr. Laswai
(Senior Evaluation and Registration Officer, NBAQS&BC)
6 November 1995

Mr. Mlay
(Principal engineer at the NBC, Property Development and Estate Management Department)
7 November 1995

Mr. Andersen
(DANIDA project coordinator at the Ardhi Institute)
22 November 1995

Appendix **F**

Profile of Tanzania

F.1 Introduction

In this appendix a presentation is given of Tanzania. This is done by providing a profile of some major institutions within the Tanzanian society. The contents of this appendix lays down the national environment in which contractors in Tanzanian have to operate. As much as possible will be indicated what the possible and/or actual impact of certain national environmental characteristics is on the contractor's activities.

F.2 The geo-physical profile

F.2.1 Climate[1]

Climatic factors can have a negative influence on construction work. This influence concerns:[2]
- the well-being of labourers (both physically and mentally),
- the wearing of equipment,
- damage of materials,
- damage of finished works,
- delays in work progress.

All five aspects can have a negative effect on the contractor's project performance, including delays and an increase in the total costs of direct inputs. In general climatic factors can be considered the least controllable factor for a contractor. Based on this and their possible impact climatic factors require careful consideration and planning.

Tanzania is situated in East-Africa, just south of the equator. Its landscape has considerable altitude differences, causing a variance of temperatures in the country. Three climate zones can be distinguished:
- temperature zones: Southern (Iringa, Mbeya, Songea) and Northern Highlands (Arusha area),
- warm and humid zones: around the lakes and coastal plateau,
- hot and dry zones: inland plateaus.

The mean annual temperature lies between 20 °C (Iringa and Arusha) and 25 °C (Dar es Salaam). In the coastal and lake areas the diurnal and monthly temperature differences are much smaller than in the higher parts of the country.

Rainfall varies according to location and time. The largest part of the country has one rainy season, from December till May. In North-Tanzania two rainy seasons occur during this period: one in November / December and one from March till May. Twenty-one percent of the country receives more than 750 mm rain per year; only three percent receives more than 1250 mm (both 90% chance). Considerable differences are possible in annual rainfall, especially in the drier areas of the country. An overview of climatic factors for the major towns in Tanzania is presented in figure F.1.

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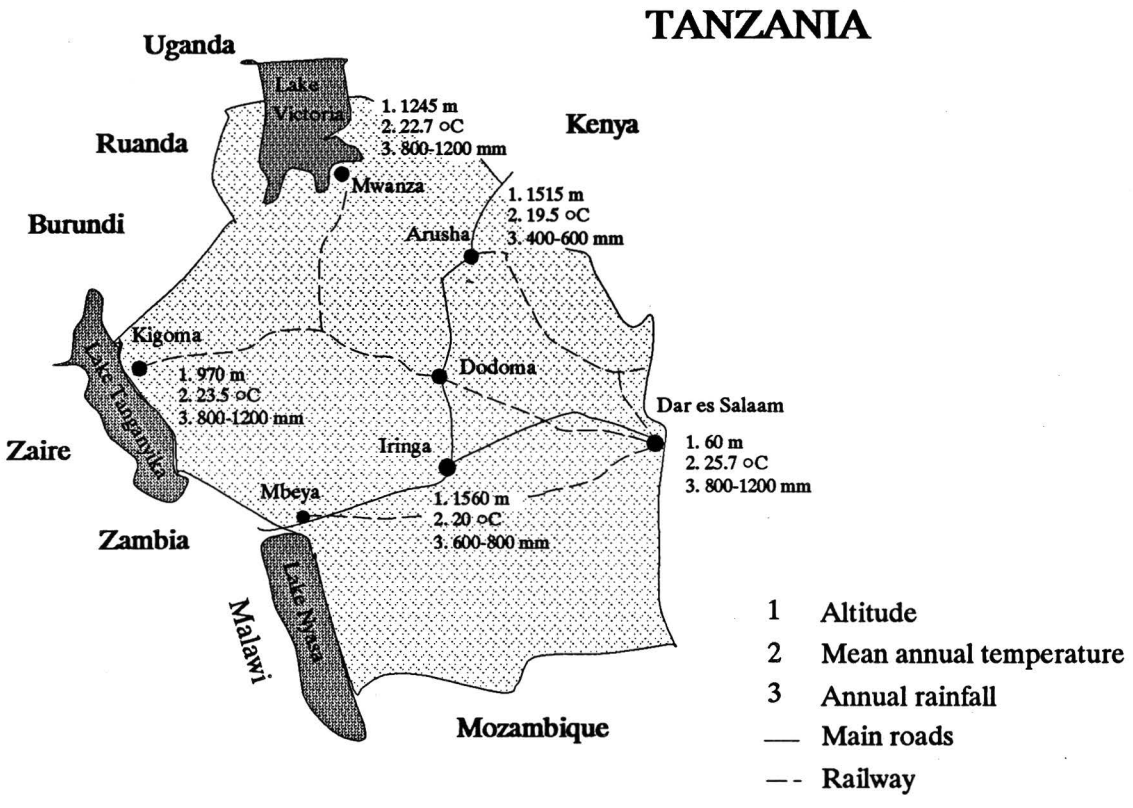
1 Mark, D.F.W. van der. *Tanzania.* 1975, p.3; *Africa South of the Sahara.* 1995, p.924-946.

2 Maas, G.J. et al. *Uitvoeringstechniek 1.* 1992, p.102.

Figure F.1 Climatic factors for major towns in Tanzania



Source Based on: Mark, D.F.W. van der., *Tanzania.* Landendocumentatie K.I.T. 1975, p.3.

Especially the rainy period(s) can have a severe influence on the progress of construction projects. For example, pouring concrete should be planned as much as possible outside the rainy season, so that the chance of delay is limited as much as possible. Moreover, one has to account for the fact that the access to building sites and road transport can be severely hindered by heavy rains. Two major projects going on in Dar es Salaam at the time of this research stated to have suffered serious delays due to heavy rains earlier that year.[3]
The possible rains plus the large diurnal temperature differences in some areas can also influence the condition of materials stored on site and of finished construction work. This requires special storage methods and protection techniques. Also, equipment on site has to be protected from rains. If not, it will have a consequence on its life-time.

Another impact of the climate is the influence of high temperatures on the labour productivity. Heat can negatively influence the speed of work.

F.2.2 Natural resources

The type and quantity of natural resources available within a country, is an important factor in the availability of local building materials. If certain building materials are not locally available they have to be imported. For the contractor this means more planning, knowledge of foreign suppliers, and provision of foreign exchange by the client. If one or more of these three factors are not sufficiently

[3] The projects concerned were: 'Extension/renovation of the Ardhi institute' and 'TDFL office block phase II'. The former project was carried out by a foreign contractor, the latter by a local Class I contractor of Tanzanian-Asian origin.

taken care of, the procurement of non-locally available building materials may form a constraint. Based on this and from the viewpoint of a self-sustaining construction industry, it is very important to have natural resources within the national boundaries.
Available natural resources in Tanzania include diamonds, gold, petroleum, salt, phosphates, coal, kaolin, tin, nickel, soda ash, iron ore, uranium and natural gas.[4] Natural resources especially relevant for the construction industry, include clay (estimated production of 2 thousand metric tons in 1992), gypsum (estimated production of 35 thousand metric tons in 1992), limestone (found down the coast and several places inland), pozzolanic materials[5], vermiculites[6], lateritic soils[7] and stones (like marbles, basalts, granites etc.).[8] Especially lime can be of great importance for the Tanzanian construction industry (e.g. use in building mortar). Current production is however inadequate and primitive.

Kimambo (1984) listed several problems faced by the Tanzanian mining industry in the beginning of the 1980s.[9] These include constraints such as a lack of financial resources, a lack of skilled high and middle management, a lack of transport facilities, a very small internal market and a long distance to the main world mineral markets. No data on current mining developments were available at the time this report was written. Several indicators could be used to express the mining developments over the years (e.g. yearly production per mineral type, number of new mines opened each year, demand for versus supply of minerals etc.). No data on these indicators were found though. Therefore the increase in mining GDP using constant prices is used here to get a first impression (figure F.2 on the next page). The graph shows that after a decline during the eighties, mining GDP increased during the early nineties. This seems to indicate that (a slight) improvement and/or expansion has taken place in this sector.

However, within the scope of this research it is more relevant to judge the performance of the mining sector from the viewpoint of the construction industry. This requires information on the ability of the mining sector to supply local building material producers with the necessary raw materials. No quantitative figures were readily available on this subject. A survey of the National Construction Council (NCC), including 43 responding local building material producers, revealed the shortage of raw materials to be the major constraint for their production.[10]

A major natural resource in Tanzania are the forests and woodlands. These constitute 47% of the total land area. Approximately 30% of the total forest area is reserved by the government for, among other things, the production of timber, which is also used by the construction industry. Currently, the share of the construction industry in total wood use is only 2.2%. According to Van Iwaarden (1996) the local

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4 *Africa South of the Sahara.* Europe publications Ltd. 1995.

5 Pozzolanic materials are materials which contain a considerable amount of silicates and aluminates. Those materials do not posses any binding characteristics of themselves, but, in combination with lime and water they can act as a binder.

6 Vermiculite is a mineral which resembles mica and is used for similar purposes A building materials, produced by heating of the mineral, has the same name and is used for isolation purposes.(Mica is a glasslike material with a metal shine. This material can easily be split and resist high temperatures.)

7 Lateritic soils are soils containing iron and aluminium, which came into existence by chemical weathering of certain stones in tropical areas.

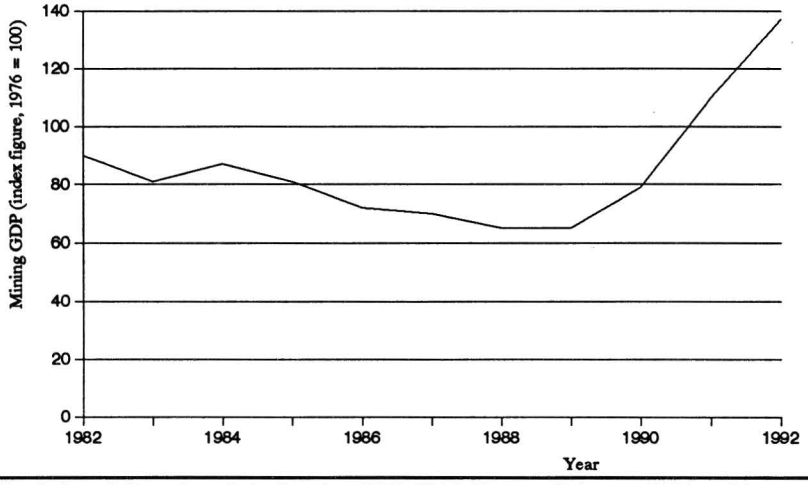
8 Dorgan, C.A. (ed.) *Gale country & world rankings reported.* 1995, p.49 +75; Kimambo, R.H. *Mineral prospects in Tanzania.* 1984, p.108-109

9 Kimambo (1984), p.76.

10 NCC. *Identification and promotion of utilisation of local resources and locally produced materials for the construction industry in Tanzania.* 1992, p.9.

wood industry can currently fulfill the demand for wood from the construction sector in quantitative sense, but hardly in qualitative sense.[11]

Figure E.2 Mining GDP expressed in index figures (1976 =100)



Source Bureau of Statistics. *Selected statistical series 1951-1991.* Dar es Salaam, 1994, p.33

F.2.3 Infrastructural situation

A good infrastructure is essential for the socio-economic development of a country.[12] Many production processes require transportation of raw materials and products. Contractors, especially those with projects inland, have to deal with sometimes bulky transport of building materials, building products, and equipment. A good road network can lead to decreased transport costs, because of decreased wearing and tearing of vehicles. It, moreover, saves time and thus costs.

Figure F.3 (next page) gives a comparison of the amount of infrastructural facilities available in Tanzania as compared to those in other countries in the region. Considering the fact that Tanzania by far covers the biggest land area compared to its neighbouring countries, the availability of infrastructural facilities per 1,000 square kilometre land area seems to be limited.

Apart from quantitative aspects one also has to look at qualitative aspects of the infrastructural facilities and their distribution over the country. Figure F.1 above includes the location of railways and major roads in Tanzania. It shows that large parts of the countries are not reachable by one of the major roads and/or railways. The road network is concentrated on linking the coastal area, and especially Dar es Salaam with other parts of the country. Problems experienced by the rail system include inadequate maintenance and a lack of rolling stock.[13]

The most important infrastructural facility from the viewpoint of contractors is the road network. The total available road network in Tanzania is approximately 85,500 km.[14] Until recently this road network

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11 Based on: Iwaarden, A van., 1996.

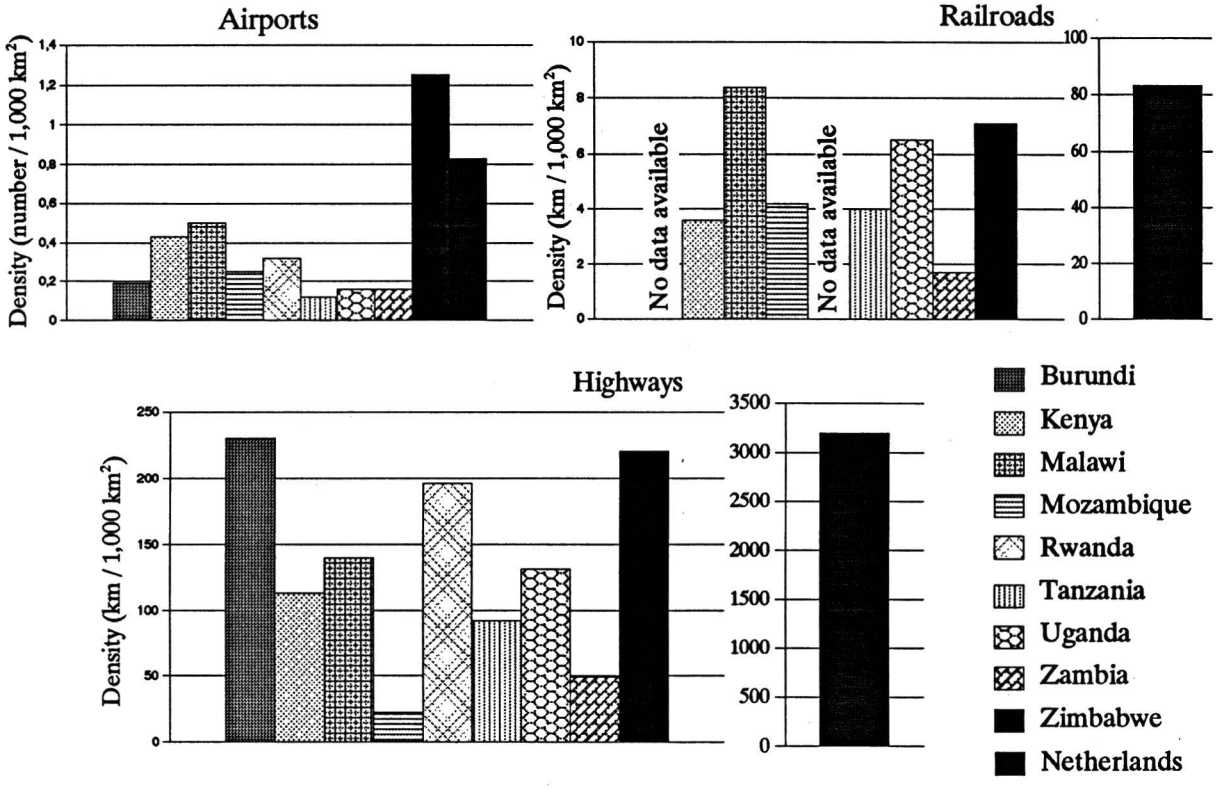
12 Fleischeuer, M.J.A. *Road construction in Tanzania.* Eindhoven University of Technology, 1994, p.3-5.

13 Netherlands Development Cooperation. *Tanzania. Evaluation of the Netherlands development programme with Tanzania, 1970-1992.* 1994, p.47.

14 Dorgan, C.A. (ed.) *Gale country and world ranking reporter.* 1995.

was in a very poor state. The road density (5.8 km/km^2) was one of the lowest in the world. No relation existed between road density on the one hand and economic activities and population size in the various regions on the other.[15] Improvements have taken place in recent years, but they are still not

Figure F.3 Infrastructural facilities in selected African countries and the Netherlands



Source Dorgan, C.A. (ed.) *Gale country and world ranking reporter.* 1995.

sufficient to secure an optimal road network. Currently (early nineties) only 3,700 km of the network is bituminised.[16]

Tanzania has several coastal ports, of which the most important is the natural deep-water harbour of Dar es Salaam. It serves as a transit port for land-locked countries in the region, such as Zambia, Burundi, Rwanda and Uganda. The presence of this harbour is very important for the development of the country (export/import) and is a major advantage over the previous mentioned land-locked neighbour countries. For the construction industry it facilitates the import of materials and equipment.

Electricity is supplied by TANESCO. The electrical grid especially connects the main towns. Many rural areas are not connected yet. At the beginning of the nineties the situation with respect to electricity supply deteriorated, leading to rationing. This rationing affected industrial production in the

15 Fleischeuer (1994).

16 Netherlands Development Cooperation. *Tanzania. Evaluation of the Netherlands development programme with Tanzania, 1970-1992.* 1994, p.47.

country. During the period 1983-1992, the gross production of electrical energy increased only with 3.9 %, whereas the population grew with approximately 300%.[17]

F.3 The political situation in Tanzania since Independence

In 1961 Tanganyika gained Independence. Three years later it joined Zanzibar to become the United Republic of Tanzania. The Tanganyika African National Union (TANU) was the most important political party within the country at that time. In 1965 Tanzania officially became a one-party state: TANU became the only political party in the country; Julius K. Nyerere became the country's president. In 1977 TANU and the Afro-Shirazi Party, ruling on Zanzibar, joined to become the Chama Cha Mapinduzi (CCM), following the approval of a new constitution. This constitution acknowledged the principles of socialism and self-reliance. The political ideology of TANU/CCM, developed in this post-Independent period, has had a crucial impact on the economic situation of Tanzania (see section E.6).
The socio-economic crisis of the late seventies and early eighties and the consequent political changes versus a more liberalised economy, led to Nyerere's resignation. The ideology of the CCM became less and less influential. Under presidency of Ali Hassan Mwinyi an end was put to the political economy. Since 1986 a liberalisation of the economy is taking place. In 1992 the monopoly of the CCM was abandoned by law, followed by the registration of several political parties a year later. In 1995 the first multi-party elections were held, partly based on pressure from donor parties. The elections have resulted in a victory of the ruling CCM; Benjamin W. Mkapa has succeeded Ali H. Mwinyi. Despite the CCM victory the 1995 elections should be viewed as the start of a more democratic process and of political self-consciousness among the population of Tanzania.

F.4 Socio-demographical profile

For a labour intensive industry such as the Tanzanian construction industry, it is very important to be able to make use of a labour force which is quantitatively and qualitatively sufficient. The socio-demographic situation in the country plays an important role in this respect.

F.4.1 Demographic characteristics

In 1993 the population of Tanzania comprised 26.7 million people. The average population growth over the period 1980 till 1993 amounts to 3.0% per annum.[18] The population distribution over the country is very uneven. The largest part of the population lives in the coastal area, where the possibilities for agriculture are most favourable. The urban population comprised 24.4% of the total 1994 population. Dar es Salaam, although not the capital city, is by far the biggest urban centre of the country with over 2 million inhabitants; the second largest being Mwanza with over 200,000 inhabitants. Other major towns and their geographical location can be found in figure F.1.

Many different tribes live in Tanzania, but none of them constitutes more than 10% of the total population. Kiswahili has been and still is a binding factor. No major ethnic struggles have taken place in Tanzania sofar, unlike in neighbouring countries such as Rwanda and Burundi. This makes the Tanzanian society in this respect a very stable and secure society, which especially is a relevant factor in view of foreign (contracting) companies operating in the country.
Other population groups include Asians, which are primarily of Indian origin. Whereas the Tanzanian-African population is mainly occupied with agriculture, the Tanzanian-Asian population has a

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17 World Bank. *World Tables update 1994.* (software programme); United Nations. *Industrial Commodity Statistics Yearbook 1992.* 1992, p.856.

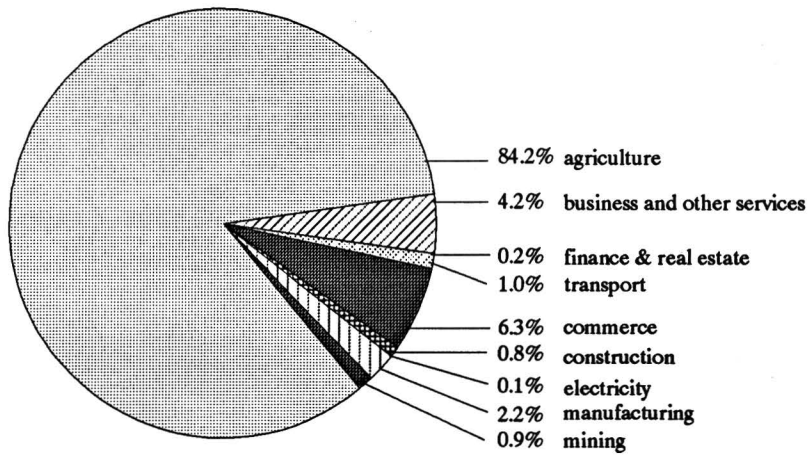
18 World Bank. *World bank Tables update 1994.* (Software programme).

dominant position in the trade sector.

The economic reforms and political pluralism have slightly sharpened ethnic differences (indigenous African versus Tanzanian-Asian and religious based differences respectively). The future has to show wether or not Tanzania is capable of dealing with the major changes it is currently experiencing in two major institutions of its society.

Approximately 51% of the Tanzanian population is economically active.[19] Figure F.4 gives an indication of the employment per economic sector for Tanzania mainland in 1990. The pie-chart shows that the majority of the labour force is working in the agricultural sector.

Figure F.4 Share in employment per economic sector Tanzania mainland 1990/91



Source Bureau of Statistics. *Statistical Abstract: 1993.* 1994, p.21.
NOTE Includes paid, self employed and unpaid employees.

F.4.2 Social characteristics

During the period after Independence the Tanzanian government, in line with the policy of socialism and self-reliance, gave much attention to the provision of social services, especially in the health and education institution. Due to a lack of financial resources the existing health system deteriorated more and more during the eighties. At the same time the population grew with an average of 3% per annum. Table F.1 gives a statistical overview of some social indicators for Tanzania for the period 1972-1992.

Table F.1 Selected social indicators for Tanzania, 1972-1992

	1972	1977	1982	1987	1992
Life expectancy (years)	46.5	49.0	51.0	51.8	50.8
Infant mortality (per 1000)	130.0	125.0	119.2	108.6	91.6
Food production (1987 = 100)	93.4	110.3	103.6	100	85.6

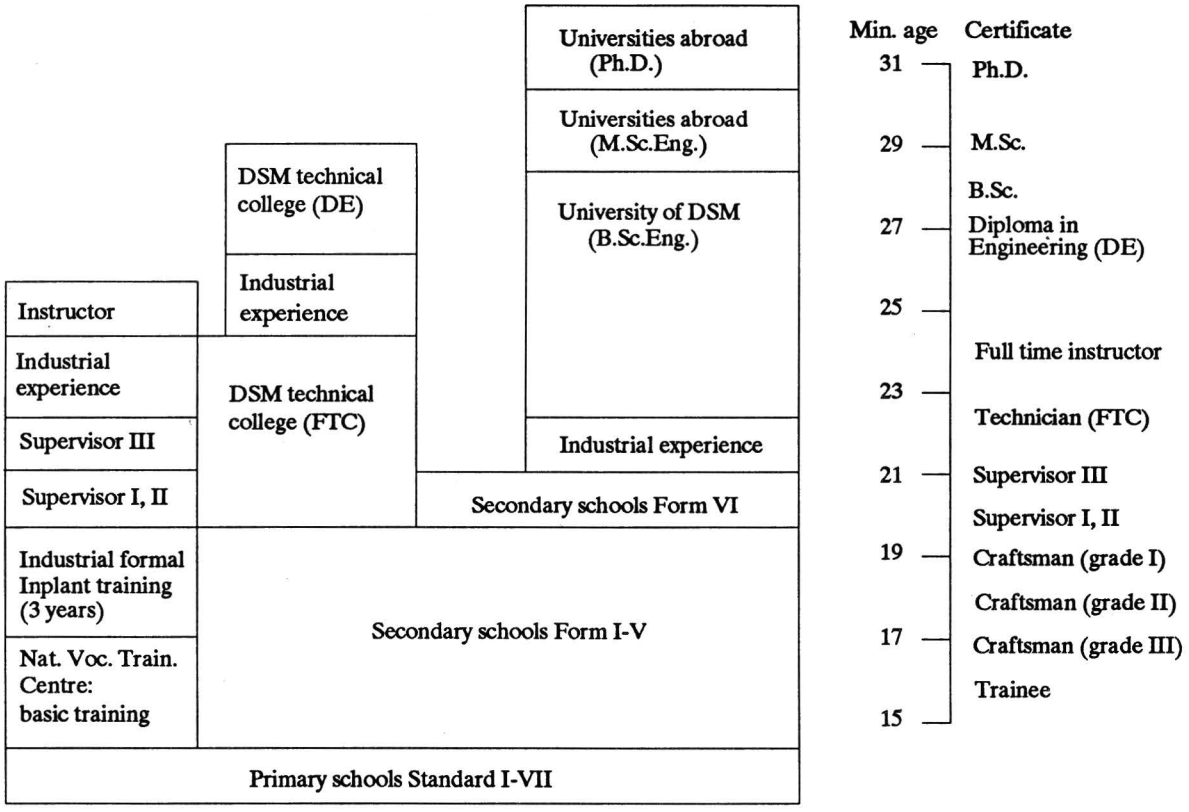
Source World Bank. *World Tables 1994.* (Software programme).

[19] UNDP. *Human development report 1992.* World Bank. *World Tables update 1994.*

F.5 The educational profile[20]

The Tanzanian construction sector is a relatively labour-intensive industry. It needs skilled and unskilled labourers, as well as highly qualified technicians and managers. For this, the sector depends on the country's educational system. The Tanzanian educational system can be represented by a pyramid, with primary education at the broad basis and tertiary education at the top, the latter being accessible to a selected few only. For the construction sector technical education is most important. Figure F.5 presents the structure of the technical education system in Tanzania.

Figure F.5 Formal technical education system in Tanzania



Source Ministry of Industry. *Local construction industry study.* 1977, p.226; Dam, A. van. *Onderwijs in Tanzania.* 1990, p.14/15.

Soon after Independence the Tanzanian education system proved to be qualitatively and quantitatively unsatisfactory. It could not meet the demand, especially not the demand for highly skilled people which came into existence with the disappearance of many expatriates. Under British rule only one locally educated African engineer was available. At the early seventies 180 locally trained African engineers were available. As a consequence of this, hardly any Africans were to be found at higher positions at that time.

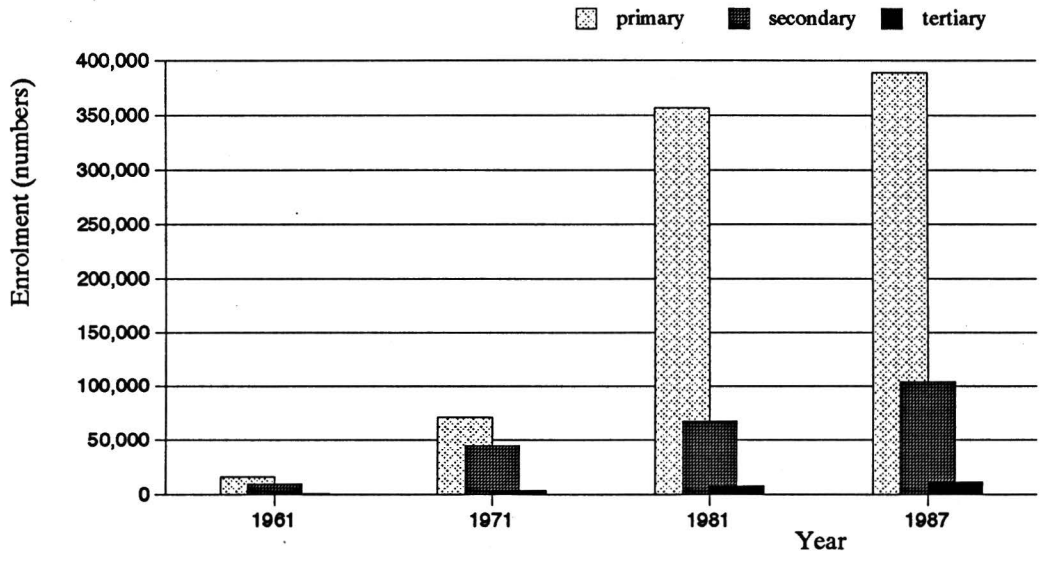
The then government decided to improve the educational situation in view of the political ideas of that time: 'educational self-reliance'. Most attention was given to the provision of primary education for

[20] Altbach, P.G. *International higher education. An encyclopedia.* Volume I, 1991; Dam, A. van. *Het onderwijs in Tanzania.* 1990; Netherlands Development Cooperation. *Tanzania. Evaluation of the Netherlands Development programme with Tanzania, 1970-1992.* 1994, p.269-271.

everybody ('universal primary education'). But, while primary education increased in quantitative sense, its quality decreased due to a lack of qualified teachers, instruction materials and schools. The final result is that the primary enrolment ratio has decreased since the late sixties till now (from 93% in 1980 to 69% in 1991). Another important cause for this is that, although the government pays most of the costs, a lot of parents can still not afford to send their children to school.
The entrance to secondary education has long been rationed by the government. This was done to avoid producing more students than could be absorbed by the public sector. The result of this rationing policy has been the fact that currently Tanzania is among the two countries with the lowest secondary enrolment ratio in the world: 4.7 % in 1990 (against 2.7% in 1970).[21]
Tertiary education is only reserved for a few. The availability of third level institutions is very limited. During the period 1986-88 the tertiary enrolment ratio amounted to 0.3%.

Figure F.6 shows the enrolment on primary, secondary and tertiary level for a few selected years in the past. Primary enrolment has increased sharply over the period concerned. A less sharp increase was experienced in secondary education. Tertiary enrolment has remained limited considering the selected years.

Figure F.6 Enrolment at different education levels for 1961, 1971, 1981 and 1987



primary	16,157	70,922	356,905	388,933
secondary	9,505	45,000	67,602	104,046
tertiary	603	3,767	7,952	11,430

Source Altbach, P.G. (ed.). *International higher education. An encyclopedia.* 1991, p. 428.

According to UNESCO a country has to spend at least 6% of its GNP to education. Only then a qualitatively well-developed education system can be obtained.[22] Public expenditure on education in Tanzania increased from 4.4% of GNP in 1980 to 5% of GNP in 1990. The biggest part of these funds are meant for primary education.[23] Due to its focus on primary education, Tanzania experienced a

21 World Bank. *Tanzania. Social sector review. Executive summary.* 1995, p.16.

22 De Volkskrant. *Nederlands onderwijs haalt UNESCO-norm niet.* 11 April 1996, p.1.

23 UNESCO. *Statistical Yearbook 1995.*

major increase in its literacy rate.: from 46% in 1978 to 76% in 1993 (both figures based on people aged 15 years and older).[24] In judging these figures it should be noticed that the absolute population even increased from 17 to 26.7 million during the same period.

From the viewpoint of the construction sector, improvement of the current education system seems to be very much needed. Only then the local construction capacity can improve quantitatively, but, more important, also qualitatively. A very major constraint currently experienced by the contracting sub-sector would then be alleviated.

F.6 The economic situation since Independence[25]

The economic situation in the past is briefly discussed to provide some insight into the underlying factors of the current economic status of the country. The period from Independence till now can be divided in three main periods:
- 1961 - 1966: this is the period before the Arusha Declaration (section E.6.1),
- 1967 - 1981: during this period the economy was dominated by a policy of socialism and self-reliance (section E.6.2),
- 1982 - now: this period is characterised by a transformation from an economy dominated by a socialistic policy to a more liberalised economy (section E.6.3).

F.6.1 Period 1961 - 1966
In the period after Independence the First Five Year Plan for Economic and Social Development (FFYP) was formulated. This FFYP focused on industrial development and an acceptance of dependence on foreign initiatives.
The effect of the Plan on the GDP was as follows:
- the share of agriculture and mining declined from 52.3% in 1964 to 43.2% in 1969,
- the share of industry increased from 6.6% to 10% during the same period.

F.6.2 Period 1967 - 1981
In 1967 TANU launched the Arusha Declaration. This meant the beginning of a period in which socialism and self-reliance were the key items. The most important means of production came under public control. The principles of the Arusha Declaration were brought into practice by the Second Five Year Plan (SFYP), from 1969 until 1974. The Arusha Declaration led to many nationalisations of major local and foreign organisations. Trade was also nationalised.

In 1974 Tanzania experienced a first major crisis due to an increase of oil prices on the world market, leading to a worsening of the balance of payments. The Third Five Year Plan (TFYP) could not improve the situation. At the beginning of the eighties Tanzania viewed a severe balance of payment crisis, caused by a combination of different factors. These comprised a lack of foreign exchange, dependence on foreign aid and a major influence of politics on economic decisions. The situation asked for drastic economic reforms. In 1981 the National Economic Survival Programme (NESP) was launched. This was the beginning of a period of important political and economic changes.

F.6.3 Period 1982 - now
In cooperation with the World Bank a three-year Structural Adjustment Programme (SAP) was formulated in 1982. This programme meant the end of the socialistic economy and a transformation to

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[24] Dorgan, C.A. (ed.). *Gale country and world rankings reporter.* 1995, p.80; Euromonitor. *World economic factbook 1994/5.* 1995, p.413; Ferreira, L. et al. *Poverty Income and Inequality. Tanzania 1993.* 19995, p.30.

[25] Based on: Ministry of Works. *Proposed National Construction Industry Development Policy.* 1995; *Economic policy w.r.t road transport in Tanzania,* p.11-21; *Africa South of the Sahara.* p. 924-946.

a more liberalised economy. Its main objectives were:
- stimulation of the private sector,
- decrease in government expenditures,
- relaxation of price controls.

Although at the start successful, a lack of foreign exchange hindered production and economic growth. It thus was necessary to continue and even intensify the reforms started under the SAP.

In 1986 the Economic Recovery Programme (ERP) was launched, which was greatly influenced by IMF-policy. The overall objective of the ERP was to stop the economic decline from the late 1970s and early 1980s. The IMF insisted on the following reforms in change for its support to the programme:
- reduced government influence,
- more opportunities for the private sector,
- domination of economic criteria over political ones,
- a realistic exchange rate,
- a stable and more favourable balance of payments.

With this first ERP, from 1986 till 1989, an improvement of the economy was noticeable: GDP grew with an annual average of 4.1% during this period, industrial exports increased and a recovery took place in agricultural production. Export earnings increased and, in combination with increased donor support, this had a positive impact on the availability of foreign exchange. This again stimulated import, making more goods and services available for the various economic sectors.
On the other hand, the balance of payments problems, and the exchange rate measures have had a negative impact on the provision of social services during this first ERP-period.[26]

One of the key elements of the first ERP was rehabilitation of the infrastructural situation. The Integrated Roads Project, initiated under the ERP, was a great stimulus for the construction industry. This project, first of all, has had a direct impact on the construction industry, by increasing its activity level. Second, it has an indirect, long-term effect, since it makes transport of materials and equipment to the building site more efficient and cheaper.

In 1989 the Fifth Five Year Plan (FFYP) was launched, focusing on the transport and communication sector. In the same year the second ERP (ERP II) started. This Programme focused on the same objectives as the ERP I, supplemented with the objective to decrease the social costs of the adjustment measures.

Presently no five-years plans are used anymore. They have been replaced by a system of Rolling Plans and Forward Budgets (RPFB), covering a period of two years with a review taking place every year. The RPFB's contain policies for every major economic sector.

F.7 The Tanzanian economy in statistics

The economic developments discussed in the previous section are summarised in the figures below, using a few selected economic indicators, like GNP per capita versus population growth, GDP, inflation rate, interest rates, and exchange rates.

According to figure F.7 the GNP level experienced a negative growth rate during most of the period 1983 till 1993. At the same time the degree of this negative growth is fluctuating. Overall, the GNP shows an increasing trend. In the same period the population increased with an average yearly growth rate of 3.0%. Consequently, the GNP per capita shows the same trend as the GNP.

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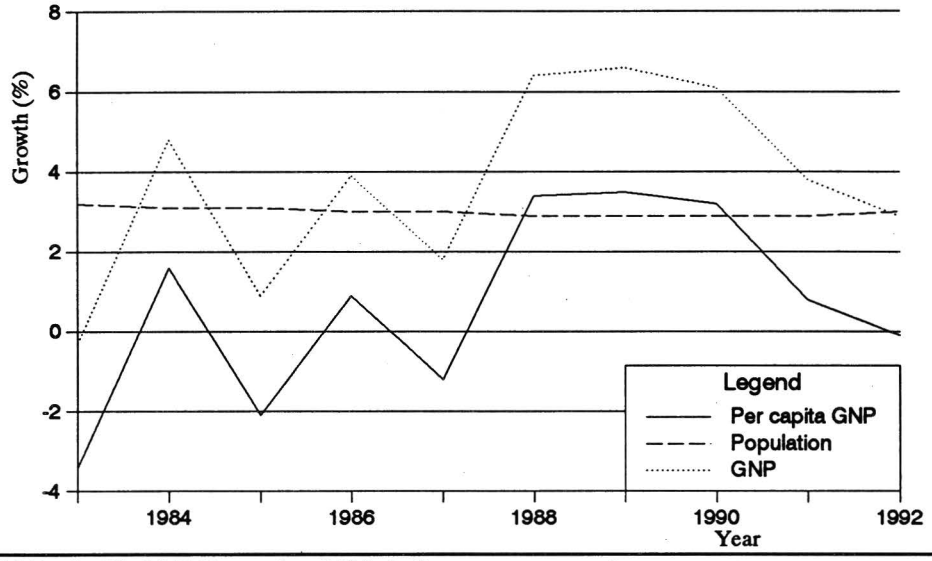
[26] National Government of Tanzania. *Economic Recovery Program II.* 1989, p 1/2.

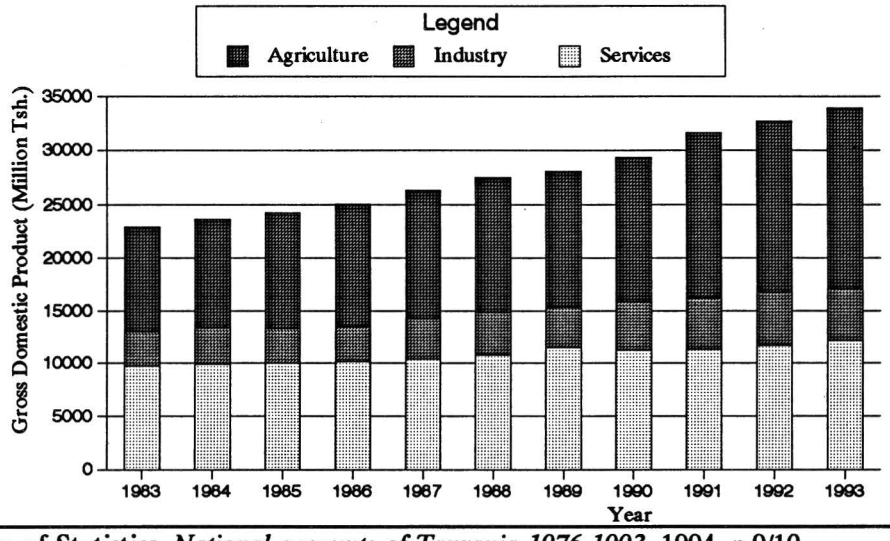
Figure F.7 GNP per capita and population growth, 1983-1993



Source World Bank. *World Tables update 1994.* (software programme).
NOTE GNP and GNP per capita based on constant 1987 prices.

According to figure F.8 the GDP seems to have improved under the economic reforms. The share of the agricultural sector in GDP has increased slightly over the years at the expense of services. The share of the industrial sector in GDP remained constant comparing 1983 and 1993.

Figure F.8 Gross Domestic Product and share of economic sectors in total GDP level, 1983-1993

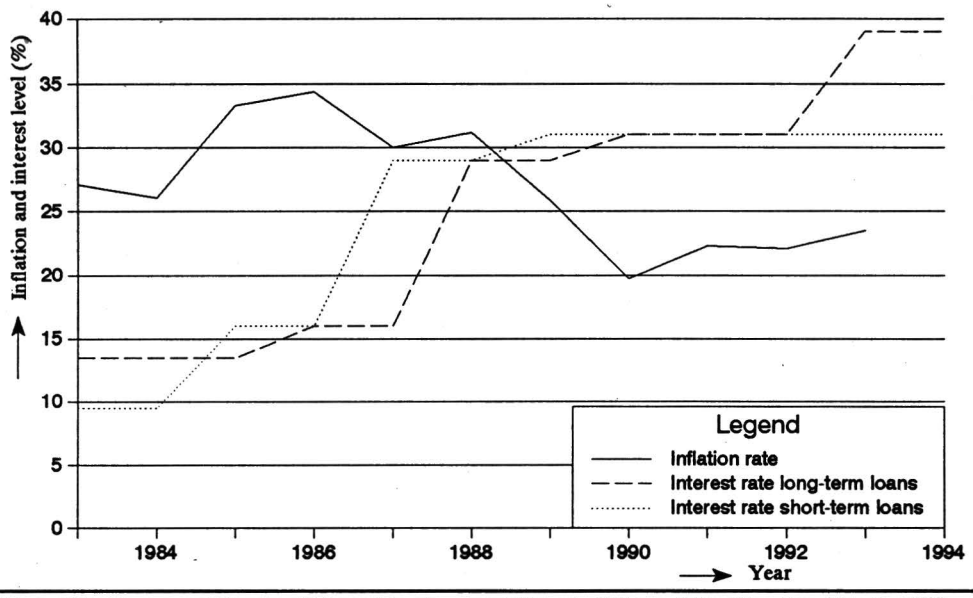


Source Bureau of Statistics. *National accounts of Tanzania 1976-1993.* 1994, p.9/10.
NOTE Based on constant 1976 prices

The inflation rate (figure F.9) decreased from 1983 till 1990. Since the early nineties the inflation shows an increasing trend. The current level (23.5%) is still on the high side and does not meet

government objectives (1993: 15%).[27] To limit the inflation, interest rates were increased (figure F.9). The higher rates make investments in Tanzania more attractive, attracting foreign investors. On the other hand, borrowing money becomes more and more expensive, which can be a severe constraint for the expansion of economic activities, including construction activities.

Figure E.9 Inflation rate and interest rates, 1983-1994



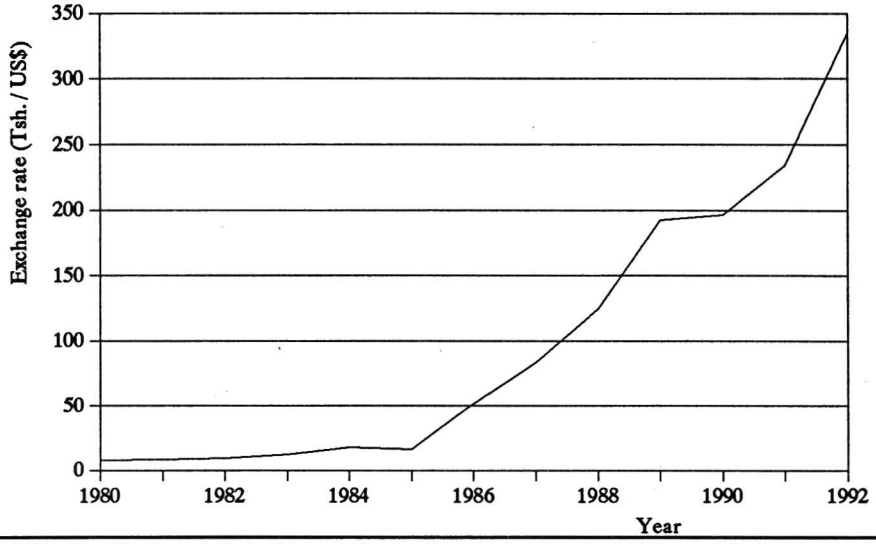
Source African Development Bank. *African Development Report.* 1994, p.134; The President's Office. *Rolling Plan and forward budget for the period 1994/95-1996/97.* 1994, p.3; Bureau of Statistics. *Statistical Abstract 1991/93.* 1992/1994, p.22.

NOTE Inflation rate has been based on the Consumer Price Index (CPI).

The trade liberalisation, after 1986, increased import/export possibilities for the private sector. This resulted in more (building) materials and products being available on the local market. But, although import became easier, it also became more expensive, since the official exchange rates were adjusted Figure F.10 shows a sharp increase for the exchange rate in 1986, after the introduction of more realistic exchange rates.

[27] The President's Office. *Rolling Plan and Forward Budget for the period 1994/95-1996/97.* 1994, p.3.

Figure F.10 Exchange rates for the period 1980-1992

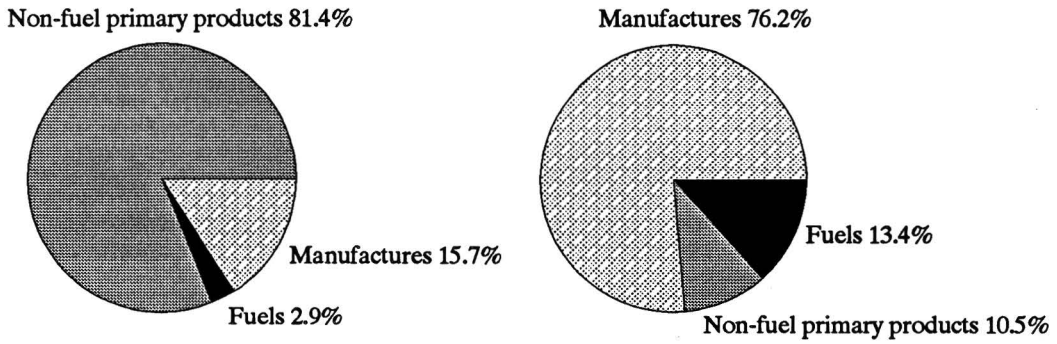


Source Baart, P.E.H. *Facilitating trade policy making and execution at the Ministry of Industries and Trade, Tanzania.* 1995, p.111.

F.8 Tanzania's international relations

Figure F.11 below gives an overview of the export and import structure of Tanzania in 1992. Tanzania is mainly an exporter of nonfuel primary exports and an importer of manufactures. This relatively great dependence on primary exports only, makes the Tanzanian economy rather vulnerable to extortions. Especially since primary production to a great extent depends on climatic conditions.

Figure F.11 Export (left) and import (right) structure for Tanzania, 1992

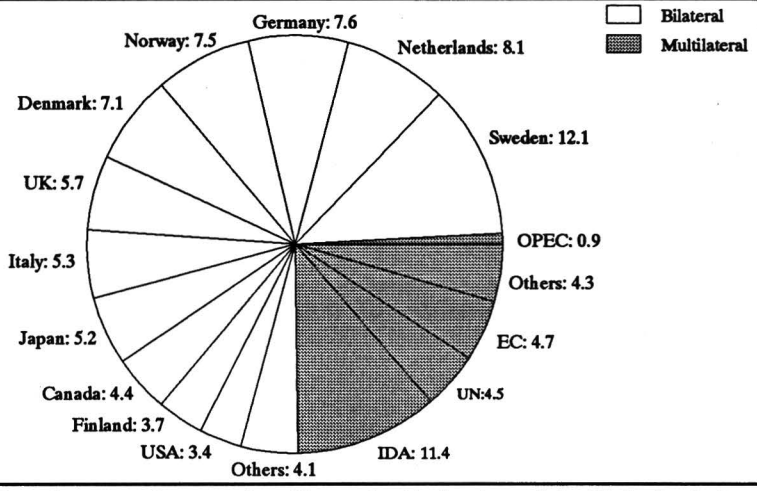


Source World Bank. *World Tables update 1994.* (Software programme).

Since the export-import balance does not provide Tanzania with the necessary financial resources, it is largely dependent on external financial assistance. In 1992 the external debt of Tanzania amounted to 16.8 times the export earnings of that year and to almost 2.5 times the GDP level.
Figure E.12 (next page) below shows bilateral and multilateral aid received by Tanzania per donor. The pie chart shows that especially the Scandinavian countries and The Netherlands and Germany have provided relatively a lot of financial assistance.

The vast amount of foreign financial aid has made the Tanzanian economy very dependent on this type of financial source. In 1990 the ODA amounted to 42.8% of the then GDP and even to 288.7% of the country's export. With the increasing tendency among donors to limit the development assistance and/or to tighten the conditions of the aid, this dependency is even larger than merely expressed by these figures.

Figure F.12 Total net ODA to Tanzania by main donors, 1970-1992



Source Netherlands Development Cooperation. *Tanzania. Evaluation of the Netherlands Development programme, 1970-1992.* 1994, p.62.

F.9 Conclusion

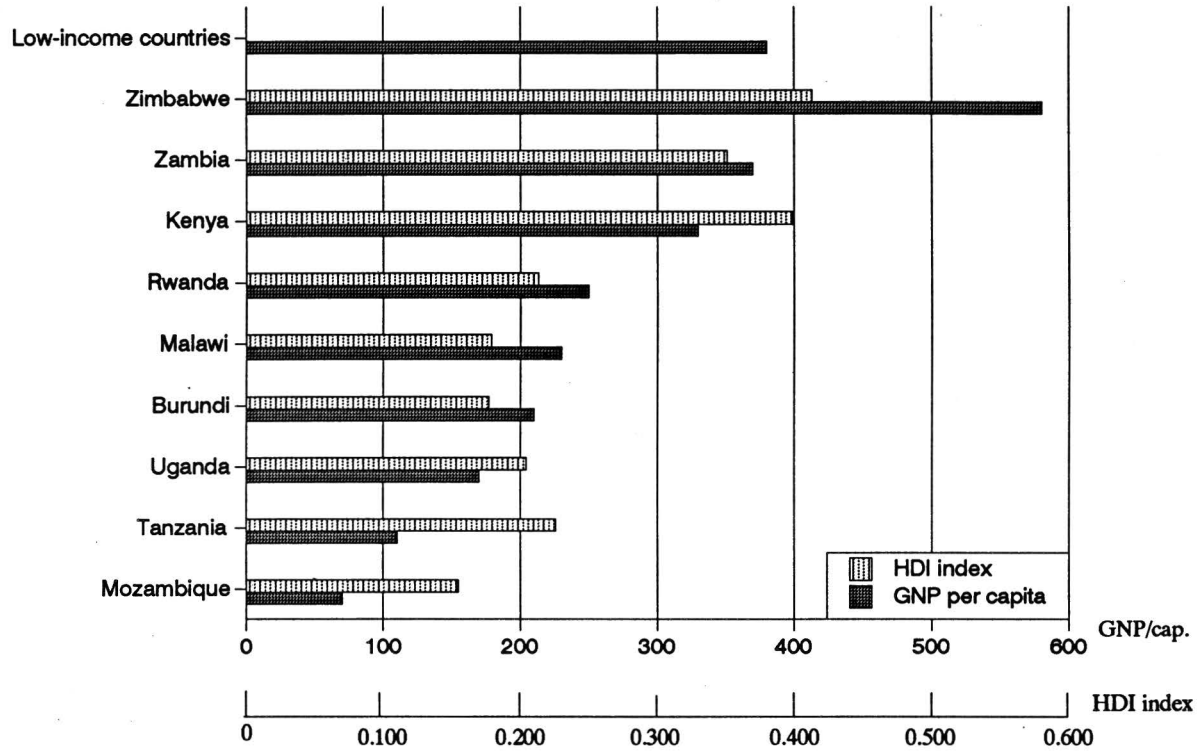
To conclude the above presented profile of Tanzania, the country will be ranked using official ranking indicators. Ranking can take place on the basis of economic indicators and social indicators. Both types are used here, since economic growth should be accompanied by a better fulfilment of basic human needs. Ranking is done with respect to other countries in the region and the entire group of low-income countries.[28]

Figure F.13 shows the GNP per capita level per country and HDI index for Tanzania and neighbouring countries. According to World Bank measures, all countries are to be classified as low-income countries. The GNP per capita level of Tanzania is on the lower side compared to other countries in the region and also compared to the entire group of low-income countries.

All countries are ranked as low human development countries, with Tanzania just above the average HDI score for the nine countries depicted (0.266 versus 0.262).

[28] Low-income countries are those countries with a 1993 GNP per capita of less than 695 US$. Based on World Bank classification.

Figure F.13 Ranking of Tanzania and neighbouring countries on the basis of GNP per capita (1992) and HDI index (1991)[1]



Source World Bank. *World tables update 1994.* (Software programme); UNDP. *Human Development Report 1991.* 1991, p. 120-121.

NOTE The HDI index is based on a scale of 0 to 1.

Appendix G

Profile of the Tanzanian construction sector

G.1 Introduction

In this appendix attention is given to the performance of the construction sector of Tanzania. This concerns past and present performance as well as future performance expectations. This appendix should be read in connection with appendix F, which presents the national operating environment. This environment sets the framework for the construction sector and its actors.

G.2 Historic developments in the construction sector

Long time the Tanzanian government did not have an official policy for the construction industry. Its importance for the development of the country was never fully realised and exploited. In 1977 the government had a major study conducted on the situation in the construction sector.[1] The underlying motivation for this study was the undesirable state-of-affairs noticed within this sector.

During the early colonial days no indigenous construction industry existed in Tanzania. The necessary construction works were carried out using foreign resources. Only in the 1920s and 1930s the first general contractors had established themselves in the country. Private initiatives constituted the major part of the construction activities during this whole period.

After Independence the construction industry suffered from a lack of confidence among potential investors. By the mid sixties, with more political stabilisation being reached, the sector showed a more positive development.[2]

During the seventies the industry was strongly influenced by the contents of the Arusha Declaration. For the construction industry the following objectives were set:[3]
- reduce the import-content of construction programmes and make maximum use of local materials (self-reliance),
- develop sufficient capacity in the industry, with increased efficiency, a greater degree of cost control and improved quality of design and workmanship, on a level compatible with the economic and social limitations of Tanzania (economic and social transformation),
- increase the public sector participation in construction programmes and distribute capacities and benefits more evenly throughout the country (in line with policy of socialism).

The government was not able to realise these objectives. She did however become the major investor: during the first ten years after the Declaration 90% of the annual construction activities was initiated by

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1 Ministry of Works. *Local Construction Industry Study.* 1977.

2 Mkanga, P.J. The development of public construction capacity. p.3. In: National Construction Council. *Role of contractors in national development seminar.* Arusha, 1982.

3 Wells, E.J. *Expansion of public sector construction in Tanzania.*1984, p.1.

the government.[4] In 1970 the government even nationalised one of the existing construction companies of that time and became full owner. This company had to be the government's direct link with the construction market.[5]

It soon proved that the demand in the construction industry exceeded the supply by the public sector. Despite the government's intentions, the construction industry therefore continued to depend on private inputs: in 1982 only 14% of the public construction works was realised by public contractors. The remaining part was realised by private contractors.[6] But the new policy, and especially the aspect of nationalisations, led to a decline in private initiatives, increasing the gap between demand and supply.

At this time the industry also still heavily relied on foreign sources, both for materials, and manpower and expertise. Actually, foreign companies prove to have always played an important role in the construction sector, despite all the intentions of the government to change this situation.[7]

The results of the 1977 Study meant the turning-point in the attention given by the government to the construction sector. Until that time the contribution of this sector was considered marginal as compared to more relevant sectors, like the agricultural. The growing awareness with respect to the crucial role of the construction sector in socio-economic development, together with the results of the 1977 Study, showed the necessity of drastic government action.

The main problems the industry saw itself confronted with during the seventies and the beginning of the eighties, included:[8]
- a severe shortage of local contractors and consultants,
- a lack of skilled manpower and supervisory staff,
- a severe shortage of foreign-exchange, and consequently:
- a lack of imported building materials and equipment, as well as of raw materials and machines necessary for local production. This uncertainty in the supply of resources resulted in an increase of construction costs. This cost development was also stimulated by:
- a general rise in prices and wages (also affecting other parts of the economy),
- a low productivity level,
- decreasing competition (resulting in high profit levels for contractors).

The two latter factors were caused by the gap between construction demand and supply. Private contractors did not dare to expand their capacities, out of fear for nationalisations. Moreover, the high profit levels did not provide them any stimulus to increase the productivity level on their projects. The high risk level was included by the contractors in their tenders, which also had its effect on the level of construction costs.[9]

As a consequence of the above-mentioned bottle-necks the share of construction in total GDP declined from 5.3% in 1973 to 3.8% in 1982. The economic problems had also clearly affected the construction industry. In 1982 200 public sector projects were suspended. The government only continued and

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4 Vianney, O. *Effects of delays in decision making on construction projects.* 1989.

5 Mwananchi Engineering and Contracting Corporation (MECCO). *Company presentation report.* p.7.

6 Wells (1984), p.20.

7 Ministry of Works. *National Construction Industry Development Strategy.* 1991, p.11.
Personal interviews.

8 Wells (1984), p.3; Ministry of Works. *Construction Industry Work Study.* 1977, p.90-93.

9 Ofori, G. Improving the construction industry in declining developing economies. In: *Construction Management and Economics.*1984 (2), p.127-132.

started projects which could count on foreign financial support.[10] According to the opinion of Wells (1984), who conducted a study on the construction industry of Tanzania in the early eighties, the sector was, at that time, at the point of collapse.[11]

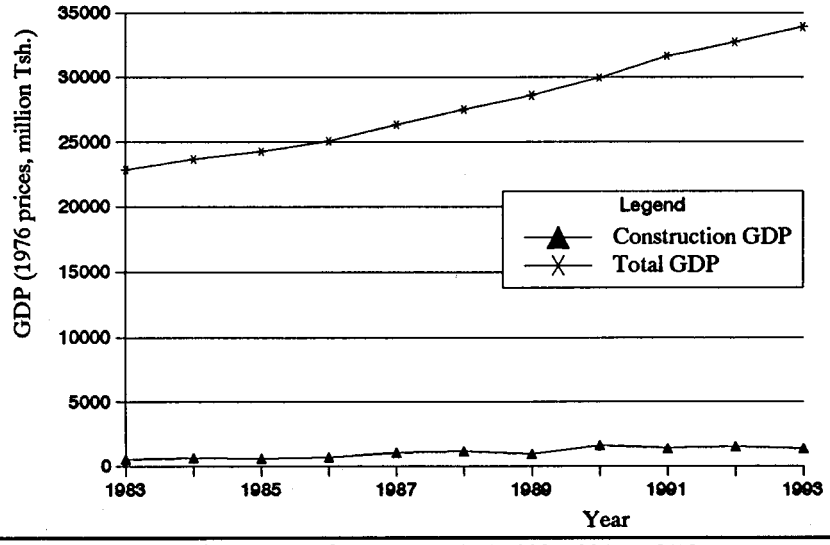
The above presented historic developments in the construction industry laid the foundation for its current performance.

G.3 Current performance of the construction sector

Figure F.1 below gives an indication of the growth of construction GDP versus total GDP, for the period 1983-1993. Total GDP has experienced a steady growth, especially after the economic reforms. Construction GDP shows a much more constant development. The statistical data included in enclosure I at the end of this appendix reveal a very fluctuating movement in the growth rate of construction GDP, from a negative growth of 41% in 1982/83 to a positive growth of almost 70% in the year 1989/90. Moreover, according to the figures in table I.1 of this enclosure, the contribution of the construction sector to total GDP growth seems to be limited during this entire period, and sometimes even negative.

Figure G.1 and the statistical data of table I.1 show no structural link between the current growth of the Tanzanian economy and the share of the construction sector in this growth. On the contrary, whereas the economy shows a structural growth, the construction industry seems to be very unstable. This could indicate that the informal sector, which is not represented in the official statistics, fulfils a considerable part of the demand for construction which irrevocably results from the overall economic growth. However, one should also not neglect the possible influence of a certain degree of inaccurateness in the construction statistics. Currently, the Bureau of Statistics, in cooperation with the World Bank, is trying to cover the construction sector in a statistical way which is to be more elaborate and accurate than at present. The results of this operation are not available yet.

Figure G.1 Total GDP and construction GDP, 1983-1993



Source Bureau of Statistics. *National accounts of Tanzania 1976-1993.* 1994, p. 9/10.

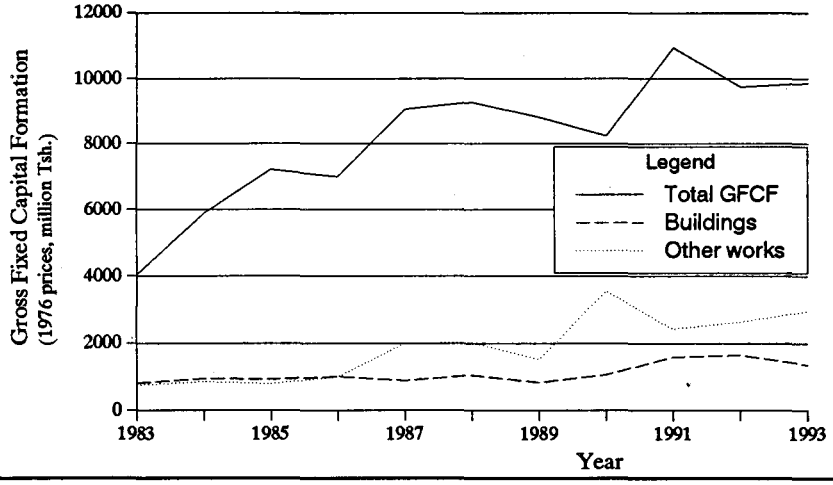
10 Ofori (1984), p.129.

11 Wells (1984), p.4.

Another important economic indicator for the construction industry is its share in Gross Fixed Capital Formation (GFCF). Enclosure I also contains an extensive overview of data on this economic parameter. Figure G.2 below provides a first insight into the share of construction works in total GFCF.

According to this figure construction works form a minor part of total GFCF. The share of building works has even decreased since 1983; the share of other works (land improvement, road, water and other works) increased. This latter development could be attributed to the Integrated Roads Project, which started at the early nineties.

Figure G.2 Total GFCF and the share of building and other works, 1983-1993



Source Bureau of Statistics. *Selected Statistical Series 1951-1991.* 1994, p. 35; Bureau of Statistics. *Statistical Abstract: 1993.* 1995, p. 31.

G.4 Government objectives for the construction sector

G.4.1 The future economic contribution of the construction sector

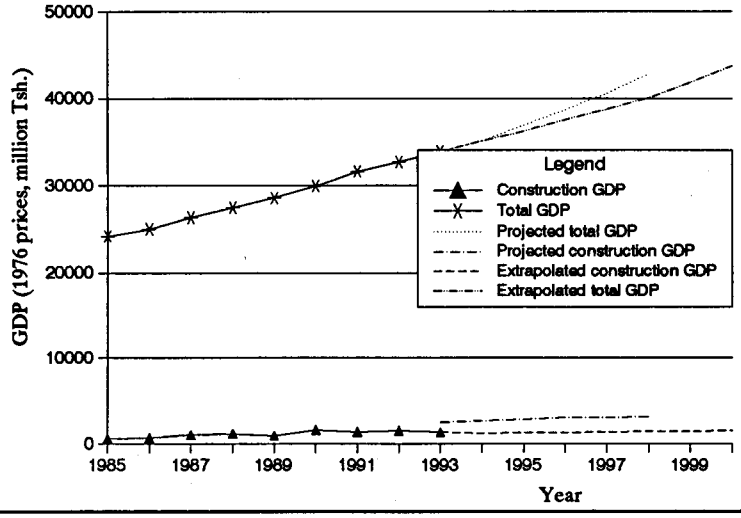
In the previous two sections the past and present position of the construction sector in the overall economy of Tanzania has been discussed. Figure G.3 (next page) presents the future economic contribution of the sector as projected by the government (using GDP figures). Also included is the extrapolated development of both total and construction GDP.

Both for total GDP and construction GDP the projections of the government shows a slightly more optimistic development, as is to be expected according to the extrapolations. For construction GDP this is largely due to a difference in base figure used for 1993.

It is the government's intention to tune the future development of the construction industry to the overall social and economic developments.[12] Based on both the projections and extrapolations in figure G.3 this does not seem achievable in the near future.

[12] Ministry of Works. *National Construction Industry Development Strategy.* 1995, p.17.

Figure G.3 Projected and extrapolated development of total GDP and construction GDP



Source Bureau of Statistics. *Statistical Abstract 1993.* 1994, p.31; Bureau of Statistics. *Selected Statistical Series 1951-1991.* 1994, p.33; The President's office. *Rolling Plan and Forward Budget for the period 1995/96-1997/98.* Summary Tables, 1995.

G.4.2 Policy objectives for the construction sector[13]

Only in 1991 the government of Tanzania formulated its first comprehensive policy strategy for the construction industry. In this first policy document, the government formulated the following overall development objective:

'to develop an efficient and effective, self-sustaining construction industry that is capable of meeting the diverse needs for construction, rehabilitation and maintenance of all building and civil works.'

The existing construction capacity will have to be exploited and expanded to the fullest. At the same time, the development and creation of new capacities will have to be encouraged. In the national context the sector has to contribute to the country's economy and self-sufficiency.

G.5 Actors in the Tanzanian construction process

G.5.1 The clients

In the case of Tanzania the client's role in the construction process is dominated by the government. According to the Ministry of Works (MOW), which is the main responsible body for the construction sector, 90% of the building projects in the country is initiated by the government and 100% of the road projects.[14] This is not totally surprising, since most construction works involve huge costs, which cannot be afforded by many private actors, especially not in a developing country like Tanzania. Moreover, some construction works have a community character (like roads), which makes the government the right 'person' to act as initiator. Still, the overall priority given by the Tanzanian government in recent years, to private sector activities might also give a more prominent role to this sector on the construction market in the near future.

Some of the government projects are financed by foreign donors, which may not be surprising

[13] Ministry of Works (1995).

[14] Based on interview with the chief engineer at the Ministry of Works, Dar es Salaam.

considering the relatively large amount of foreign aid, which Tanzania receives (see appendix F). These donors are both multilateral (African Development Bank, European Community, UNDP) and bilateral (Norad, DANIDA, FINNIDA, USAid[15])[16]. This foreign assistance in the construction sector is especially focused on road projects (the Integrated Roads Project), and to a much lesser extent also on building projects (e.g. DANIDA). Foreign funds are often channelled through one of the ministries of the Tanzanian government.

G.5.2 The consultants[17]

The role of consultants within the Tanzanian construction sector is fulfilled by both foreign and local companies.

G.5.3 Branch organisations

Various branch organisations exist in Tanzania, which represent contractors, quantity surveyors, architects and consultants. During this research no detailed information has been found on the exact activities of these organisations within the Tanzanian construction sector. Moreover, it was striking to notice that people working at relevant positions in the construction industry could not provide any information on the existence and/or location of the Tanzania Building Contractors Association. This might indicate towards a very low activity level of this Association.

G.5.4 The government

In this case the government includes the national and local government as well as various affiliated government organisations. The MOW has the main coordinating and regulating responsibility towards the construction sector. This responsibility includes:[18]

- the formulation of policy,
- developing action programmes and development strategies,
- determining and coordinating all public sector construction activities,

In the planning of the development of the construction sector the MOW is assisted by the Planning Commission and the Ministry of Finance.

The combination of the government's role as coordinator and client is represented by the Central Tender Board (CTB). This Board is responsible for the award of government projects. Through this Board the government can use its role as a client to implement certain policy measures. This takes place by the bidding system which is used. Depending on whether international competitive bidding or local competitive bidding procedures are used, a contract can be awarded to local and/or foreign contractors. International competitive bidding is used for road projects, since only few capable local road contractors are available. However, to protect local contractors against too much competition of foreign contractors, a preferential treatment of 7.5% is used.[19] For building projects local competitive bidding is used most of the time. Another measure used to protect local contractors is to split large projects into smaller ones. This makes the project less attractive to foreign contractors, because their overheads become too high in view of the contract value.[20]

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15 Norad, DANIDA and FINNIDA are development organisations of the Norwegian, Danish and Finnish government respectively; USAid is a development organisation from the United States of America.

16 Based on interview with mr. Mamiro of the National Construction Council, Dar es Salaam.

17 This includes engineers, architects and quantity surveyors.

18 Ministry of Works. *National Construction Industry Development Strategy.* 1991, p.26.

19 This 7.5% is added to the tender value of foreign contractors, before evaluation of all tenders takes place.

20 Information based on interview with mr. Nkinga, chief engineer at the Ministry of Works.

For the daily execution of some coordinating and controlling tasks the government is assisted by several organisations. The most important ones are the National Construction Council (NCC), the National Board of Architects, Quantity Surveyors & Building Contractors (NBAQS&BC) and the Tanzania Bureau of Standards (TBS).

The National Construction Council (NCC)

The NCC, operating since 1981, has the following functions:[21]

- to promote the development of the construction industry,
- to plan and coordinate the activities of persons and institutions engaged in the industry and to provide then with training facilities, advisory services and technical assistance,
- to advise the government on all matters relating to the industry and to formulate proposals and recommendations for their implementation,
- to advise on tendering procedures[22], the economical use of materials and adaptation of technology and to encourage the maximum use of local materials,
- to carry out and to promote the carrying out of research and to arrange relevant conferences and seminars.

The National Board of Architects, Quantity Surveyors & Building Contractors (NBAQS&BC)

Apart from registration of contractors, the Board has the following functions:[23]

- regulate activities and conduct of architects, quantity surveyors and contractors,
- promote and provide opportunities and facilities for the study of and for the training in architecture, quantity surveying, design, construction and related subjects. Within this function the Board also conducts examinations and grants diplomas in the mentioned subjects.

The registration system of the NBAQS&BC restricts unlimited entry to the construction market and, at the same time, helps to maintain a certain quality level within the industry.

The Tanzania Bureau of Standards (TBS)

The Ministry of Industry has started, through the TBS, to formulate local building regulations. Current building regulations date from 1930 and can be considered to be outdated.[24] In the formulation of new building regulations the TBS is assisted by organisations such as the NCC, the Building Research Unit (BRU), and the MOW. Control of the quality of construction work on site is the responsibility of the local government. E.g. in Dar es Salaam the building department of the City Council takes care of visual inspections on construction sites. Another task of this department is to provide building permits.

G.5.5 Research institutes

The group of research institutes related to the construction sector comprises the Building Research Unit (BRU), the University of Dar es Salaam, three technical colleges in Dar es Salaam, Arusha and Mbeya, and the NCC. The BRU especially focuses on research on the production of appropriate local building materials. Current research efforts of the NCC focus on the improvement of contractual and tendering procedures as well as research into the escalating construction cost trend in the sector.

The present research efforts in the construction industry are considered too limited, based on he government's opinion. This is partially due to a lack of financial resources. Coordination and dissemination of the results of conducted research are, moreover, inadequate.[25]

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21 Ofori (1990), p.212 / 213.

22 The NCC has formulated a 'code of procedure for tendering for civil and building works in Tanzania'.

23 NBAQS&BC. *WAJENZI Newsletter.* 1995 (1), p.6

24 Ministry of Works (1991), p.24.

25 Ministry of Works. *National Construction Industry Development Strategy.* Draft version 1995, p.29.

G.5.6 Education institutes

The Tanzanian educational system and the problems it faces are discussed in section F.5 of appendix F. In its policy documents for the construction sector the government especially stresses the lack of professionals with the required management capacities. The University of Dar es Salaam only since 1980 offers courses in construction management. Moreover, until recently engineers were obliged to work in the public sector for 5 years after their graduation, leaving little management capacity for the private construction sector. Currently, the Dar es Salaam Technical College also offers management courses.[26]

As a consequence of the lack of local professionals, the industry has to rely on expatriate employees. The cause of the local shortage also results from a lack of training facilities. Moreover the coordination among existing institutes is inadequate.
The training facilities for technicians are said to be also inadequate, both quantitatively and qualitatively. Also here this has led to a shortage of enough qualified people.[27]
Both the shortages of technicians and professionals were already predicted in 1977, when the Ministry of Works conducted a major study into the then state-of-affairs in the construction sector.[28] It seems no structural improvements have taken place since then.

G.5.7 Labour organisations

Labourers in the construction sector are represented by the Tanzania Mines & Construction Workers Union (TAMICO). Until April 1995 TAMICO operated as part of the Organisation of Tanzanian Trade Unions (OTTU). Currently TAMICO is (said to be) an independent union. As a trade union TAMICO is responsible for:

- occupational health & safety on construction sites,
- collective bargaining for salaries and benefits,
  (According to TAMICO foreign contractors tend to pay better wages to local labourers as compared to local ones.[29]).
- arrangement of trade disputes,
- informing labourers on their rights, position and all labour-related aspects.

Under Tanzanian law every private company has to have a representation of OTTU on its premises. The representatives are elected by the company personnel among their own group. The company management is obliged to negotiate with this OTTU representation on labour salaries and conditions. Currently, TAMICO has approximately 22,000 members.[30]

In theory OTTU and its affiliated trade unions are supposed to be politically independent. However, the CCM, Tanzania's leading political party has strong historical links with the trade unions.[31] This makes the independency rather doubtful. Current developments versus political pluralism may guarantee the independence status more.

Since OTTU is the only labour organisation in the country and because of its historic link with the CCM, its influence is relatively big. This has been noticeable during the last few years by the

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26 Morgan, P.R. and J. Bakari. Bar-charts to CPM - construction scheduling and Tanzania. p.81. In: *International Journal for Development Technology,* vol. 4, 79-91 (1986).

27 Ministry of Works (1995), p.26.

28 Ministry of Works. *Local construction industry study.* 1977, p.236 + 239.

29 Based on interview with mr. P. Olum of TAMICO.

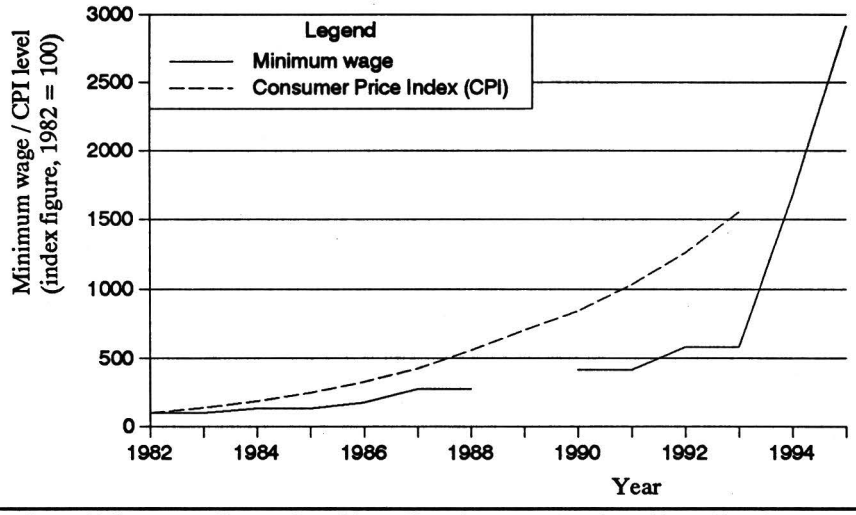
30 See [29].

31 Netherlands Development Cooperation (1994), p.48.

considerable increase in the minimum wage level. Figure G.4 shows the minimum wage level, expressed in index figures, for the period 1982 - 1995. Comparison with the Consumer Price Index (CPI) shows that until 1993 the development of the wage level fell far behind the development of the CPI. Only since 1993, wages have been increasing sharper than the CPI. TAMICO claims that the current minimum wage should be 35,000 Tsh.[32] Of course TAMICO is not to be considered entirely objective,

since it represents the labourers. However, the difference with the actual minimum wage is rather considerable (100%).

Figure G.4 Minimum wage index versus Consumer Price Index (1982=100), 1982-1995



Source Dankers, B. (1995), appendix p. 19. African Development Bank. *African Development Report.* 1994, p.134; The President's Office. *Rolling Plan and Forward Budget for the period 1994/95-1996/97.* 1994, p.3.

G.5.8 Building material suppliers

Building material suppliers are mostly concentrated in Dar es Salaam (especially of the production of cement, plastic pipes, paints, quarry products, wire products and roof covering) and in a few major towns inland (cement: Tanga and Mbeya; steel: Tanga; ceramic wares: Morogoro; chipboards / plywood: Tanga; fibreboard: Arusha; lime: Tanga).[33] Only the production of bricks seems to be scattered over the country (Iringa, Mbeya and Arusha: burnt bricks; Dar es Salaam: sand/cement bricks).

The availability of local building materials has since long been a problem in the Tanzanian construction sector, both in qualitative and quantitative sense. A survey which took place at the beginning of the nineties under 43 Tanzanian companies producing building materials, revealed that a shortage of raw materials was the most important cause of a decline in their production.[34] The availability of local raw materials was limited due to transportation problems and a lack of resources to process them. A shortage of foreign exchange has long hindered import of needed raw materials and building materials. Since the economic reforms of the eighties the influence of this factor has diminished. But the establishment of more realistic exchange rates has at the same time increased the prices of imported

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32 Based on TAMICO/OTTU representation at SJI, Dar es Salaam.

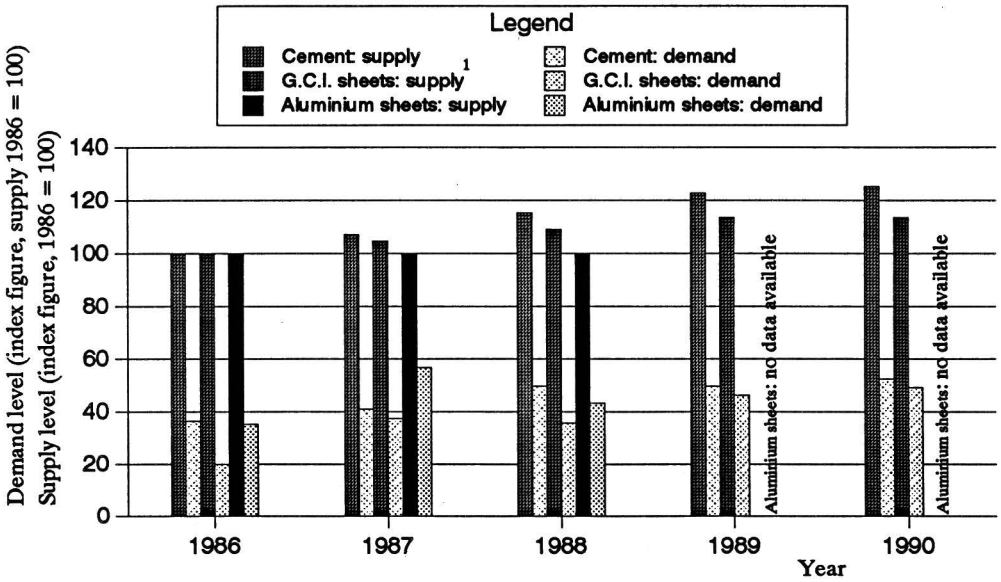
33 Komba (1992), p.9.

34 National Construction Council. *Identification & promotion of utilisation local resources and locally produced materials for construction industry in Tanzania.* Final report phase I, 1992.

building materials. Figure G.5 gives an example of the shortage with respect to three randomly selected building materials for the late eighties.[35] Since the absolute figures might not be totally accurate, index figures have been used. These, more over, also provide a better insight into:
- the growth of both supply and demand;
- the relation between supply and demand.

The demand for the materials in 1986 has been set on 100. Supply has been indicated as a share in total annual demand.

Figure G.5 Demand and supply developments for three selected building materials (index figures), 1986-1990



Source Data taken from: NCC. *Identification & promotion of utilisation of local resources and locally produced materials for construction industry in Tanzania.* 1992, p.10-11.
NOTES G.C.I = Galvanised Corrugated Iron

This figure shows that for the three selected materials, supply did not meet demand during the period concerned. Moreover, demand has increased relatively more than supply during this period, increasing the already existing gap. In her policy documents the government acknowledges the declining availability of locally produced materials as a major bottle-neck for the development of the construction sector.[36]

Another problem with respect to the material component in the construction sector is the sharp price increase which took place, especially during the eighties. In enclosure II this price development has graphically been depicted for a few selected building materials for the period 1980 till 1990 (1980 = 100). These graphs show that the prices of the selected materials increased sharply during the late eighties, which is the period of the economic reforms. For some materials this could be explained by the shortages as indicated above. Moreover, before 1986 the prices of the various materials show a similar price increase, but after this date price developments tend to differ. Overall the prices of most

35 The gap between demand and supply has been based on *estimated* demand figures. This means that the actual gap may have been bigger or smaller. No indication is available as to where these estimates are based on. However, the data still are usable in the sense that they indicate the company's lack to realise the planned production quantities.

36 The President's Office/Ministry of Finance. *The Rolling Plan and Forward Budget for Tanzania for the period 1995/96-1997/98.* 1995, part II, chapter 7, p.63.

materials increased more than the CPI during this period.

The price of -imported- fuel has also been included in the figures of enclosure II. The correspondence between the price development of fuel and of some building materials seems to indicate that the devaluation of the Tanzanian shilling has also had an impact on the building material prices. This devaluation led to higher import prices. This factor would explain the different price development for the various materials after 1986. These differences may also be caused by internal production problems within the various material-manufacturing companies.

G.5.9 Equipment suppliers

Contractors in Tanzania generally keep little equipment themselves. The reason behind this is the uncertainty in the amount of available projects. Because of this uncertainty and the relatively large investments involved with equipment purchases, the contractors experience the risk as too big.[37] External equipment suppliers are thus very much needed to cover the demand for equipment.

In the past local manufacture of construction equipment has been very limited. Inadequate availability of foreign exchange has partly prevented the necessary import of equipment and spare parts.[38] In 1992 PEHCOL, an equipment hiring organisation established by the Ministry of Works, started operating as a parastatal. It consists of seven branches spread over the country. Its most important clients are the contractors which carry out gravel works under road work contracts. The bigger contractors do not make much use of the facilities of PEHCOL due to the bad state of its equipment. On average the equipment is 10 to 15 years old. Another problem of PEHCOL is its lack of capacity to always fulfill the demand.[39]

Some of the bigger contractors themselves are another possibility to hire equipment, especially foreign ones (e.g. SJI). However, it may be evident that this option is limited. The contractor having the necessary equipment items could very well try to win the contract himself, especially since the competition on the Tanzanian construction market is high.[40] Moreover, even a large contractor such as SJI keeps a minimum of own equipment under the current market conditions. This minimal capacity also limits the possibilities to make equipment available for hiring to other contractors. Most of the time the available equipment capacity is needed by SJI itself. Another limiting factor with respect to large contractors is that they are almost all located in Dar es Salaam. This makes rental from contractors relatively expensive in the case of in-land projects. PEHCOL's rental facilities are more scattered over the country. It has branches in Tabora, Singida, Shinyanga, Mwanza, Morogoro, Moshi and Dar es Salaam. Until 1994 the hire rates differed per region, depending on the availability of equipment per region. Since that year the rates are equal for all regions.

Based on the daily hire rates of PEHCOL for the period 1991/1992 till 1995/1996 it became clear that between 1991/92 and 1993/94 the rates increased with an average of 11% per annum. The following year the rates increased with almost 35% in the in-land offices. The Dar es Salaam rates remained constant. During 1994/95 and 1995/96 the rates increased with an average of almost 21%. The supply of fuel is not included in these rates. Price increases are therefore likely to result from the price increase

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37 Based on interview with Mr. Rweyemamu of PEHCOL, Dar es Salaam and the equipment department at SJI, Dar es Salaam.

38 Ministry of Works,(1995), p.27.

39 Based on interview with mr. Rweyemamu of PEHCOL, Dar es Salaam.

40 Based on interviews with people at various positions in the construction sector. See also list of people interviewed in appendix D.

in spare parts (2 to 2.5% during 1993-1994[41]) and/or from the oligopolistic position of equipment rental facilities in Tanzania.

Research of Maro et al. (1991) revealed that between 1979 till 1985 the equipment hire rates increased with 13.7% per annum, while during the period 1986 till 1990 this growth rate was 47.8% per annum.[42] This big difference in increase can be explained by the devaluation of the Tanzanian shilling which especially took place after the economic liberalisations of 1986. This affected the prices of imported spare parts and fuel. The research of Maro et al. focused on equipment rates of one company only, just as is the case with the PEHCOL figures. This means that the exact level of the growth rates mentioned may also include some company specific aspects. However, the figures do provide an indication of the general cost increase which took place during this period with respect to construction equipment.

G.5.10 Financiers

The role of financiers in the construction process is to provide financial resources to both the client and contractor. Enclosure III contains an overview of financing institutions currently present in Tanzania. An adequate supply of financial funds is among the many problems facing the industry.[43] Loan conditions are often hard to meet by contractors.[44] Moreover, lending from banks has become expensive with an interest rate of almost 40%.[45]

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41 Based on documentation of equipment department of SJI.

42 Maro, W.E. et al. *Study on construction cost trends and control mechanisms in Tanzania.* NCC/University of Dar es Salaam, 1991, p.42.

43 Ministry of Works (1991), p.19.

44 Based on interview with mr. Likumbo, NCC employee, who conducted research into the causes of cost overruns on construction projects executed by Tanzanian contractors.

45 Bank of Tanzania. *Economic bulletin for the quarter ended 30th September 1994.* 1994, p.28.

Enclosure I Statistics on the construction sector of Tanzania

Table I.1 Relation between GDP and construction 1983-1993

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Average annual GDP growth (%)	-2.4	3.4	2.6	3.3	5.1	4.2	4.0	4.8	3.9	3.5	3.7
Share of construction in GDP (%)	2.4	2.8	2.5	2.8	4.0	4.3	3.3	5.4	4.4	4.6	4.0
Growth in construction GDP (%)	-41.0	20.2	-8.9	17.3	49.2	11.9	-19.2	69.8	-14.1	9.4	-10.3
Contribution of construction to GDP growth[2] (%)	-1.0	0.6	-0.2	0.5	2.0	0.5	-0.6	3.8	-0.6	0.4	-0.4

Source Bureau of Statistics. *National accounts of Tanzania 1976-1993.* 1994, p. 9/10.

NOTES The data in the table are based on constant 1976 prices. The contribution of construction to GDP growth has been calculated as 'growth of construction (%) x share of construction sector in GDP'.

Table I.2 Share of different type of construction activities in GFCF / growth rate of construction activities and total GFCF, 1983-1993

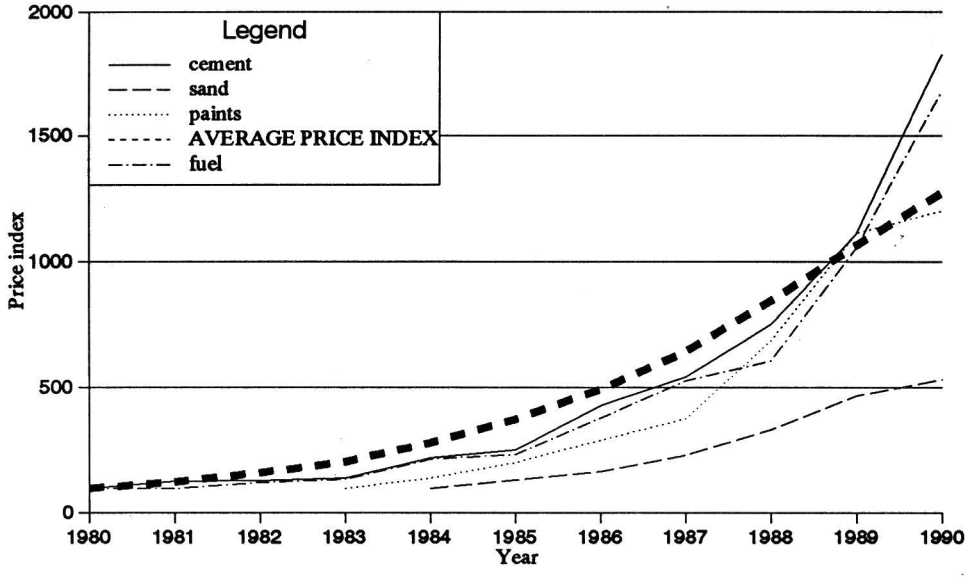
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Growth in total GFCF (%)	-33.2	45.7	22.6	-3.0	29.4	2.3	-5.1	-6.5	32.0	-11.0	-5.4.
Growth in GFCF 'buildings' (%)	-32.7	17.2	-3.2	10.1	-13.1	19.4	-21.4	29.5	49.7	3.33	-16.6
Growth in GFCF 'other works' (%)	-17.0	14.1	-6.5	27.6	98.3	1.3	-25.3	136.2	-32.1	9.1	12.3
Share of 'buildings' in GFCF (%)	19.9	16.0	12.7	14.4	9.7	11.3	9.3	12.9	14.5	16.9	13.7
Share of 'other works' in GFCF (%)	18.3	14.3	10.9	14.4	22.0	21.8	17.2	43.4	22.2	27.2	30.0
Share of 'buildings' in annual GFCF growth (%)	-6.5	2.8	-0.4	1.5	-1.3	2.2	-2.0	3.8	7.2	0.6	-2.3
Share of 'other works' in annual GFCF growth (%)	-3.1	2.0	-0.7	4.0	21.6	0.3	-4.4	59.1	-7.1	2.5	3.7

Source Bureau of Statistics. *Selected Statistical Series 1951-1991.* 1994, p. 35; Bureau of Statistics. *Statistical Abstract: 1993.* 1995, p. 31..

NOTES The data in the table are based on constant 1976 prices.

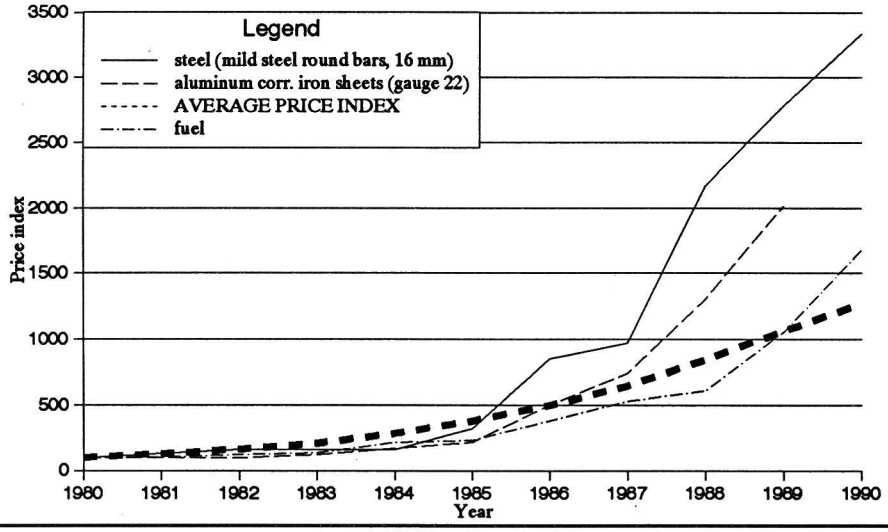
Enclosure II Price developments for selected building materials

Figure II.1 Price indices for cement (1980-1990), sand (1984-1990) and paint (1983-1990)



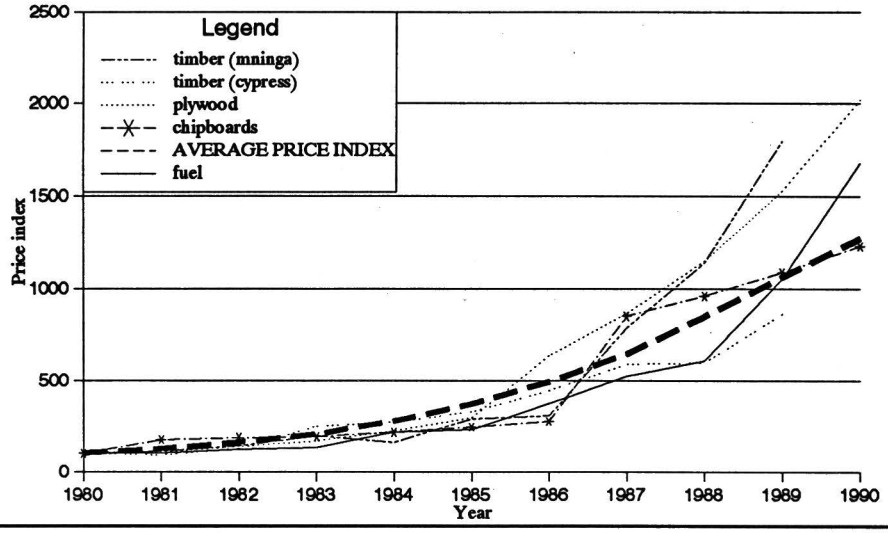
Source Maro et al. (1991), p.5, 18, 23, 32.

Figure II.2 Price indices for steel (1980-1990) and aluminum corrugated iron sheets (1980-1989)



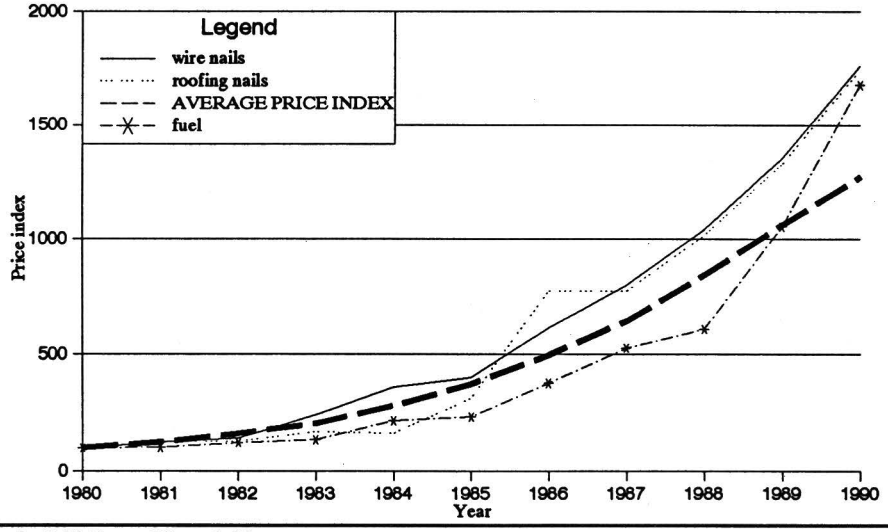
Source Maro et al. (1991), p. 7, 18, 26.

Figure II.3 Price indices for mninga (1980-1989), cypress (1980-1989), plywood, chipboard, wire nails and roofing nails (all 1980-1990)



Source Maro et al. (1991), p. 16 and 18.

Figure II.4 Price indices for wire nails and roofing nails (1980-1990)



Source Maro et al. (1991), p. 23 and 38.

Enclosure III Financing institutions in Tanzania

1. Bank of Tanzania
2. National Bank of Commerce
3. People's Bank of Zanzibar
4. Tanzania Investment Bank
5. Co-operative and Rural Development Bank
6. Tanzania Housing Bank
7. Tanganyika Development Finance Company Ltd.
8. Post Office Saving Bank
9. National Insurance Corporation Ltd.
10. National Provident Fund
11. Karadha Company Ltd.
12. National Development Credit Agency
13. Government Employees Provident Fund
14. Local Government Employees Provident Fund
15. Public Trustee Reserve Fund
16. East African Development Bank

Source The President's Office / Planning Commission. *The National Investment Promotion Policy.* 1990, p.24.

Appendix

H

Registration criteria for building contractors

Table H.1 Criteria for registration of building contractors as formulated by the NBAQS&BC

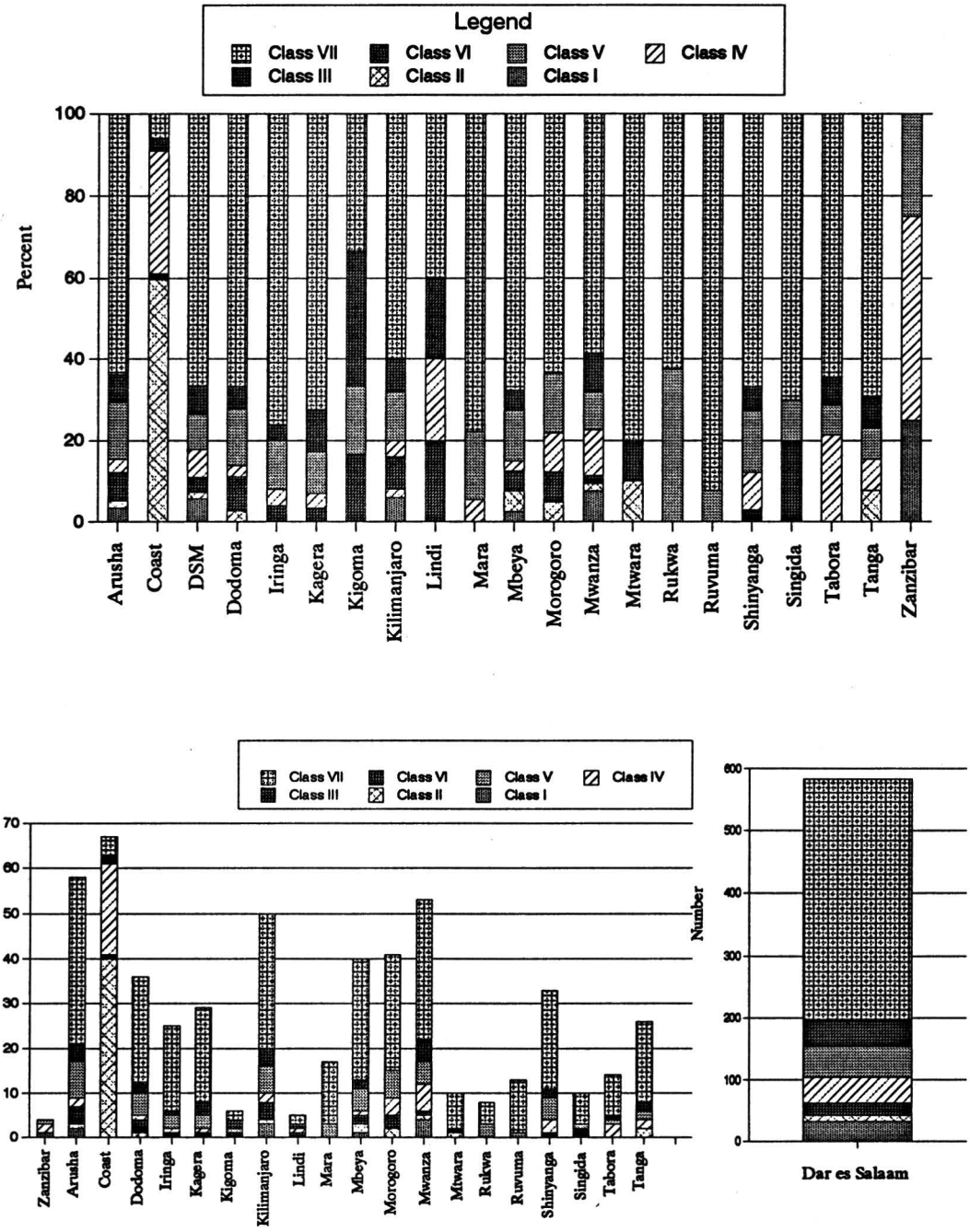
	Class I	Class II	Class III	Class IV	Class V	Class VI	Class VII
Staff (all with proven experience)							
1. Managing Director / General Manager	1	1	1	1	1	1	1
2. Financial Controller / Chief Accountant	1	1	1	1	-	-	-
3. Clerical Staff (Accounts, store, registry)	several	several	several	few	few	-	-
4. Structural / Civil Engineer (min. Dip.Eng. or equiv. + 5 years experience)	3	2	1	1	-	-	-
5. Chief Engineers (Min. Dip.Eng. or equiv. + 10 years experience)	1	1	-	-	-	-	-
6. Mechanical Engineering Technicians	2	2	-	-	-	-	-
7. Civil Engineering Technicians	20	15	10	5	3	2	1
8. Electrical Engineering Technicians	2	2	1	1	-	-	-
9. General Foremen	4	3	2	1	1	1	casual staff
10. Foremen	10	8	5	3	2	1	1
11. Artisans	40	20	10	7	3	2	1
Plant & Equipment (with competent operators)							
12. Tower crane	1	1	-	-	-	-	-
13. Concrete mixers	3	2	1	1	1	-	-
14. Block making machine	2	1	1	1	-	-	-
15. Steel bending machines (set)	1 set	1 set	1 set	-	-	-	-
16. Water pumps	2	1	1	-	-	-	-
17. Concrete dumpers	2	2	-	-	-	-	-
18. Heavy duty motor vehicles	3	2	1	-	-	-	-
19. Compactors	2	1	-	-	-	-	-
20. Compressors	1	1	-	-	-	-	-
21. Concrete vibrators	2	1	1	1	-	-	-

Source NBAQS&BC, Dar es Salaam, Tanzania.

Appendix I

Geographical spreading of building contractors in Tanzania

Figure I.1 Percentile geographical spreading per class (above) and number of contractors per class per region (below)



Source National Board of Architects, Quantity Surveyors & Building Contractors.

Appendix **J**

Internal bottlenecks at local contracting companies

Table J.1 presents an overview of internal bottlenecks. These are based on research from Maro et al. (1991).[1] Contractors included in this research, and thus the bottlenecks presented in table J.1, concern local contractors only.[2] The comment in italic has been added by the author of this report.

Table J.1 Internal bottle-necks

INTERNAL BOTTLE-NECKS

Contractor (local)

Tender phase

- lack of competency to analyse project and costs properly
  (Can result in unrealistic, expensive tender)
- lack of historic tender data
  (Makes preparation of realistic tender more difficult, costly and time-consuming)
- non-uniformity tendering practices
  (Makes evaluation by client / consultant more difficult. Can result in wrong choice of contractor)
- tendering not on basis of alternative construction methods, but on basis of market rates of cost/m^2
  (Results in relatively high tenders and inefficient construction)
- unrealistic construction programmes prepared; sharp programmes submitted to win contract.
  (Was found to sometimes result in actual construction time being 2 to 3 times estimated time)
- no incentive for contractors to use appropriate construction methods in view of national situation.
  (May result in inefficient construction methods, not optimally making use of local resources)

Construction phase

- lack of scientific approach to construction management. Includes lack of realistic planning, manpower, plant and materials schedules, financial forecasting, budget and monitoring, proper site lay-out.
  (May lead to delays and cost increase)
- lack of quality monitoring and control
  (May result in instructions for rework and thus delays and extra costs)
- lack of competent and experienced supervisors
  (May result in low productivity, low quality rework and consequent delays and extra costs)

Source Maro, W.E. et al. *Construction cost trends and control mechanisms in Tanzania.* 1991, p.148-151.

1 Maro, W.E. et al. *Construction cost trends and control mechanisms in Tanzania.* 1991.

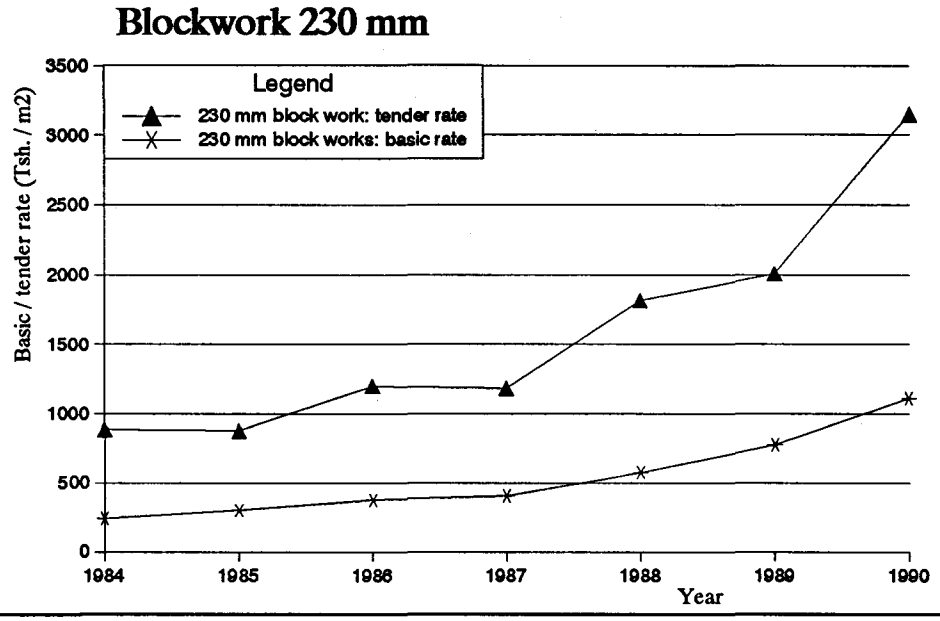
2 Based on statements of Mr. Maro, team leader of the research group.

Appendix

K

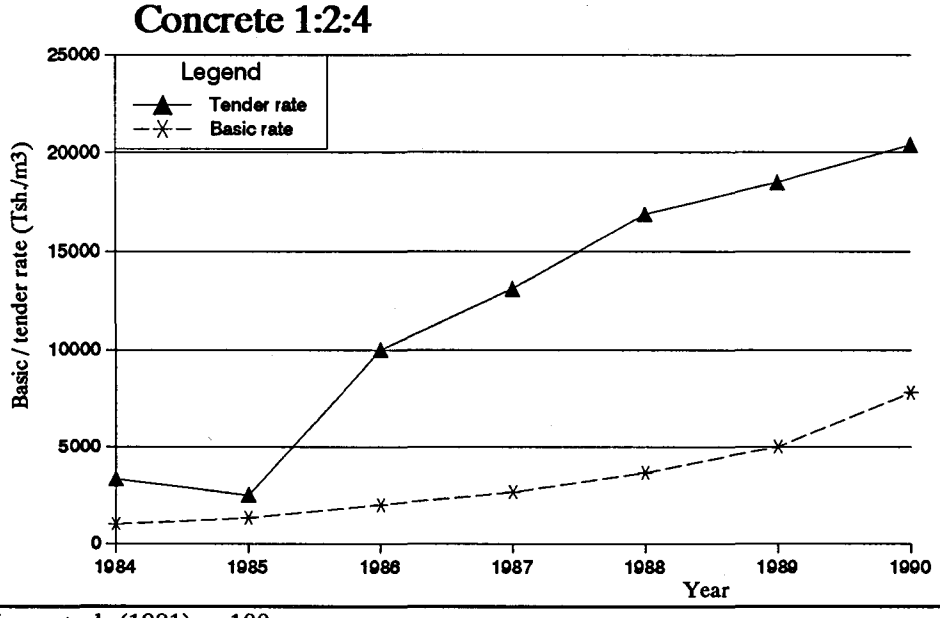
Development of tender rate versus basic rate for selected construction works

Figure K.1 Tender and basic rate for block work 230 mm (1984-1990)



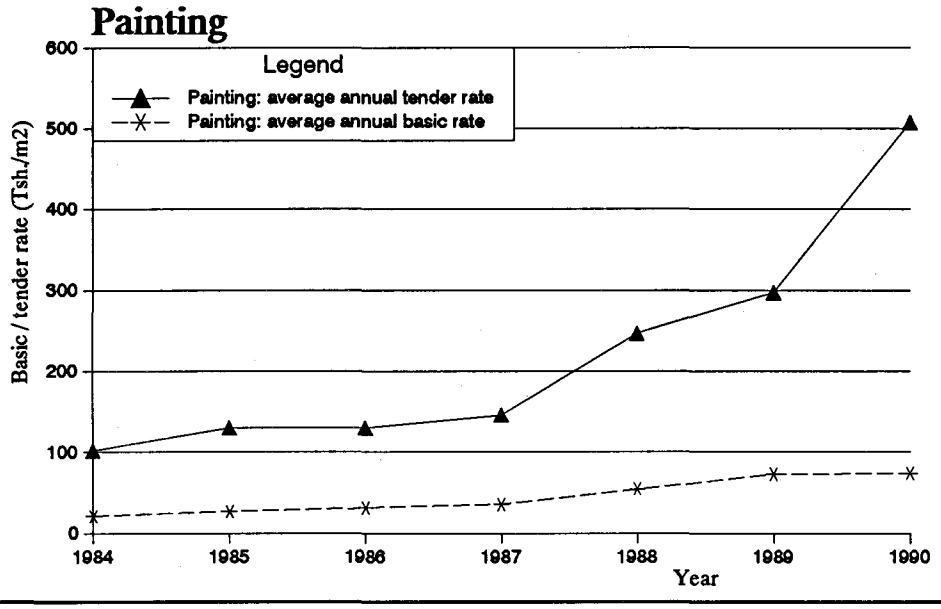
Source Maro et al. (1991), p. 99.

Figure K.2 Tender and basic rates for concrete work 1:2:4 (1984-1990)



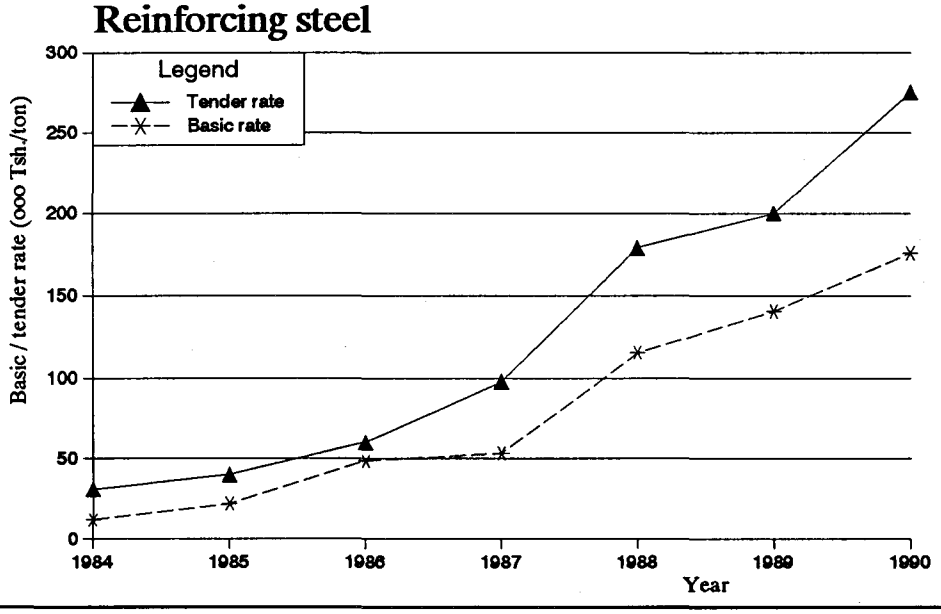
Source: Maro et al. (1991), p.100.

Figure K.3 Tender and basic rates for emulsion painting (1984-1990)



Source Maro et al. (1991), p.98.

Figure K.4 Tender and basic rates for reinforcing steel work (1984-1990)



Source Maro et al. (1991), p.101.

Appendix L

Results of the comparative case study

This appendix contains an overview of subjects given attention in the comparative case study. The subjects are covered for the three different companies, presented in chapter 6. More background information on the structure of the case study as well as conclusions which have resulted from it, can be found in this same chapter.

I Basic characteristics

I.1 Foundation (that is: start of construction activities in Tanzania)

MECCO	Africa Construction	SJI
1950	1930	1974 (branch office opened in 1984)

I.2 Founder

MECCO	Founded by a private person of Tanzanian origin
Africa Construction	Founded by two private persons of Indian origin, with British nationality, but being Tanganyikan residents.
SJI	Founded by a Danish construction company

I.3 Type of public accountability / ownership

MECCO	Africa Construction	SJI
a public organisation (parastatal status	Ltd. company, not quoted in the stock market	Branch office of a larger international private contracting organisation[1] (not registered as Ltd. company in Tanzania)

[1] This international contracting company of Danish origin (head office Copenhagen) is wholly owned by an internatioanlly operating Swedish construction company. The Danish company is a subsidiary unit with its own Board of Directors. Skanska Jensen International is an independent international division with its head office in the United Kingdom. This division comprises several branch offices in African countries, among which the Tanzanian office. See also chapter 1 and appendix A.

I.4 History in ownership

MECCO	1950-1964	Tanzanian-owned private company: TECCO
	1964-1970	40% shares owned by economic wing of TANU (=Mwananchi Development Corporation): name changed to MECCO
	1967	MDC transfers shares to National Development Corporation (NDC); TECCO sales remaining shares to Overseas Construction Company (OCC) from The Netherlands. NDC + OCC jointly owners of MECCO, under OCC management,
	1970	Government acquires 40% shares in MECCO
	1971	MECCO is nationalised.
	1983-19??	MECCO is reestablished as a company (Parastatal)
Africa Construction	1930-1950	Partnership
	1950-now	Private Ltd. company, owned by Tanzanian residents (Indian origin)
SJI		no changes in situation as described in table 3 have taken place sofar

I.5 Pattern of registration at NBAQS&BC

MECCO	Class I	since 1974
Africa Construction	Class II	1976 - 1979
	Class I	1979 - now
SJI	Class I	since 1981

I.6 Annual turnover (figure in *italic* is real turnover value, without inflation)

	MECCO[1]	Africa Construction[2]	SJI
turnover 1994[3]	1.031 mil. Tsh. *(835)* (440 mil. Tsh.)[4] *(356)*	-	No turnover data available for Tanzania branch separately
turnover 1993	-	460 mil. Tsh. *(377)*	
turnover 1992	1.462 mil. Tsh. *(1197)* (578 mil. Tsh.) *(473)*	356 mil. Tsh. *(292)*	
turnover 1991	986 mil. Tsh. *(806)* (533 mil. Tsh.) *(436)*	293 mil. Tsh. *(240)*	
turnover 1990	579 mil. Tsh. *(484)* (277 mil. Tsh.) *231)*	299 mil. Tsh. *(250)*	

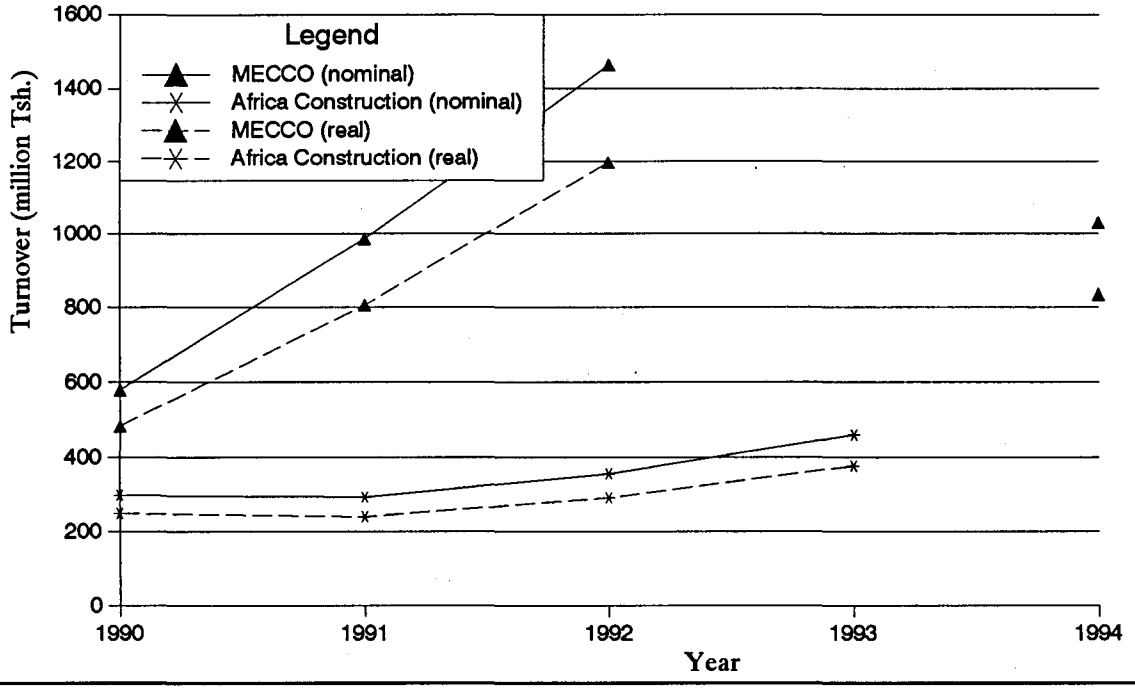
1 Turnover MECCO is split into turnover resulting from construction projects and that resulting from the production units
2 No information available on structure of turnover.
3 Estimated inflation rate of 24% has been used here.

(Table I.6 continued)

4 In 1994 the structure of MECCO's turnover was as follows:

Particulars	Budget	Actual	Variance	% Achievement
Projects	1,266,985	1,030,941	236,044	81.3
Production units	522,681	439,688	82,993	84.1
Machine pool	420,000	302,150	117,850	71.9
Other income	1,323,525	1,384,391	60,866	104.6
TOTAL	3,533,191	3,157,191	376,021	89.3

Figure K.1 Pattern of growth in turnover (nominal and real) for MECCO and Africa Construction 1990-1994



Source Based on table I.6.

I.7 Number of personnel in offices (No growth figures available)

MECCO	Africa Construction	SJI
154[1]	48[2]	150[3]

1 Figure also includes personnel within the various production units.
2 Figure includes personnel in all company departments.
3 Figure includes office personnel and personnel in workshop, Mbagala.

I.8 Type of business activities (construction and non-construction)

MECCO	Africa Construction	SJI
• Building and civil works projects	Building and civil works projects	Building and civil works projects
Production of building materials: quarries, sawmill, pipe factory, carpentry, premix plant, blacksmith	Wood-working workshop; plant/ maintenance workshop; sawmill/ timber yard; metal fabrication workshop; machinery workshop;	Workshop: manufacture of building products (seldom for third parties); storage and maintenance of equipment (rental to third parties also)
Marketing and sale of some of its products	facilities for production of culvert/ blocks / slabs and other precast items at company's quarry	
Electrical contracting	Sometimes rental of equipment to third parties.	
	Company tries to diversify activities towards mining, agriculture and tourism	

I.9 Type of construction output

All three companies undertake building and civil construction works on the basis of the specifications of the client / consultant (traditional project organisation type). Only SJI also undertakes turnkey projects (= design to completion), depending on the foreign head office for execution of the design function.

I.10 Location of offices in Tanzania

	MECCO	Africa Construction	SJI
Head office (town)	Dar es Salaam (metropole)	Moshi (big town)	Dar es Salaam (metropole)
All three companies have been located in the same town since their date of foundation			
Branch offices (town)	Mwanza, Dodoma, Tanga, Morogoro (all to be classified as big towns)	-[1]	-

[1] Branch offices in Tanga and Arusha in the past. Closed when projects in area were finished.

I.11 Dependence on parent organisation

MECCO	Africa Construction	SJI
No	No	Yes, located in Denmark (C.G. Jensen). See for status also table 3 above. After take-over of African activities of British construction company (Wade Adams), following changes took place: - new head office established in London, UK for joint foreign activities of Skanska and C.G. Jensen; - new offices of SJI in Ghana, Uganda, Zambia, Zimbabwe. Zimbabwean office head branch unit towards other African offices. SJI-Tanzania is not represented on policy-making bodies of other branch units or the head office. SJI-Tanzania depends on European head office for supply of imported materials and equipment, expatriate employees. In specific use is made of planning and tendering capacity of European offices and Zimbawean office.

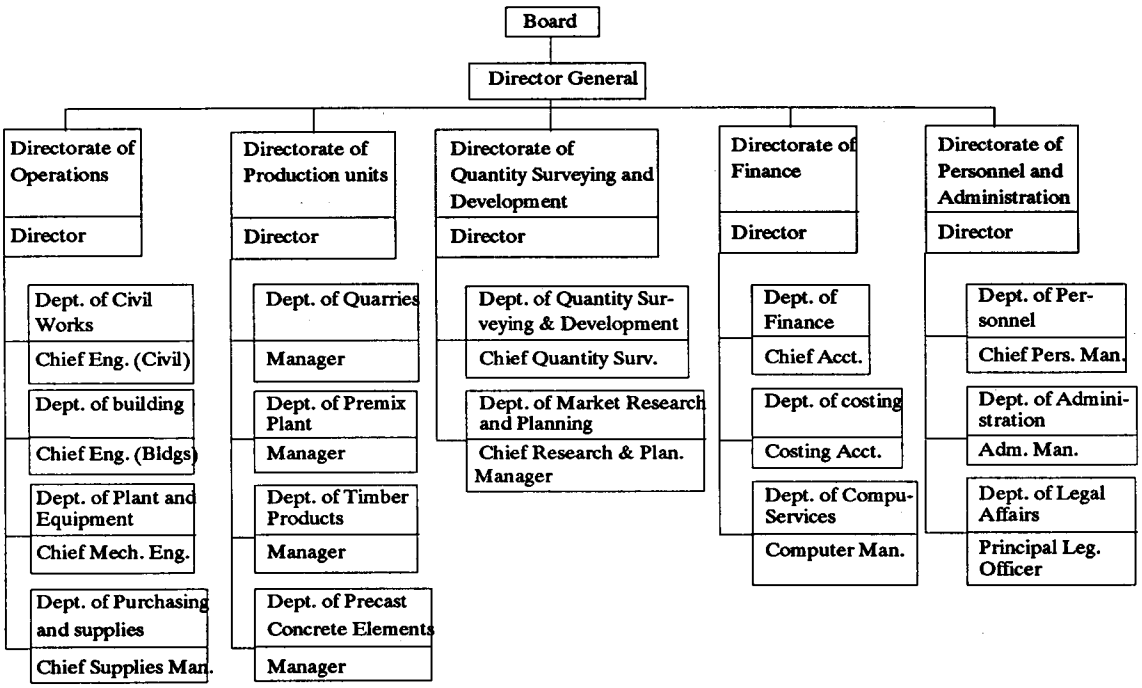
I.12 Working area of company

	MECCO		Africa Construction		SJI	
	generally	currently	generally	currently	generally	currently
Dar es Salaam	X	X			X	
Arusha	X		X	X		
Iringa	X					X
Morogoro					X	
Mbeya	X	X				X
Coast region					X	
Dodoma	X	X				
Kilimanjaro			X	X		
Shinyanga				X		
Tanga	X		X	X		X

I.13 Organisation structure

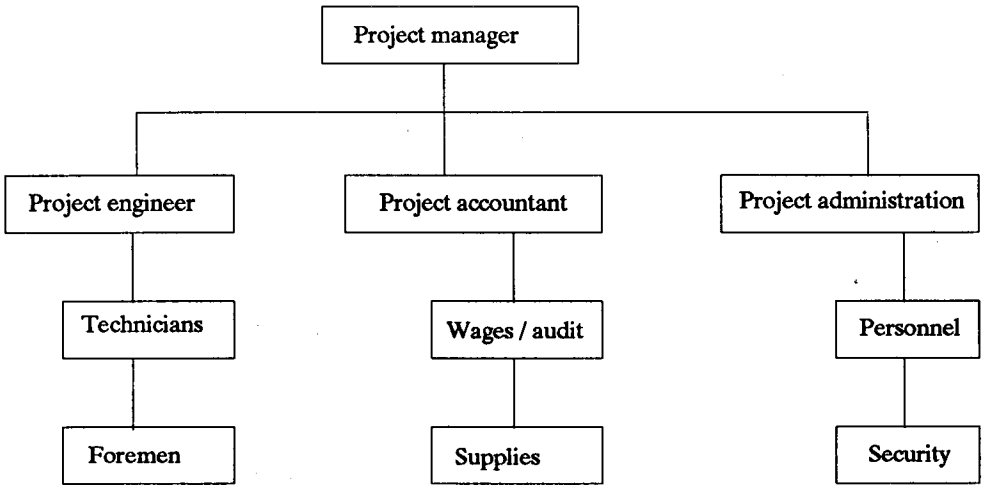
Organisation structure MECCO

(company level)



Organisation chart MECCO

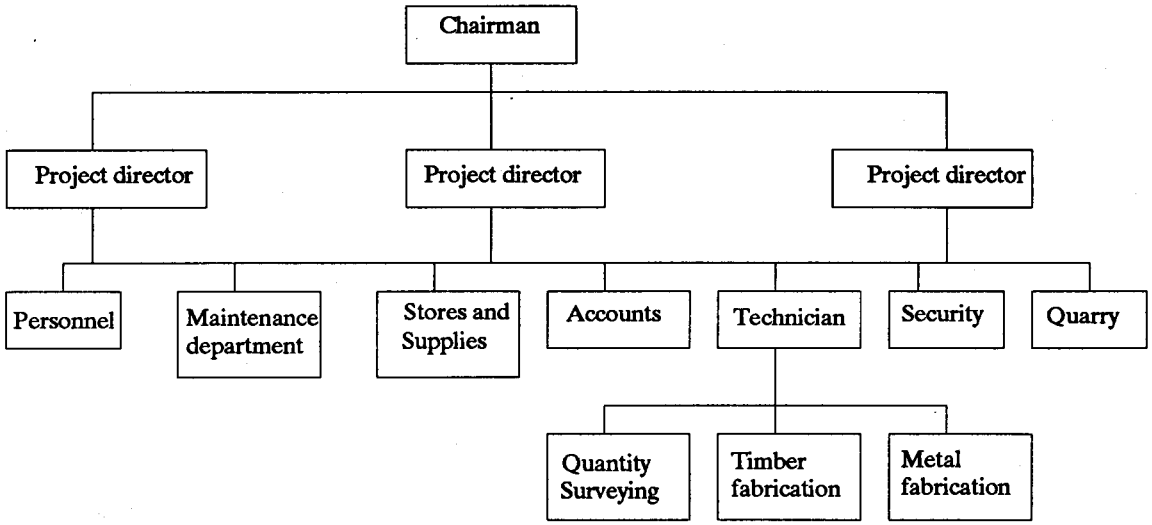
(Project level)



(I.13 continued)

Organisation chart Africa Construction[1]

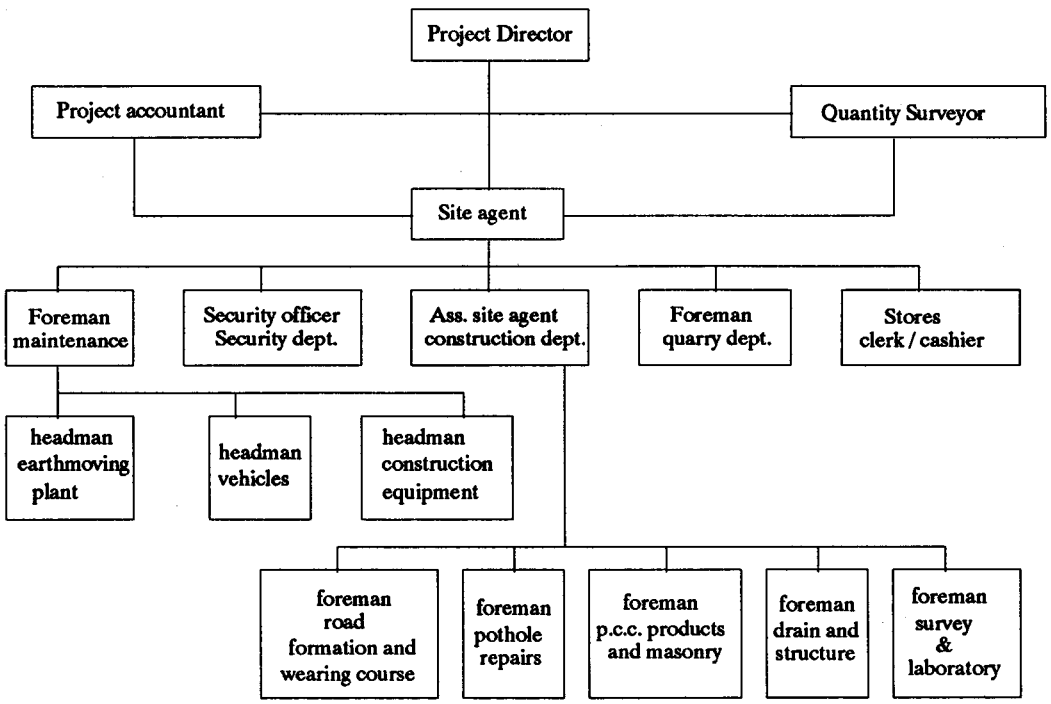
(company level)



[1] Chart not standard available; was drawn by project director during interview.

Organisation chart Africa Construction

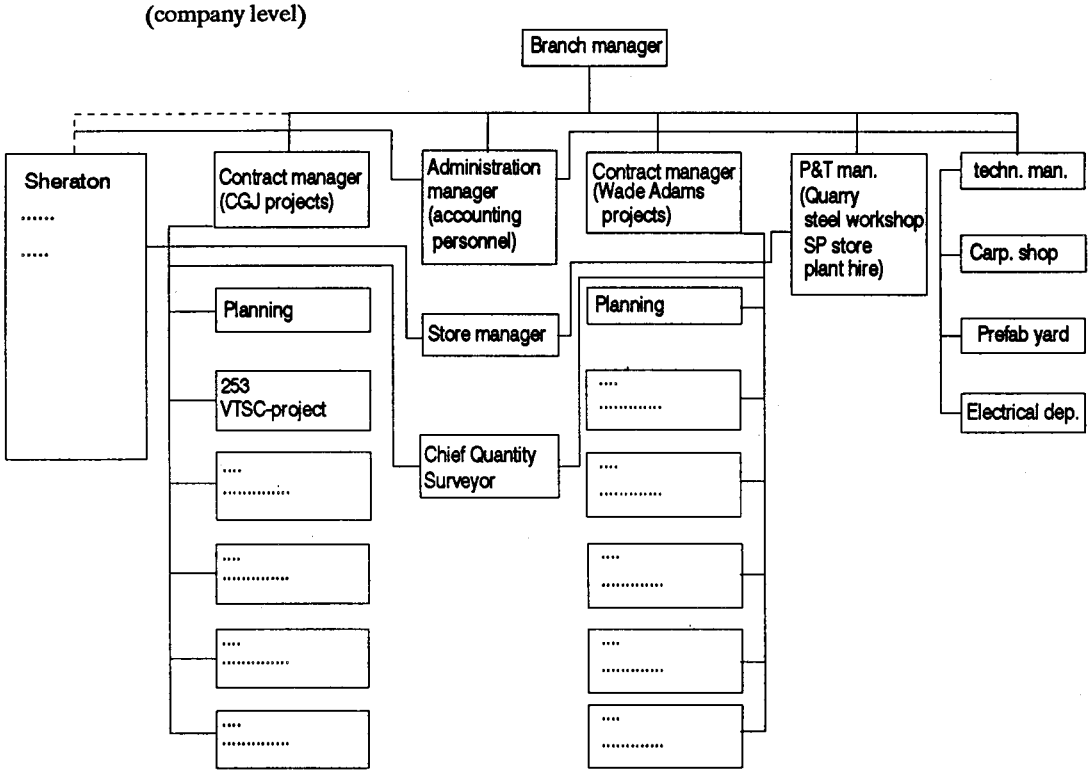
(project level)



(I.13 continued)

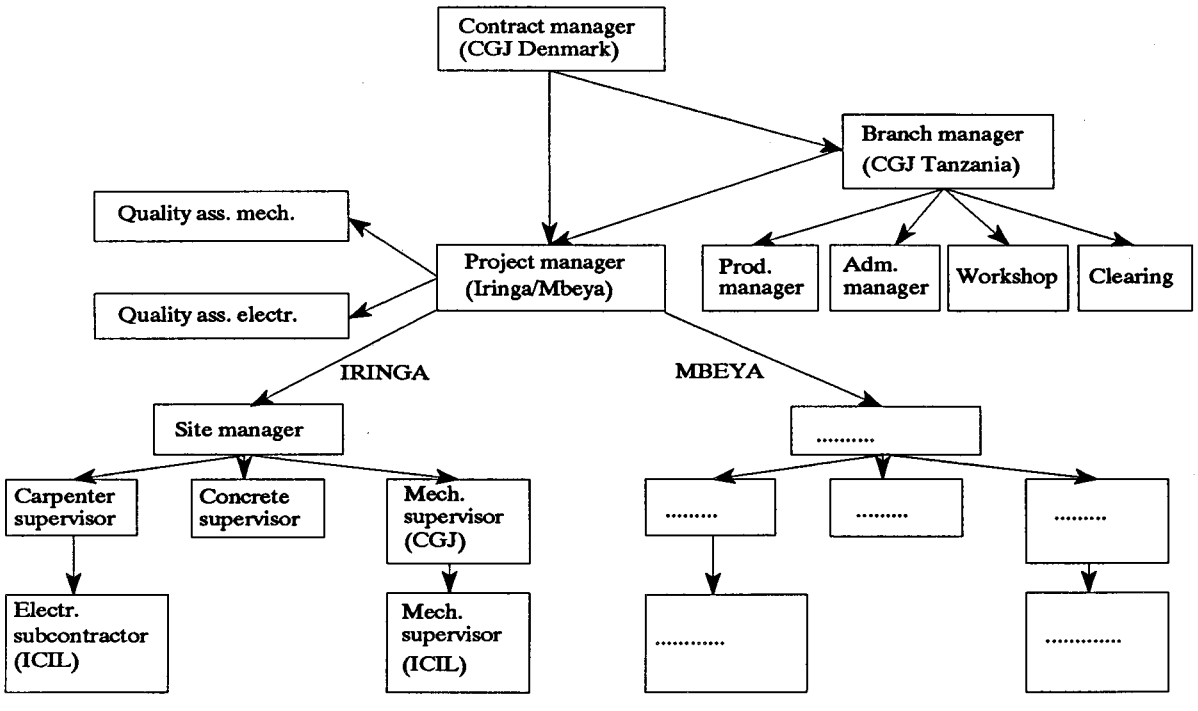
Organisation structure SJI

(company level)



Organisation structure SJI

(project level)



II External relations characteristics

Relations with contractors: competition, subcontracting, joint-venturing and other cooperation forms

II.1 Competition experienced by the company

	MECCO	Africa Construction	SJI
Local private contractors with a local management	much	much (too few contracts being competed for by too many local contractors)	very much (price competition)
Local private contractors with partly a local, partly a foreign management	some	some (foreign management has links with donors)	some
Local private contractors with a foreign management	some	some (as under 2)	some
Foreign contractors	some	some (in foreign-aided projects)	very much (major competitors: Wade Adams, NOREMCO. Wade Adams has been taken over by SJI in 1995. Now SJI biggest contractor on market).
Public contracting organisations	some	some (government's preference to boost up parastatal)	no

II.2 Links with other contractors (subcontracting and joint ventures on construction projects)

MECCO	Africa Construction	SJI
Work as subcontractor (regularly, seldom, never)		
regularly	seldom	seldom
Type of contractors for which subcontracting work is done		
public contractors	foreign-owned	Tanzanian-owned companies private contractors (with foreign management; with part foreign, part local management); Foreign-owned companies
Use of subcontractors (regularly, seldom, never)		
regularly	seldom (only labour-based)	regularly (only class I)

(Table II.2 continued)

	MECCO	Africa Construction	SJ
Reasons to use subcontracting	- lack of time (not enough resources available to carry out all activities itself within the agreed construction time) - lack of equipment the company has insufficient knowledge of works concerned - geographical distances (it is easier to use a contractor close to the site instead of bringing own resources) - financial reasons (other company can do it cheaper than own company) - to raise productivity level on project - to avoid constraints in availability of resources (better access to certain resources by subcontractor)	- geographical distances (it is easier to use a contractor close to the site) - financial reasons - company has insufficient knowledge of works concerned	-the company has insufficient knowledge of the works concerned - own company wants to expand range of projects it is undertaking
Joint venture experiences	NO	NO	YES Name project: * DSM Port rehabilitation Type of partner: Foreign owned private company Reason: Financing conditions * M/V Serengeti Foreign owned private company Experience * Kidatu Hydropower Foreign-owned company Experience

II.3 Other type of cooperation with contractors

MECCO	Cooperates with three foreign contractors: * Norwegian company: hired employees and equipment from MECCO during first time in Tanzania. MECCO acted as entrance port to Tanzanian construction market. Now independent company with own office in Dar es Salaam.. * German company: MECCO is entrance to local construction market. Contacts still exist. MECCO obtains more knowledge of construction methods due to above two contacts. * Canadian company: established joint venture with MECCO on the harvesting of timber products. The foreign company provides knowledge and technology. MECCO brings in equipment, people and necessary permits.
Africa Construction	Medium and other contractors in the country. Informal exchange of information on input resources & market trends
SJI	Only contact concerns rental of equipment to smaller local contractors.

II.4 Labour organisations (OTTU and Labour Office)

	MECCO	Africa Construction	SJI
Relation with OTTU			
	full recognition and facilities (OTTU branch established on company premises. Ran on part-time basis by employees)	Partial recognition (representatives among employees present, but no election held for years now) Wages are said not to be adjusted every year.	See under MECCO
How often are there meetings between your company and OTTU representatives?			
	Yes, on irregular basis. Only if any need exists.	Yes, on irregular basis.	Yes, on irregular basis. Only if any need for meeting exists with one or both parties.
What subjects are discussed during these meetings?			
	Specific problems between management and employee(s)	Once a year wage negotiations Formulation of so-called voluntary agreement (contains all regulations between company and labourers; formulated between TAMICO and company)	Wage negotiations for all employees once a year; Redundancies / termination of employment (fairness of decision taken by management); Accidents and loss of company assets within work sites

Direct meetings with OTTU and Labour Office (Ministry of Labour) only occurs if an employee reports irregularities in whatever field to one or both organisations. If matter is reported to OTTU, the latter may contact Labour Office. All other contact is between company management and representative of OTTU on company premises, as described above.

Suppliers (materials and equipment) (see also under input characteristics, origin of materials and equipment)
(1 = never; 2 = seldom; 3 = occasionally; 4 = usually; 5 = always)

The suppliers of building materials and products depend on the materials and products needed for a specific project. The three companies did not keep records of such data for completed projects.

II.5 Local suppliers

	MECCO	Africa Construction	SJI
How frequently do you feel satisfied with the quality of the:			
- building materials	4	4	2
- building products	4	4	2
- machines	-[1]	-[1]	-[1]
- tools	4	4	2
supplied to you?			
REMARKS	-	-	-
How frequently do you feel satisfied with the prices of the:			
- building materials	3	4	4
- building products	3	4	4
- machines	-1	-[1]	-[1]
- tools	3	4	4
charged to you?			
REMARKS	Prices of building materials experienced as relatively high	-	-
How frequently do you feel satisfied with the delivery times of the:			
- building materials	4	4	3
- building products	4	4	3
- machines	-[1]	-[1]	-[1]
- tools	4	4	4
REMARKS	-	-	-
How frequently do you feel satisfied with the services and helpfulness of the suppliers of:			
- building materials	3	3	2
- building products	3	3	2
- machines	-[1]	-[1]	-[1]
- tools?	2	3	2
REMARKS	In general very little information about product(s) provided by suppliers	-	-
How frequently do you feel satisfied with the knowledge and skills of the suppliers of:			
- building materials	4	4	3
- building products	4	4	3
- machines	[1]	-[1]	-[1]
- tools?	4	4	3

(**Table II.5** continued)

	MECCO	Africa Construction	SJI
REMARKS	Satisfaction is sufficient if bought at manufacturer; not at shop: no information is available here.	-	-
How frequently do you feel you can depend on the promises made to you by suppliers of:			
- building materials	3	4	2
- building products	3	4	2
- machines	-[1]	-[1]	-[1]
- tools?	3	4	2
REMARKS	Judgment said to depend on type of supplier. If supplier is also manufacturer reliability of promises is judged as usually (4). In other cases judged as occassionally (3).	-	-

[1] No machines bought from local suppliers

II.6 Foreign suppliers

	MECCO	Africa Construction	SJI
How frequently do you feel satisfied with the quality of the:			
- building materials	4	4	4
- building products	4	4	4
- machines	4	4	4
- tools	-[1]	4	4
supplied to you?			
REMARKS	-	-	-
How frequently do you feel satisfied with the prices of the:			
- building materials	3-2	3	4
- building products	3-2	3	4
- machines	3-2	3	4
- tools	-[1]	3	4
charged to you?			
REMARKS	-	-	Items bought by head Has network, knows suppliers.
How frequently do you feel satisfied with the delivery times of the:			
- building materials	4	4	4
- building products	4	4	4
- machines	4	4	4
- tools	-[1]	4	4
REMARKS	Delays experienced in harbour (both in Tanzania and exporting country).	-	-

(Table II.6 continued)

	MECCO	Africa Construction	SJI
How frequently do you feel satisfied with the services and helpfulness of the suppliers of:			
- building materials	4	4	-[2]
- building products	4	4	-[2]
- machines	4	4	-[2]
- tools?	-[1]	4	-[2]
REMARKS	-	-	-
How frequently do you feel satisfied with the knowledge and skills of the suppliers of:			
- building materials	4	5	-[2]
- building products	4	5	-[2]
- machines	4	5	-[2]
- tools?	-[1]	5	-[2]
REMARKS	-	-	-
How frequently do you feel you can depend on the promises made to you by suppliers of:			
- building materials	4	5	-[2]
- building products	4	5	-[2]
- machines	4	5	-[2]
- tools?	-[1]	5	-[2]
REMARKS	-	-	-

[1] No tools imported by organisation

[2] Contacts with suppliers are arranged by head office in Denmark. Therefore no opinion on this matter by Tanzanian personnel / management.

II.7 Clients (see also under 'output characteristics, clients')

	MECCO	Africa Construction	SJI
How would you rate your degree of satisfaction with the promptness with which the customer pays the interim certificates issued to him by the Consultant?			
Local public client	not on time; often delays experienced[1]	bad	relatively bad
Local private client	less delays experienced compared to local public client	fairly prompt	- (no projects)
Foreign client (donor)	Money is channelled through ministries. Procedures to get money takes time. No serious delays experienced in general.	prompt	Sometimes delays

[1] The relatively bad performance on construction projects during the year 1994 is attributable to delays in payments of certificates by the clients of MECCO. These late payments affected the work progress of MECCO. The table below gives an indication of the degree of late payments.

Project	Certificate no.	Date approved	Date paid	No. of months outstanding
Shinyanga Urban	4	15/8/94	25/1/95	5
	5	29/9/94	25/1/95	4
Sam Nujoma Extension	14	29/8/94	-*	7
Bukoba Urban 1		27/9/94	25/1/95	4
	2	2/12/94	1/2/95	2
Njenga - Masaninga	5	28/12/94	-*	3

* not paid at time of publication annual performance report 1994

How would you rate your degree of satisfaction with the customer's general fairness in its deals and transactions with your firm?			
Local public client	Local public clients experienced as more fair than local private client, especially in the treatment of claims. This fairness considered to result from fact that public clients work with government money, which is not their own.	fair	fair
Local private client	See 'local public client'	fair	-
Foreign client	Fairness judged as often better. Less disputes, more clearness. Foreign clients experienced as having more experience and knowledge.	very fair	fair

(Table II.7 continued)

	MECCO	Africa Construction	SJI
How would you rate your degree of satisfaction with the customers receptiveness to suggestions you make with respect to the design and construction method of the various projects?			
Local public client	Procedures for approvement take relatively a lot of time Less with other type of clients.	good	good
Local private client	See under 'local public client'	good	-
Foreign client	Receptiveness considered as relatively higher	good	good
GENERAL REMARKS	Most clients are local public clients. Prompt payments often problem by every client, also foreign ones. In the case of the latter payment can be delayed by fact that information has to be send to donor country.	-	Most clients are foreign donors

II.8 External organisations (including government organisations, educational and R&D institutes)

	Organisation	Type of relation
MECCO	University of DSM (contact irregular: depends on needs)	Material tests; consultant services (for example on foundation matters); legal opinion in case of disputes, places for university students on sites for practical training.
	Tanzania Bureau of Standards	Materials tests; approval / advice on quality of imports to be done.
	National Construction Council (contact said to be relatively intensive)	Contract documents; building regulations; arbitration; seminars / workshops.
Africa Construction	University of Dar es Salaam / Technical colleges	Research data; training provided for undergraduates
	National Construction Council	Research data
	National Board of Architects, Quantity Surveyors & Building Contractors	Research data
SJI	University of Dar es Salaam	Discussion on problems in field of construction; participation seminars. SJI provides special equipment and information on materials for teaching purposes. SJI offers places for undergraduates on its building sites for practical training purposes.
	National Construction Council	No contacts. SJI does not experience cooperation / helpfulness of NCC.

III Input characteristics

Labour

III.1 Number of employees (Type and number)

	MECCO		Africa Construction		SJI	
	Total	Expatriates	Total	Expatriates	Total	Expatriates
Office personnel	154	-	60	-	150	3
Project managers / supervisors	10	-	6	-	-	50
Foremen	22	-	12	-	50	-
Skilled labour	35	-	60	-	1000[1]	45
Unskilled labour	120	-	120	-	500[2]	3

[1] High numbers caused by Sheraton project

III.2 Labour problems

	MECCO	Africa Construction	SJI
Office personnel	-	-	Lack of training and healthy food
Project managers / supervisors	Lack of planning practices and consequently in control practices	Lack of cost-consciousness	Lack of right management training before starting at SJI
Foremen	-	Sometimes lack of foresight	Training and healthy food needed
Skilled labour	-	Lack of pride in workmanship	Healthy food needed Lack of training
Unskilled labour	-	-	

III.3 Qualitative aspects of labour

MECCO	Africa Construction	SJI
Requirements skilled labour before employment		
Evidence of level of education/ training Experience in the said skill	Own necessary hand tools Should have proven record of experience	Grade test

(Table III.3 continued)

	MECCO	Africa Construction	SJI
Training facilities provided			
	YES	YES	YES
Kind of training facilities			
	Management courses for office personnel Trade tests etc. for labourers	On-the-job training of skilled and unskilled labourers	On-the-job training Foreign education for higher personnel (like quantity surveyors)
Ratio 'supervisors : foremen : labourers' used for building projects			
	1 : 4 : 8	1 : 6 : 36	1 : 2 : 50
Is this ratio the same for every building project?			
	NO	NO	NO

Materials

III.4 Origin of building materials and building products

	MECCO	Africa Construction	SJI
Frequency of import building materials *(with building materials is meant cement, wood, reinforcement steel, etc.)*			
always			X
often			
sometimes	X	X	
never			
Frequency of import building products *(with building products is meant doors, purlins, roofing sheets, casements etc.)*			
always			X
often			
sometimes	X	X	
never			
Reasons for import materials and products			
	requirements in contract	non-availability locally low quality locally contract requirements cheaper to import (special conditions) more reliable supplies special items	non-availability locally low quality locally cheaper to import (special conditions) more reliable supplies

(**Table III.4** continued)

	MECCO	Africa Construction	SJI
Problems experienced with import of materials and products			
	Delays, both in Tanzania and exporting country	Bureaucratic delays Quantity may be too small to get interest of exporter	Import regulations are not followed by import authorities
Manufacturing of building products by own organisation			
always		X	
often			X
sometimes	X		
never			
Problems experienced with materials and products			
	Delay in delivery time for local materials and products	No problems indicated	*Local materials/products:* Varying quality, insufficient quality; delivery dates uncertain VERSUS: *Imported materials/products:* High quality, fixed delivery dates, constant quality

Equipment

III.5 Origin of equipment used on sites

	MECCO	Africa Construction	SJI
Use of external equipment			
	YES	YES	YES
Frequency of use of external equipment			
	regularly	seldom	seldom
Origin of external equipment			
	building contractors PEHCOL	*For civil projects:* agricultural estates PEHCOL	building and civil contractors
Reasons for external equipment rental			
	Less costs for own company lack of own equipment	Company's equipment deployed on other projects To expedite fast track completion	non or insufficient quantity available itself

III.6 List of equipment

Plant + equipment - AFRICA CONSTRUCTION

Plant/equipment	Number
Tipper, 7 tons	4
Tipper, 10 tons	4
Tipper, 15 tons	3
Tipper, 18 tons	2
Long wheelbase, 18 ton	1
Long wheelbase, 7 ton	1
Platform truck, 7 ton	2
Water bowser, 4000 gallon	3
Water bowser, 1200 gallon	1
Water bowser, 1500 gallon	3
Bull dozers	2
Motorgraders	3
Compactor Vibratory, 10/12 ton	1
Compactor 8/10 ton	1
Roller steel wheel smooth	1
Compactor 2 drum vibrator	2
Compactor vibrating plate	2
Traxcavator	2
Wheelloader	2
Backhoe / chained loader	1
Front loader	1
Generator, 56 kVA	1
Generator, 4.5 kVA	1
Generator, 15 kVA	1
Mobile welding plant heads, 300 Amps / 1000 pm	1
Electric welding plant	1
Radio call system, base	4
Radio call system, handheld	8
Radio call system, mobile	2

Plant/equipment	Number
Water storage tank, square, 600 ltrs. (local manufacture)	1
Water storage, round, 2000 gallon (local manufacture)	1
Fuel storage tank, square, 600 ltrs.	1
Fuel storage tank, 27400 ltrs.	1
Fuel storage tank, 8800 ltrs.	1
Fuel storage tank, 1000 ltrs.	1
Delivery pump	2
Gas welding units	3
Motorbikes	6
Pick-ups	4
Canter lorry	1
Station wagon	3
Water pump 2" + hoses	1
Water pump 4" + hoses	1
Water pump 5" + hoses	1
Water pump 8" + hoses	1
Compressor	4
Mobile workshop	1
Lathe workshop + compressor + welding	1
Military Type trailer	2
Dumper, 1 ton	3
Dumper, 3 ton	2
Concrete mixer, small	4
Concrete mixer, large	3
Concrete mixer, tyred	1
Tractor + Trailer	4

Plant + equipment - SKANSKA JENSEN INTERNATIONAL
(III.6 continued)

C.G. JENSEN

LIST OF PLANT AND EQUIPMENT

PLANT TYPE	TYPE	MAKE	COUNTRY OF ORIGIN	NO. OWNED	YEAR OF MANUFACTURE	CURRENT LOCATION	PLANT NO.
Water Pump	DP 3	Homelite	USA	3	1981	Tanzania	
Welder	303	Kempi		2	1979	Tanzania	
Welder	160	Esab		1	1983	Tanzania	
Welder	453	Kempi		2	1989	Tanzania	
Welder	200	Kempi		2	1989	Tanzania	
Rectifyer	303	Tylark		4	1989	Tanzania	
Compressor	XA 120 DD	Atlas Copco	Denmark	2	1985/1986	Tanzania	3713/3707
Compressor	160 lit/sec	Atlas Copco		3	1981	Tanzania	
Compressor	85 lit/sec	Atlas Copco		4	1982	Tanzania	
Asphalt Layer	SB 140	Barber Green	Sweden	1	1987	Tanzania	
Chip Spreader	H/S	Savalco		2	1986	Tanzania	
Bitumen Spreader	HM 10 H	Dynapac	Sweden	2	1982	Tanzania	
Sweeper	LA 490	NEBI		2		Tanzania	

LIST OF PLANT AND EQUIPMENT

PLANT TYPE	TYPE	MAKE	COUNTRY OF ORIGIN	NO. OWNED	YEAR OF MANUFACTURE	CURRENT LOCATION	PLANT NO.
Tractor	265	Massey Ferguson	England	1	1984	Tanzania	1506
Tractor	BM 2654	Volvo	Sweden	1	1979	Tanzania	1502
Tractor	BM 2654	Volvo	Sweden	1	1985	Tanzania	1502
Wheel Loader	966 E	Caterpillar	USA	2	1984/1986	Tanzania	1309
Wheel Loader	BM 4300	Volvo	Sweden	2	1983	Tanzania	
Wheel Loader	966 C	Caterpillar	USA	1	1987	Tanzania	
Wheel Loader	BM 4300 B	Volvo	Sweden	4	1983	Tanzania	1306
Wheel Loader	BM 4500	Volvo	Sweden	1	1984	Tanzania	1308
Truck	F 12-38	Volvo	Sweden	2	1986	Tanzania	1418/1421
Truck Tipper ~ 10 m³	F 12-54	Volvo	Sweden	2	1986	Tanzania	1423/1426
Tipper	N 12 6x4	Volvo	Sweden	1	1987	Tanzania	
Tipper Truck	F 12 N	Volvo	Sweden	2	1982	Tanzania	
Fuel Truck	12000 LK	Volvo	Sweden	1	1983	Tanzania	
Water Truck	10000	Volvo	Sweden	2	1986	Tanzania	1467
Flatbed Loader Lorry	N 7	Volvo	Sweden	1	1982	Tanzania	1415
Cement Bulk Trailer		Semitrailer	Sweden	1	1984	Tanzania	1474
Tip Trailer	1067	(Volvo)	Sweden	3	1982	Tanzania	1471/1473/1475
Trailer	40 ton lowbed	Volvo	Sweden	1	1983	Tanzania	
Trailer	40' flat trailer	Volvo	Sweden	2	1981	Tanzania	

(III.6 continued)

Plant + equipment - SKANSKA JENSEN INTERNATIONAL

LIST OF PLANT AND EQUIPMENT

PLANT TYPE	TYPE	MAKE	COUNTRY OF ORIGIN	NO. OWNED	YEAR OF MANUFACTURE	CURRENT LOCATION	PLANT NO.
Grader	12 G	Caterpillar	USA	1	1979	Tanzania	1703
Crane mobile	2509	PPM	France	1	1983	Tanzania	1613
Crane mobile	1800 CC	Drott	Sweden	1	1979	Tanzania	1601
Tower Crane	K 36139	Kroell	Denmark	1	1983	Tanzania	1609
Tower Crane	SK 90	Peiner	Germany	1	1984	Tanzania	1610
Mobile Crane	A 380	PPM	France	1	1988	Tanzania	1611
Roller	CA 30	Dynapac	Sweden	1	1982	Tanzania	
Roller	SP 54	Ingersoll-Rand	Sweden	1	1987	Tanzania	
Roller	CC 42	Dynapac	Sweden	1	1986	Tanzania	
Compactor	LG 200	Dynapac	Sweden	2	1982	Tanzania	
Compactor	LG 400	Dynapac	Sweden	1	1984	Tanzania	
Compactor	CM 13	Dynapac	Sweden	3	1981/1987	Tanzania	3664
Sheet Piling Unit	752	Aakerman	Sweden	1	1985	Tanzania	1106
Sheet Pile Extractor	-	Aakerman	Sweden	1	1984	Tanzania	1109
Transmixer	N 12-46	Volvo	Sweden	2	1985	Tanzania	1419/1443
Concrete Batching		Elba 30/45 m^3/hour	Germany	2	1980	Tanzania	
Aggregate crushing	600 mm	Swedala	Sweden	1	1980	Tanzania	
Cement Silo		Elba	Germany	2	1986/1988	Tanzania	

2

(III.6 continued)

Plant + equipment - SKANSKA JENSEN INTERNATIONAL

LIST OF PLANT AND EQUIPMENT

PLANT TYPE	TYPE	MAKE	COUNTRY OF ORIGIN	NO. OWNED	YEAR OF MANUFACTURE	CURRENT LOCATION	PLANT NO.
Concrete Mixer	14 R/400 R	Winget	England	1	1981	Tanzania	3408
Concrete Mixer	Various	Ultra ~ 300 lit.	Denmark	10	1981/1989	Tanzania	3411/3412
Sundry Vibrating Equipment	-	-	-	-	-	-	
Bulldozer	D 8 K	Caterpillar	USA	2	1979	Tanzania	
Bulldozer	D 6 D	Caterpillar	USA	1	1980	Tanzania	
Excavator	H 12 B	Aakerman	Sweden	2	1980	Tanzania	1103/1104
Back Hoe	BM 6/6 B	Volvo	Sweden	1	1982	Tanzania	
Wheel Loader	BM 4300	Volvo	Sweden	2	1983	Tanzania	
Excavator	H 9 B	Aakerman	Sweden	1	1980	Tanzania	1105
Fork Lift	-	Kalmar	Sweden	1	1986	Tanzania	1652
Generator	125 Kva	Volvo	Sweden	1	1986	Tanzania	3811
Generator	160 Kva	Volvo Stanford	Sweden	1	1987	Tanzania	
Generator	130 Kva	Volvo	Germany	1	1986	Tanzania	
Generator	65 Kva	Deutz	Germany	2	1986	Tanzania	3812/3811
Water Pump	Minette	Grindex	Denmark	5	1989/1991	Tanzania	
Water Pump	S 80-70	Desmi	Denmark	2	1981	Tanzania	
Water Pump	US 30	Honda	Japan	5	1986	Tanzania	
Water Pump	CR4-1000B	Grundfoss	Denmark	1	1987	Tanzania	

(III.6 continued)

Plant + equipment - MWANANCHI ENGINEERING AND CONTRACTING COMPANY

Plant / equipment	Make	Number
Wheel loader	CASE	1
Wheel loader	ACT 950	1
Wheel loader	VALMET	1
Buldozer	CAT D8K	1
Buldozer	CAT D7G	1
Buldozer	CAT D6D	1
Buldozer	CAT 950	1
Motor Grader	140G	2
Motor Grader	120G	1
Motor Scraper	CAT 621B	1
Vibrating Roller	DYNAPAC CA 25	1
Vibrating Roller	DUNAPAC CC21	1
Vibrating Roller	DYNAPAC CC 11	1
Tower Roller	LOKOMO	1
Plate compactor		1
Pneumatic type roller		1
Concrete mixer 250 Lts.		2
Concrete mixer below 250lts.		2
Dumper 1.5 tonnes		2
Water pump		2
Fuel Tanker	SCANIA	2
Terrazo grinding machine		2
Floor sanding machine		3
Water pump		2
Excavator tractor	VALMET	1
Agricultural tractor		1
Bitumen sprayer 8000 lts.	FORD	1
Bitumen sprayer 800 lts.	PHOENIX	1
Bitumen sprayer 3000 lts.	PHOENIX	2
Bitumen sprayer 600 lts.		1
Tipper 7 tonne	ISUZU/TATA	5
Tipper 9 tonne		2
Tipper 12 tonne		2
Tipper 18 tonne		1
Tipper 25 tonne	SCANIA	1
Portable welding machine		1
Semi trailer truck loader	SISU	4
Water bowser 1000 lts.	SISU	1
Water bowser 9000 lts.	SISU	1
Premix plant 50 TPH		1
Crushing plant	LOKOMO	1
Crushing plant	PORKER	1
Crushing plant	PORKER HINEER	1
Mixer batch		2
Asphalt park	FORD	2
Compressor mahcine		1

(III.6 continued)

Plant + equipment - MWANANCHI ENGINEERING AND CONTRACTING COMPANY

Plant /equipment	Make	Number
Aggregate spreader	DYNAPAC LF 45	2
Compactor	DYNAPAC CM 13	1
Compactor	ZOOM	1
Truck		1
Drill machine		2
Motor cycle		2
L/Rover or Sipular		3
Generator set 175 kVA		1
Generator set 50 kVA		1
Generator set 25 kVA		1
Generator set 250 kVA	VALMET	1
Mobile crane 30 tonne	LOKOMO	1

IV Process characteristics

IV.1 Standardisation of forms / formalisation and documentation of procedures in organisation

	MECCO	Africa Construction	SJI
Does your organisation have:			
an organisation chart:			
with all the departments in the company/office	Yes	No (not available, but drawn on request)	Yes
indicating the link/relation between employees	No	No	Yes
indicating no. of employees	No	No	No
available for all employees	No	No	No
available for some employees	Yes	Yes	Yes
indicating the link between the projects and the head office	No	Yes	Yes
indicating the organisation structure on site	Yes	Yes	Yes
written job-descriptions for office personnel	Yes	No	Yes (only for higher personnel)
site personnel	Yes	Made for each project separately; content depends on project type	Yes, but adjusted for each project
a written handbook / guidelines for project managers on management of project	Yes	No	Yes (3T-file)
If yes: does handbook contain guidelines regarding cost estimation / cost control on construction projects	No	No	Yes
does handbook contain explicit guidelines regarding time planning / progress control on construction projects	No	No	Yes
agenda for internal meetings between office and site	Yes	Yes	No
standard procedures for reporting from site to office	No	No	Yes
standard forms for time planning / scheduling of projects	Not laid down, but same set-up used on every project	Always same set-up	Always based on bar chart Standard forms provided in 3T-file

(Table IV.1 continued)

standard forms for cost planning	No Cost planning document shown provides only tool for very rough planning.	No (made for each project separately)	Yes (cash flow overview; rough planning)
standard forms for cost control (standard cost control report)	Yes	No	Yes
standard form(s) for labour used on a project	Yes	Yes	Yes
standard form(s) for ordering of materials needed for a project	Yes	Yes	Yes
standard form(s) for equipment needed on site	Yes	No form made; monitored on site	Yes
coding system for the different cost items occurring on a project	Yes	No	Yes
written reports concerning overall performance on site (that is, cost and progress) (if yes, what frequency?)	Yes (monthly)	No (site visited weekly by projects director)	Yes (monthly)
record of factors causing deviations from the project's planning	No	No	No
record of factors causing deviations from the project's budget	No	No	No
standard form for feedback from office to site during project?	No	No	No
written procedures/instructions concerning feed-back after project completion	No	No	Yes (feedback limited to financial performance and opinion on subcontractor)
standard procedures/instructions for new project managers (briefing methods/procedures)	Yes	No	No (only instruction concern behavior in other culture)

Specific time-related process characteristics

IV.2 Scheduling techniques

MECCO	Africa Construction	SJI
Type of scheduling technique used; type of project technique is used on; experienced advantages/disadvantages of technique.		
Bar charts: Advantage: easy to prepare; saves time in preparation Disadvantage: difficult to detect future delays	**Bar charts:** building works: Advantages: easy to understand Disadvantage: variation and delays difficult to incorporate **Time displacement charts:** road works. Advantage: clearly sets rate of production; easy to monitor Disadvantage: critical operations cannot be shown	**Bar charts:** Easily understood
Schedules with different degree of detailedness on one project (that is: long-term and short-term planning)		
NO	No	Yes

IV.3 Computer use in planning, control and feedback

MECCO	Africa Construction	SJI
No	No	Yes (planning, both of work and resources needed, and monitoring)

IV.4 Brief decription of practices on construction projects

MECCO

Project manager is responsible for project's performance. New project managers are briefed by the chief engineer for buildings and/or civil works during one week. During this week procedures on previous projects are explained and discussed. A document on project management practices has been prepared internally (1991); project managers are also send to courses on project management. Annual meetings with all project managers take place in which management procedures are discussed.

Despite the presence of a guideline for project managers MECCO herself acknowledges the following shortcomings with respect to its project management practices:
- planning is based on experience and common sense. The main reasons provided by the project managers themselves are: lack of inputs (materials and equipment), which prevents effective planning, lack of planning data and lack of information system.
- Non-scientific approach to project management is past on to new project managers.
- No use is made of network scheduling techniques, only bar charts are used.
- Lack of proper control techniques.

MECCO herself states that time and cost overruns are 'common phenomena' on its projects.

Tendering for a project is done by the Department of Quantity Surveying and Development and the Department of Operations. No central data base or library is available for this purpose; prices have to be obtained from suppliers or through other Departments in the office. Upon winnig the projecta project management team is selected. This team consists of employees from different departments in the company (matrix project organisation). The project manager is provided with all the necessary documents during the preparation phase. He prepares a time schedule and list of requirements. Both documents are checked by the chief engineer. The chief engineer plays an important role in the coordination of the activiites on a number of projects. He also acts as intermediary between the projects and the directors of departments in the office, especially the Departments of Operations and of Quantity Surveying and Development. The various departments provide services to the various projects, including purchase and supply of materials, preparation of work programmes etc.

During construction project costs are registered on site by a clerk. Each month a financial report is prepared by the site accountant and send to the Director of Finance at the head office. Cost overruns are checked by the Audit and Finance Department.
A progress report is also send to the office monthly. The progress reports are send to the chief engineer (buildings or civil works). After check by the chief engineer the, the report is send to the planning unit which checks if the project is still on schedule. If needed feedback and advise is provided to the site.

After completion of a project the responsible chief engineer writes an executive report for the Board members on the overall project performance. This report also contains causes for time- and cost overruns. Also a final account is prepared with loss or profit made on project. This account is prepared by the accounting department for the Board.

The link between the site (project manager) and the head office (chief engineer) is relatively strong, especially when a project is located in Dar es Salaam. In these cases approvement is necessary on all matters from the head office (chief engineer): a lot of bureaucratic procedures.

Africa Construction

The company's projects are distributed among the three Project Directors (PD) in the company. These three PD's carry the main responsibility for the performance on the projects. An example of a project

organisation chart is provided above. The site agent is responsible for the daily management of the site activities. He is under direct control of a projects director. This PD can have several sites under his responsibility at the same time, depending on the total amount of projects the company is working on at a specific moment. The projects director visits all the sites weekly.
The site agent does not have to prepare a monthly report for the head office. The PD controls his work and agrees on what has to be finished in what time (short-term planning). The site agent has to let the PD know what resources he will need during this period. If an agreement has been reached between the projects director and site agent with respect to the amount of resources, the former takes care of the actual supply of these resources to the site.

The site clerk has to prepare a daily report, for which the site agent has the final responsibility. This report is meant for the PD.

SJI

The preparation of tenders with a value of 1 million Danish Kroner and above takes place in the head office in Denmark. A Project Manager (PM) is assigned to the project after the contract has been won. He is in charge of planning and controlling the entire project. A servicing and controlling task is performed by the Contracts Manager (CM). This task is however less stringent as in the case of MECCO and Africa Construction.

Within SJI a guideline for the execution of projects, from tendering till compeltion, is available. This guideline is prepared by the mother company in Sweden and focuses on time and cost saving project management. Despite the presence of this handbook and the short training which every employee receives, it is not used on every project of the company.

During construction the PM has to report to the CM on a monthly basis. A fixed checklist of items to include in this monthly report is given to each PM.

V Output characteristics (projects carried out during last two years (1993-1995))

V.1 MECCO

Name project	Client	Financing	Contract value (mill. Tsh.) planned	actual	Fixed/flexible contract sum	Construction period (months) planned	actual
TRADECO Oil Industries - DSM	TRADECO (private)	TRADECO (private)	300	300	flexible	14	18
Office accomodation scheme for LAPF[1] - Dodoma	LAPF (public)	LAPF (public)	2.0 billion	2.0 billion	fixed[2]	30	35
Completion of 15 houses - Dodoma	NIC[3] (public)	NIC (public)	65	65	flexible	4	5
Mbeya Technical College	Ministry of Science, Technology & Higher Education (public)	Russian donor	162	162	flexible	6	10
Highlands Hotel Mbeya[4]	Hotel tours & management (private)	Hotel tours & management (private)	178	200	flexible	24	36

[1] Local Authority Provident Funds
[2] Inititally this concerned a fluctuating contract as well. However, due to considerable cost increases for the client, this was changed into a fixed contract.
[3] National Insurance Company
[4] Little activity going on at project at time of research due to inability of client to finance work. This was already the situation in 1994.

V.2 Africa Construction

Name project	Client	Financing	Contract value (mill. Tsh.) planned	actual	Fixed/flexible contract sum	Construction period (months) planned	actual
Factory buildings	Parastatal	Donor + local	666	1.2 billion	fluctuating	30	30
Hospital extension	Donor	Donor	56	73	fluctuating	8	9
Beer depots	Parastatal	Local	148	298	fluctuating	18	24
Gravel roads	Donor + government	Donor	632	881	fluctuating	28	30

Name project	Client	Financing	Contract value (Tsh.) planned	actual	Fixed/flexible contract sum	Construction period (months) planned	actual
Bank of Tanzania	Bank of Tanzania (parastatal)	Bank of Tanzania (parastatal)	15 billion	45 billion	fixed	6	30[1]
M/V Serengeti	DANIDA / Tanzania Railway Corporation	DANIDA	7 billion	7 billion	fixed	24	24
DSM port rehabilitation project	SIDA/NORAD Tanzania Harbour Authority	SIDA / NORAD	-	-	fixed	30	33
Sheraton hotel	Tanruss	Private	48 million US$		fixed	30	30
Karume Technical School	DANIDA / Zanzibar government	DANIDA	-	179 million	fixed	12	12
Iringa and Mbeya Vocational Training Centres	DANIDA	Royal Danish Embassy	2,6 billion	-	fixed	14	not completed yet, but initial time was already exceeded

[1] Time overrun due to lack of funds of client.

V.4 Reasons for delays and cost overruns

Main reasons of delays during construction time as experienced by company

1 = lack of labourers; 2 = lack of knowledge and/or skills among labourers; 3 = lack of materials; 4 = problems with the quality of the building materials and products received on site; 5 = lack of equipment; 6 = break down of equipment; 7 = lack of supervision on site; 8 = lack of experience among project management; 9 = wrong planning; 10 = lack of funds of client; 11 = plot problems (for example, problems with water supply, electricity, telephone); 12 = disputes between parties involved in project; 13 = occurence of extra works during construction time

MECCO	Africa Construction	SJI
10 / 13	3 / 8 / 9 / 10 / 11 13 OTHER: delays in receipt and settlement of interim valuations; delay in receiving instructions Consultant; weather conditions.	3 / 9 OTHER: outstanding payments

Main causes experienced by your company for deviations from the cost planning during construction time

1 = increase of labour costs; 2 = increase of materials costs; 3 = increase of equipment costs; 4= unrealistic cost planning; 5 = lack of experience among project management; 6 = lack of cost control during construction time; 7 = lack of funds; 8 = exceeding agreed construction time; 9 = occurence of extra works during construction time; 10 = works which have to be redone.

MECCO	Africa Construction	SJI
1 / 2 / 3 / 6 7 / 8 / 9	1 / 2 / 4 / 6 7 / 8 / 9 OTHERS: variation orders	1 OTHERS: additional supervision; delays

General problems experienced

MECCO

- Equipment base is insufficient, both for building and civil works projects.
This especially forms a problem since most government projects concern civil works projects (Integrated Roads Project), which require relatively a lot of equipment.
MECCO obtains most equipment externally from government organisations. But external rental is relatively expensive due to monopoly situation of a few rental facilities. MECCO loses contracts due to this matter, especially in International Competitive Bidding.

As a consequence of the above, MECCO suffers from a lack of projects. The annual turnover on projects diminishes. Since the fixed costs (office personnel etc.) remains equal, less and less financial resources are available for new projects. This matter has been a problem for years now.

- Lack of trained project managers
Too little expertise is available within the company. Most people are trained as engineer and do not know much of management practices. Everything has to be learned in practice. This is experienced as one factor causing cost- and time overruns on projects. MECCO tries to build up relations with international contracting companies in order to

improve the quality of its project managers through training by these companies. The international companies are not really interested since they have nothing or little to win by the contacts with lcoal companies. Also internal seminars and workshops are organsied with the University of Dar es Salaam and the NCC, but these lasts only one or two days.

- High competition, especially from foreign contractors.
During the late seventies MECCO was the biggest contractor in the sector. Since then its position has become worse.

Africa Construction

- Little projects available at the moment due to high competition
- Unavailability of skilled men
- Late payments by government, which is the biggest client in the sector.
- High interest rates (40%)
Is currently experienced as the biggest problem, especially in combination with late payments by the government.

SJI

No specific problems indicated other than ones mentioend above.

THE NATIONAL CONSTRUCTION COUNCIL PRICE FLUCTUATIONS FORMULA CLAUSE

Fluctuations under building contracts shall be reimbursed by the Employer to the Contractor by application of the published indices derived from the National Construction Council's price fluctuations formula (hereinafter referred to as the NCC Index).

(1) The rates and prices entered by the Contractor in the Bill of Quantities shall remain fixed for the duration of the Contract and shall not be subject to any change.

The above notwithstanding, the sums otherwise payable by the Employer to the Contractor shall, in the event of change in the NCC Index, be subject to increase or decrease as specified in this Clause. No other increases or decreases, other than so stated shall be allowed in respect of any change in the cost of labour, materials or consumables.

(2) Any sums excepting sums under this Clause and before deduction of any retention certified by the Architect in any interim monthly or final certificate as being payable by the Employer to the Contractor shall be increased or decreased by an amount "F" Tanzania Shillings where the value of "F" shall be determined as follows:-

$$F = \frac{(Ic - Io)}{Io} \times Pc$$

Wherein:-

Ic indicates the value of the NCC Index on the day which falls thirty days before the date of the interim or final valuation.

Io indicates the value of the NCC Index on the day which falls ten days before the date of submission of Tenders.

Pc indicates the "effective value" of the work done under the certificate concerned (being the value of that part of the work which is subject to such increase or decrease) and is as defined hereinafter.

The effective value (Pc) or work done which is to be subject to increase or decrease shall be the difference between:-

(i) the amount which, in the opinion of the Architect, is due to the Contractor under the payment Clause (before deducting retention and before deducting sums previously paid on account) less:-

a) any amount for payment or repayment of an Advance payment

b) any amounts for materials on site

c) any amounts for nominated sub-contractors

d) any amounts for any other items based on actual cost or current prices

e) any sums for increases or decreases in the Contract price paid under this Clause

and (ii) the amount calculated in accordance with (i) above and included in the last preceded interim certificate issued by the Architect in accordance with the payment Clause hereof.

(3) The formula for determining the value of "F" given in sub-clause (2) hereof shall not, under any circumstances, be subject to change irrespective of the actual constituents of the works.

(4) In the event that the value of "F" as determined by the formula stated in sub-clause (2) hereof is positive, then the amount "F" is an addition to the sum otherwise payable to the Contrctor whereas, if it is negative, then the amount "F" is a deduction from such sum.

(5) If an up to date NCC index is not available at the time of any certificate, then a provisional index figure equal to the last confirmed NCC index shall be used until such time as a confirmed NCC index is available. Any adjustments required as a result of a confirmed NCC index differing from provisional index figure shall be included in the first certificate following such confirmation.

(6) Any additional payments to be made to the Contractor under the terms of this Clause shall only be made provided that the work to which such additional payments relate has been completed prior to the date for completion, or such extended time as may be allowed under the contract Work carried out after such date shall not attract such additional payments.

(7) In the event that a period in excess of one month elapses before successive certificates are prepared then the effective value (Pc) as defined in (2) above shall either:-

a) be apportioned on a strictly pro-rata basis over the whole of the period concerned, or

b) apportioned by agreement between the Contractor and Quantity Surveyor over the whole of the period concerned.

The value of "F" shall then be calculated for each month or part thereof of the period concerned using the relevant NCC index in each case in order to arrive at the total amount to be aded to the certificate under this Clause.

THE NATIONAL CONSTRUCTION COUNCIL INDEX (NCC INDEX)

Computation of the NCC Index to be published on a monthly basis and to be used as a means of reimbursement of increased costs by Employers to Contractors under the National Construction Council Price Fluctuations Formula system shall be on the following basis:-

1. The base date for the Index has been set at 1st July, 1985

2. The base value for the Index has been set at 100

3. The current value for the Index (Ic) to be published on a monthly basis shall be calculated as follows:-

$$Ic = (100 \times P.F.Fc) + 100 - (\text{See Appendix I})$$

where P.F.Fc represents the Price Fluctuation Factor which is calculated from the following formula:-

$$P.F.Fc = 0.2000\left(\frac{Lc - Lo}{Lo}\right) + 0.0616\left(\frac{Cc - Co}{Co}\right) + 0.0479\left(\frac{Rc - Ro}{Ro}\right)$$

$$+ 0.0430\left(\frac{AGc - AGo}{AGo}\right) + 0.0367\left(\frac{ASc - ASo}{ASo}\right) + 0.0333\left(\frac{Zc - Zo}{Zo}\right)$$

$$+ 0.0237\left(\frac{SWc - SWo}{SWo}\right) + 0.0203\left(\frac{HWc - HW0}{HWo}\right) + 0.0105\left(\frac{Pc - Po}{Po}\right)$$

$$+ 0.0030\left(\frac{Gc - Go}{Go}\right) + 0.0200\left(\frac{Fc - Fo}{Fo}\right)$$

and where:-

suffix 'c' indicates the value of the index concerned on the first day of the month in question.

suffix 'o' indicates the value of the index concerned on the base date i.e. 1.7.1985

Index L represents the minimum daily wage for permanently employed unskilled labour in Dar es Salaam as decreed by the Government of Tanzania.

Index C represents the cost of cement as given by the official published price per tonne of ordinary Portland Cement ex Wazo Hill Factory.

Index R represents the cost of reinforcing steel as given by the official published price per tonne of 16 mm mild steel plain round reinforcing bars ex Tanga Steelworks.

Index AG represents the cost of aggregates as given by the official published price per m3 of aggregate of ex MECCO Ltd quarry at Kunduchi.

Index AS represents the cost of corrugated asbestos cement roof sheets as given by the official published price per running meter of 6 mm thick sheets ex ASBESCO, Wazo Hill Factory.

Index Z represents the cost of 'Z' purlins as given by the official published price per 6 m length of 150 x 50 mm x 14 gauge 'Z' purlin ex PIPECO Factory, Dar es Salaam.

Index SW represents the cost of softwood as given by the official published price per 1m of 150 x 50 mm untreated sawn softwood ex Sao Hill Wood Products, Dar es Salaam.

Index HW represents the cost of hardwood as given by the official published price per 1m of 150 x 50 mm prime quality wrought Mninga ex Ushirikiano Wood Products, Dar es Salaam.

Index P represents the cost of paint as given by the official published price per 20 Litres of first quality white plastic emulsion wall paint ex Berger Paints (Tanzania) Ltd., Dar es Salaam.

Index G represents the cost of steel pipes as given by the official published price per 6 m length of 19 mm diameter medium grade galvanized steel water pipe ex PIPECO Factory, Dar es Salaam.

Index F represents the cost of fuel as given by the official published retail price per litre for high speed diesel fuel in Dar es Salaam.

The value of indices for materials shall include sales tax.

The values of indices for material shall, in all cases, be the price ex factory, ex steelworks and the like as stated. In no case shall they include any amount for transport from such factory or like place. (See Appendix II)

NATIONAL CONSTRUCTION COUNCIL PRICE FLUCTUATION FORMULA INDICES

APPENDICES
APPENDIX I

CALCULATED FROM A BASE OF 100 ON 1ST JULY 1985

DATE		Labour Lc	Cement Cc	Steel Reinforcement Rc	Aggregate AGc	Asbestos Corrugated Sheets ASc	'Z' Purlin Zc	Softwood SWc	Hardwood HWc	Paint Pc	Galvanised steel pipes Gc	Fuel Fc	PFFC	Ic = (100xPFFC) +100
1985	July	-	-	-	-	-	-	-	-	-	-	-	-	100.00
	August	-	-	-	-	-	-	-	-	-	-	-	-	100.00
	September	-	-	-	-	-	-	-	-	-	-	-	-	100.00
	October	-	-	-	-	-	-	-	-	-	-	-	-	100.00
	November	-	-	0.0233	-	-	-	-	-	-	-	-	0.0233	102.33
	December	-	0.0089	0.0233	-	-	-	-	-	-	-	-	0.0322	103.22
1986	January	-	0.0089	0.0233	-	-	-	-	-	-	-	-	0.0322	103.22
	February	-	0.0089	0.0233	-	-	-	-	-	0.0044	-	-	0.0366	103.66
	March	-	0.0089	0.0233	-	-	-	-	-	0.0044	-	-	0.0366	103.66
	April	-	0.0089	0.0233	-	-	-	0.0041	0.0012	0.0044	-	-	0.0419	104.19
	May	-	0.0089	0.0233	-	-	-	0.0041	0.0032	0.0044	-	-	0.0419	104.19
	June	-	0.0317	0.0233	-	-	-	0.0041	0.0093	0.0044	-	-	0.0667	106.67
	July	0.0604	0.0317	0.0233	-	-	0.0220	0.0041	0.0093	0.0044	0.0023	0.0176	0.1751	117.51
	August	0.0604	0.0317	0.0233	0.0502	-	0.0508	0.0041	0.0093	0.0044	0.0049	0.0176	0.2567	125.67
	September	0.0604	0.0317	0.0233	0.0502	-	0.0508	0.0040	0.0093	0.0044	0.0049	0.0176	0.2666	126.66
	October	0.0604	0.0317	0.0713	0.0502	0.0834	0.0816	0.0140	0.0093	0.0044	0.0079	0.0176	0.4318	143.18
	November	0.0604	0.0317	0.0713	0.0502	0.0834	0.0816	0.0140	0.0093	0.0044	0.0079	0.0176	0.4318	143.18
	December	0.0604	0.0317	0.0713	0.0502	0.0834	0.0616	0.0140	0.0093	0.0044	0.0079	0.0176	0.4318	143.18
1987	January	0.0604	0.0579	0.0713	0.0502	0.0834	0.0816	0.0140	0.0093	0.0044	0.0079	0.0176	0.4580	145.80
	February	0.0604	0.0579	0.0713	0.0502	0.0834	0.1223	0.0140	0.0093	0.0044	0.0123	0.0176	0.5031	150.31
	March	0.0604	0.0579	0.0713	0.0502	0.0834	0.1223	0.0140	0.0044	0.0123	0.0123	0.0176	0.5031	150.31
	April	0.0604	0.0579	0.0713	0.0502	0.0834	0.1223	0.0140	0.0093	0.0044	0.0123	0.0176	0.5031	150.31
	May	0.0604	0.0579	0.0713	0.0502	0.0834	0.1223	0.0140	0.0093	0.0044	0.0123	0.0176	0.5031	150.31
	June	0.0604	0.0579	0.0713	0.0502	0.0834	0.1223	0.0140	0.0093	0.0044	0.0123	0.0176	0.5031	150.31
	July	0.1114	0.0579	0.0713	0.1109	0.0834	0.1223	0.0140	0.0093	0.0086	0.0123	0.0322	0.6336	163.36
	August	0.1114	0.0579	0.0713	0.1109	0.0834	0.1223	0.0140	0.0093	0.0086	0.0123	0.0322	0.6336	163.36
	September	0.1114	0.0579	0.0713	0.1109	0.0834	0.1223	0.0140	0.0153	0.0086	0.0123	0.0322	0.6396	163.96
	October	0.1114	0.0903	0.0713	0.1109	0.0834	0.1496	0.0148	0.0188	0.0086	0.0169	0.0322	0.7082	170.82
	November	0.1114	0.0903	0.0713	0.1109	0.0834	0.1496	0.0148	0.0188	0.0104	0.0169	0.0322	0.7100	171.00
	December	0.1114	0.0903	0.0885	0.1109	0.0834	0.1496	0.0148	0.0188	0.0104	0.0169	0.0322	0.7272	172.72
1988	January	0.1114	0.0903	0.0885	0.1109	0.0834	0.1496	0.0148	0.0188	0.0104	0.0169	0.0322	0.7272	172.72
	February	0.1114	0.0903	0.0885	0.1109	0.0834	0.1496	0.0148	0.0188	0.0104	0.0169	0.0322	0.7272	172.72
	March	0.1114	0.0903	0.0885	0.1109	0.0834	0.1496	0.0243	0.0188	0.0255	0.0169	0.0322	0.7518	175.18
	April	0.1114	0.0944	0.0885	0.1109	0.0834	0.1861	0.0243	0.0234	0.0255	0.0210	0.0322	0.8011	180.11
	May	0.1114	0.0944	0.0885	0.1109	0.0834	0.1861	0.0243	0.0234	0.0255	0.0210	0.0322	0.8011	180.11
	June	0.1114	0.0944	0.0885	0.1109	0.0834	0.1861	0.0382	0.0234	0.0255	0.0210	0.0322	0.8150	181.50
	July	0.1738	0.0944	0.0885	0.1109	0.0834	0.1861	0.0490	0.0234	0.0241	0.0210	0.0322	0.8868	188.68
	August	0.1738	0.0944	0.0885	0.1109	0.0834	0.1861	0.0490	0.0234	0.0241	0.0210	0.0322	0.8868	188.68
	September	0.1738	0.0944	0.1158	0.1109	0.0834	0.1861	0.0490	0.0234	0.0241	0.0210	0.0322	0.9141	191.41
	October	0.1738	0.0944	0.1158	0.1109	0.0834	0.1861	0.0490	0.0234	0.0241	0.0210	0.0322	0.9141	191.41
	November	0.1738	0.1489	0.1477	0.1109	0.0834	0.1861	0.0490	0.0288	0.0241	0.0210	0.0322	1.0059	200.59
	December*	0.1738	0.1489	0.1477	0.1109	0.2014	0.1861	0.0490	0.0288	0.0241	0.0210	0.0400	1.1317	213.17

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Appendix N

Long-term effect of inflation combined with devaluation

On the long-term the inflation rate leads to differences between local and foreign contractors. This is illustrated by table N.1 below. This table gives an overview of the value of the nominal minimum wage in Tanzania. Row 1 indicates the minimum wage in Tsh. as set by the Tanzanian government. Row 4 indicates this minimum wage expressed in US$. With the help of the yearly inflation rate in Tanzania and the United States respectively (row 2 and 6), the real wage level has been calculated for each year, based on 1993 prices (row 3 and 5). This has been translated to index figures (1993 = 100) (row 4 en 8).

Table N.1 Yearly nominal and real minimum wage in Tanzanian shillings and US dollars 1985-1993

	1985	1986	1987	1988	1989	1990	1991	1992	1993	
Nominal min. wage (Tsh.)[1]	810	1053	1260	1644	-	2,500	2,500	3,500	5,000	
Annual inflation rate Tanzania[2] (%)	33.3	32.5	29.9	31.2	25.8	19.7	22.3	22.1	23.5	
Real wage (Tsh.) (1993 prices)	739	985	1305	1695	2224	2797	3348	4095	5000	
Index (1993 = 100)	14.8	19.7	26.1	33.9	44.5	55.9	67.0	81.9	100	**577%**
Nominal min. wage (US$)[3]	46.3	32.2	51.8	16.6	-	12.8	11.4	11.8	12.3	
Annual inflation rate USA (%)[2]	3.5	1.9	3.7	4.0	4.8	5.4	4.3	3.0	3.0	
Real wage (US$) (1993 prices)	9.1	9.4	9.6	10.0	10.4	10.9	11.4	11.9	12.3	
Index (1993 = 100)	74.0	76.4	78.0	81.3	84.6	88.6	92.7	96.7	100	**35%**

Source
[1] Representative of labour union at Skanska Jensen International, Mbagala office, Dar es Salaam, Tanzania; Dankers, B. (1995), Appendix p.19.
[2] Based on yearly Consumer Price Index as provided by World Bank (World Tables).
[3] Based on yearly conversion factor (Tsh./US$) as provided by World Bank (World Tables).

Table N.1 shows that the real labour wage increase over the period 1985-1993 has been less expensive for foreign contractors, as compared to local contractors. The former obtain Tanzanian currency by exchanging foreign currency (for example US$). Over the years the Tanzanian currency has devaluated considerably (see also appendix F), resulting in a financial advantage for foreign contractors. They needed less and less dollars to pay the minimum wage of one local labourer. When both the Tanzanian shilling and US$ are corrected for inflation this results in a labour wage increase for local contractors

of 577% and for foreign contractors of 35%, both for the period 1985-1993. The same can be done for the other two direct inputs, materials and equipment. A considerable price advantage thus for the latter group.

The above described cost development results in foreign companies becoming relatively less expensive compared to local contractors. On the long-run this may weaken the price advantage which local companies currently have over foreign companies.

Appendix O

The productivity factors

O.1 Introduction

In this appendix, the productivity factors mentioned in table 7.1 are presented in more detail. The following format is used for each factor:

Box O.1 Format used for presentation productivity factors

Productivity factor:	[name]
Contents:	[short description of contents of productivity factor]
Element:	[productivity element affected by productivity factor]
Source:	[source from which productivity directly or indirectly, more or less originates]
Impact:	[specific impact on SJI projects]

To determine the impact of the above-presented productivity factors in the case of SJI, data had to be collected on project level and site level. SJI could offer only one construction site which could be used for this purpose: the site of the Vocational Training and Service Centre project (VTSC-project) in Iringa.

The extent to which factors apply to the VTSC-project of SJI has been determined on the basis of:
- interviews with SJI personnel on the Iringa site;
  due to the language problem interviews had to be restricted to the foreign personnel and English-speaking Tanzanian personnel;
- interviews with the consultant's representative on site;
- interviews with people of various departments within the branch office in Dar es Salaam observations on site;
- minutes of monthly site meetings between the consultant and the contractor;
- monthly reports submitted by the project manager of the VTSC-project to the contract manager at the branch office.

O.2 Presentation of productivity factors

Productivity factor: Site accidents
Contents: Accidents on site can directly influence the direct input factor labour, since costs of the accidents in general will have to be paid by the contractor. Moreover, in case new labourers are recruited to take over the work of injured labourers, accidents may have negative consequences for the progress of the work: new labourers will in general need time to get acquainted with the work (especially in the case of unskilled labour) and to reach the speed of working of the 'old' labourers. The occurrence of accidents may also affect the progress of the production process in general: work may be (slightly) delayed due to the fact that new labourers have to be recruited and trained. Moreover, accidents can, in general, cause unrest on the site, delaying the general progress of the work.
The frequency of accidents occurring on site will depend on national safety regulations and the extent to which a specific company takes notice of these regulations.
Element: Input factor: labour; Production process.
Source: Contractor; Government.

Impact: In Tanzania TAMICO, the labour union for construction labourers, is, together with labour inspectors of the government, responsible for the safeguarding of the safety and health of labourers on construction sites. Under the Employment Ordinance any labour commissioner and / or labour officer appointed by the President, is allowed to carry out inspections on building sites and all other company premises. Companies are obliged to have an insurance against accidents occurring on their premises. In case labourers are a member of TAMICO, the union will represent them in case of a company accident. If they are no member, they can go directly to the Labour Office of the Government (part of the Ministry of Labour). TAMICO also tries to educate the labourers in safety matters.[1]
SJI has OTTU representatives on its company premises, with whom wage negotiations take place every year. On the Iringa site of the VTSC-project accidents have occurred occasionally, due to inattention. According to special conditions in the contract, SJI should have 'an [accident prevention] officer dealing with questions regarding safety and protection against accidents of all staff and labour. This officer shall be qualified for this work...'.[2] No such officer was however found to be present on the site. However, on another SJI the project management stressed the importance of wearing a safety helmet. The labourers, however, did not see the relavcne of this and, consequently, almost none of them wore the helmet. No external safety inspections were found to take place on the Iringa-site (nor on other SJI sites), not by the government, nor by OTTU/TAMICO. This seems to indicate that little attention is given in practice to safety on construction sites.

Productivity factor: Labour conditions
Contents: By 'labour conditions' are meant here all facilities provided by the contractor for the labourers working on the site. Through the costs of such facilities the labour conditions directly influence the costs of the labour component on site, and thus the site productivity level. On the other hand, adequate labour conditions can have a positive effect on the production process, since they create a more stimulating working environment for the labourers on site.
Element: Input factor: labour; Production process
Source: Contractor; Labour organisations; Government
Impact: The same organisations as mentioned under the previous productivity factor (accidents on site) also occupy themselves with labour conditions. If labourers do not agree with any labour conditions on site, they can turn to these organisations. According to the special contractual conditions SJI has to fulfill all local regulations concerning labour conditions. No evidence has been found that any of these regulations was violated. SJI provided lunch for its labourers on site. A special arrangement was implemented to allow labourers to lend money for any medical care needed. Only the official working week of 45 hours was often exceeded by working 9 hours a day from Monday up until and including Saturday (54 hours).

Productivity factor: Foremen meeting
Contents: Through meetings with the foremen, the project's management will be better able to realise the desired planning. Insight can be obtained into any problems occurring on site and timely and regular feedback can then be given. This would contribute to the realisation of the desired site productivity level.
Element: Production process
Source: Contractor
Impact: No regular meetings took place with the foremen on site. The project manager and assistant site manager told the supervisors what work had to be done each day. The supervisor was responsible for instructing the foremen. The assistant site manager expressed the wish

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1 Based on interview with Mr. P. Olum, chairman of TAMICO, Dar es Salaam.

2 FIDIC. *Conditions of Contract. Part II - Special Conditions, Clause 34.5.* 1994, p.12.

for a more formal organisation and information structure with the foremen. However, the latter are not used to this, which made it hard to implement. Moreover, due to the overall lack of time on the VTSC-project, no time was taken / available to alter this matter.

Productivity factor: Quality of tender
Contents: The tender is the basic cost planning for the contractor. Any, more detailed planning will be based on this tender. The tender thus has to be accurate and provide a sound and realistic basis for control during the production process. A wrong planning may result in higher direct and site costs for one or more of the direct input factors than anticipated. Any mistakes occurring in the tender are the responsibility of the contractor.
Element: Input factor: Labour, Materials, Equipment, Subcontracting
Source: Contractor
Impact: Mistakes occurred in the tender of the VTSC-project. For example: the kitchen for the Iringa VTSC was priced for 300,000 Tsh. whereas the same kitchen for the Mbeya VTSC was priced for 300,000,000 Tsh. This increased the material costs and caused a deviation from the planned site productivity level.

Productivity factor: Degree planning
Contents: This concerns the degree to which planning takes place *after* winning the contract, during the preparation and production phase. This planning is needed for effective control of the costs of the direct input factors (and thus of the site productivity level).
Element: Input factors: labour, materials, equipment, subcontracting
Source: Contractor
Impact: On the VTSC-project the only cost planning made beforehand was the cash flow overview. This was based on the time schedules and the priced BOQ. However, the BOQ did not prove to be suitable planning tool here: the concrete works were underpriced, whereas the roof trusses were overpriced. Furthermore, mistakes occurred in the priced BOQ (see productivity factor 'quality of tender'). During production the necessary amount of labour, materials and equipment, and thus its costs, was estimated on the basis of experience and feeling. No standard data were used or even available for this. The lack of planning during production was also based on the fact that little attention was given to detailed cost control.

Productivity factor: Degree control
Contents: The sophistication of the control system used in a company has influence on the success of realising the site productivity level (see also argumentation chapter 2).
Element: Input factor: labour, materials, equipment, subcontracting
Source: Contractor
Impact: See for information on the degree of cost control at SJI chapter 7, section 7.3. At the start of the project cost control was entirely lacking, caused by a lack of preparation and mobilisation time. Overall, the project experienced severe cost overruns (no detailed insight into this was allowed by SJI. However, it resulted from statements of the general manager at the branch office and cash flow overviews).

Productivity factor: Degree feedback
Contents: The importance of feedback has been explained in chapter 2. Without feedback correction of any deviation of the costs is not possible. An adequate feedback system is thus indispensable.
Element: Input factor: labour, materials, equipment, subcontracting
Source: Contractor
Impact: Feedback from the office to the site was lacking, most of all caused by the priority given to the Sheraton project. Due to a lack of detailed planning and control feedback did also not take place very detailed. Feedback after project completion is limited by filling in a form on the financial project performance and the subcontractor's performance. See also section 7.3 and 7.4.

Productivity factor: Storage methods
Contents: Any costs involved in storing materials and equipment off and on site are part of the indirect material costs. Despite its cost increasing effect, it is very important to implement such a system. If it is lacking it may negatively affect the quality of the materials + equipment and/or lead to disappearing of material and equipment items. Both results negatively affect the site productivity level. Disappearing of items can delay the production process.
Element: Input factor: materials, equipment; Production process
Source: Contractor
Impact: Initially no official storage methods existed on the Iringa-site. This contributed to the stealing / disappearing of materials and tools. Therefore, the control has been increased at a later stage of the project. Partly finished buildings were used as temporary stores. A registration system was implemented as to who took which materials and tools, at what time and by whom this was authorised (the latter in case labourers took the materials / tools).

Productivity factor: Waste of materials
Contents: Waste of materials can occur when materials are not properly transported and / or treated. Wastage directly influences the material costs when it results in the necessary purchase of extra materials.
Element: Input factor: materials
Source: Contractor
Impact: According to the site manager no severe wastage of materials took place on the Iringa-site. However, to control this factor enough supervision is needed. This was not available on the Iringa-site. One own observation made showed that labourers sometimes treat materials uncarefully. In this specific case it did not result in wastage. However, it still affects the quality of the work and in this case affected the aesthetics of the work.

Productivity factor: Knowledge where to buy materials
Contents: In case it is known where exactly the required materials are available, this will contribute to a more efficient production process, which again contributes to realisation of the planned site productivity level. Moreover, prices may change from supplier to supplier and thus knowledge on suppliers may affect the direct costs level of materials.
Element: Input factor: materials; Production process
Source: Contractor
Impact: In the beginning this factor caused some delay in the production process. This has to do with the fact that the project management was not very well-known in Iringa. They had to rely on local people in the beginning. For the supply of imported materials the project could rely on the network of the foreign head office. Knowledge where to buy these materials was not required.

Productivity factor: Import materials / Import equipment
Contents: The influence of this factor depends on the degree to which a company imports materials and equipment for its projects. This again depends on requirements of the client. In general, imported items can have an impact on the site productivity level due to delays in the production process. These delays can for example be a result of wrong planning of delivery times, bureaucratic procedures in the harbour etc. Moreover, imported items have a relatively high cost level (both direct and site costs) as compared to locally bough materials. Problems with respect to imported items (e.g. stealing, wastage) will thus have a larger cost impact for the contractor in absolute terms.
Element: Input factor: materials, equipment; Production process
Source: Contractor; government
Impact: In the case of the VTSC-project of SJI a lot of materials were imported, due to a contractual clause which stated that all materials had to be 100% of Danish manufacture. Only some selected items (cement, aggregate, sand and treated timber) could be bought locally. Only in the beginning of the project the import of materials influenced the progress of the project (problems with harbour authorities). Because of the fact that DANIDA (foreign donor) was involved, problems were solved rather quickly through interference of the Ministry of Finance.

Productivity factor: Testing materials
Contents: Under the FIDIC conditions of contract the contractor is obliged to have material tests carried out. This is the responsibility of the contractor. The results of the tests have to be approved by the consultant, before the materials can be used in construction activities. In case such tests do not start or finish on time, this may result in delays in the production process. Costs of testing should be included by the contractor in his costs estimate.
Element: Input factor: materials; Production process
Source: Contractor
Impact: The VTSC-project depended for testing on testing facilities in Dar es Salaam. Testing of concrete cubes took place on site. No effect was noticed of this factor on the Iringa-site.

Productivity factor: Maintenance
Contents: The degree of maintenance has an influence on the possibility of breakdown of the equipment and thus on the equipment costs. A lack of maintenance, resulting in break down of equipment can result in delays in the production process.
Element: Input factor: equipment; Production process
Source: Contractor
Impact: The existing maintenance system on the Iringa-site was experienced as very satisfactory by the site management. One full-time mechanic from DSM was available who has had training in Mbagala. Once a month a supervisor was coming from he equipment department for inspection and assistance.

Productivity factor: Source of equipment
Contents: Price differences between equipment rented and equipment bought can influence the level of equipment cost on a project. If different possibilities are not compared before hand this can cause unnecessary costs.
Element: Input factor: equipment
Source: Contractor
Impact: During the project time it proved that rental of the equipment (from Mbagala as well as from external sources) was more expensive than when equipment was bought and sold after use (based on opinion of project manager).

Productivity factor: Subcontractors meeting
Contents: What has been said on the effect of regular meetings with the foremen also applies to subcontractors.
Element: Production process
Source: Contractor
Impact: No regular meetings took place with subcontractors working on the Iringa-site. The subcontractors submitted an overview of their labour and equipment on site every week. In case any problems occurred contact between both parties took place. This arrangement seemed to be satisfactory. No problems were experienced with the subcontracting component on the Iringa-site.

Productivity factor: Design changes
Contents: Changes in the design during the production process, may lead to a change in the physical output and consequently in the value of this output.
Element: Output
Source: Contractors; Client/Consultant
Impact: On the Iringa site 34 Site Instructions were issued during the first ten months of the project. According to the quantity surveyor on site this is relatively high. Two design changes were suggested by SJI herself, sicne this would make production more easy. Others were issued by the consultant. Several site instructions resulted from mistakes in the drawings.

Productivity factor: Site lay-out
Contents: An efficient site lay-out will contribute to efficient working. For example:

materials readily available to the labourers economises on time and thus on labour costs.
Element: Site
Source: Contractor
Impact: Figure O.2 in appendix O shows the site lay-out on the Iringa-site. It was not possible to conduct a thorough study into the efficiency of the site lay-out due to a lack of time. However, materials and tools had to be collected by the labourers from the central store. This does not seem to indicate an optimal efficiency of the site lay-out. The site lay-out had not been given considerate attention during the preparation phase, nor during the production phase itself.

Productivity factor: Philosophy project manager
Contents: The philosophy of the project manager, in general, determines how the organisation on site is formalised. This again will determine how strict planning, control and feedback will take place on site. And, as argued in chapter 2, these functions are crucial in achieving site productivity improvement.
Element: Production process
Source: Contractor
Impact: The project manager of the VTSC-project did not like to be bossy. Consequently, the organisation and information aspects on the higher project level (management and supervisors) were very informal. Towards the local labourers (direct and indirect) a formal attitude was adopted. The philosophy of the project manager negatively influenced the strictness with which cost control was executed during production. For example, no strict planning was made as to the costs of direct inputs needed in the execution of the various construction activities on site. The 3T-file was also not strictly used. This latter is also attributable to misjudgment of the scope of work and of the circumstances under which the work would take place.

Productivity factor: Experience project manager
Contents: Experience concerns here both *general* experience in managing construction projects and *specific* experience of managing projects in a developing country such as Tanzania. Experience has influence on the success and smoothness with which planning, control and feedback take place. Moreover, it will lead to a more proper judgment of when and how these functions are especially required. This again determines the successfulness in realising the desired site productivity level.
Element: Production process
Source: Contractor
Impact: No thorough judgement is possible here. Based on the curriculum vitae is the amount of experience of the management on the VTSC-project limited. This is also experienced as such by the consultant's representative on site. Experience and personality can also have an influence on the relationship with the branch - and head office when it comes to getting necessary inputs for the project. For example: on the Sheraton project a project manager was in charge with more experience and preponderance compared to the project manager of the VTSC-project (based on opinion other SJi employee and own observation). Consequently, the assistance by the branch office was seen to be more thorough and timely on the former project. However, this should be viewed in combination with the prestige of the Sheraton project for the company. See also productivity factor 'position project within company'.

Productivity factor: Availability expatriates
Contents: In Tanzania a general lack of qualified supervisors and professionals is experienced. Such people are indispensable for effective planning, control and feedback and thus for optimising the site productivity. Expatriates could fill this local lack of professionals.
Element: Production process
Source: Contractor; Government
Impact: In the case of SJI all management and supervisory tasks are carried out by expatriates. In view of the lack of local supervisors and professionals in Tanzania, this is a positive factor. However, on the VTSC-project incomprehension was found to exist among the foreign

management for the way local people work, sometimes resulting in little patience of the former towards the latter.

Productivity factor: Position project within company
Contents: The position of a project in the company includes such aspects as the degree of prestige of the project for the company and its geographical location towards the central office. This position will determine the amount of support received by the project management from this central office. This support can include support in the procurement of direct inputs, provision of qualified people etc. Such support can have a positive effect on the progress of the production process and on achieving the desired productivity level.
Element: Production process
Source: Contractor
Impact: The VTSC-project clearly suffered from the presence of the Sheraton project. This project had more prestige for the company and therefore got more attention from the branch and head office. The VTSC-project depended for its cash flow on the Sheraton project. Delays in payment on this latter project, caused delay in the availability of cash flow for the VTSC-project. This again caused trouble in the procurement of local direct input factors, such as materials and labour. Also less skilled people and equipment were available in Iringa, due to the Sheraton project. After completion of this project, attention was shifted to the VTSC-project.
The position of a project in the company and the assistance given to it by the branch office, also depends on its geographical location. For example, for the project manager of the VTSC-project it was more difficult to arrange matters compared to a project manager on a Dar es Salaam-located project. the latter is more close to the office and can arrange matter personally, instead of using telephones and faxes. Personal contact should be considered as more effective.

Productivity factor: Availability information
Contents: Information on the project as well as on the location where the project will take place is essential for the preparation of an accurate (costs) planning. Without such a (cost) planning no effective control can take place with respect to the site productivity level.
Element: Production process
Source: Contractor
Impact: The project manager and assistance site manager had very little information with respect to the labour and equipment which would be available to their project from the branch and head office. Also, the management had no knowledge of the Iringa surroundings and the availability of direct inputs there. This made the preparation of an accurate planning very difficult. Consequently, such a planning was lacking. This means that no proper basis for control was available, making control also difficult. During the first two months of the project cost control was entirely lacking. Sole attention was given to getting the project started and running and the progress made.

Productivity factor: Correct orders
Contents: Whether or not orders are correctly placed with suppliers will determine if the right materials are available on the right time at the right place.
Element: Production process
Source: Contractor
Impact: The foreign head office indicated to experience problems with the accurateness with which purchase orders were formulated by the management of the VTSC-project. This caused confusion and late deliveries of some imported materials. However, for the project management it was very hard to place the orders as desired by the head office, due to a lack of catalogues and other information required for this purpose.

Productivity factor: Relation between contractor and consultant
Contents: A good working relation between the contractor and consultant is important. Disturbed relations may lead to unethical behaviour, which may cause delays in the production process, cost claims being refused etc.
Element: Production process

Source: Contractor; Consultant
Impact: The exact impact of this factor in the case of the VTSC-project was hard to determine, due to the sensitivity of the subject. More in-depth research would be required. The project management on the VTSC-project stated that maintaining a good relation with the consultant was especially important on this project. Both parties not only had to work together, also their social lives interfered, due to the fact that Iringa is a very small community.

Productivity factor: Knowledge of contract
Contents: It is essential that the project management has knowledge of the contents of the contract under which a project is carried out. This especially applies to any procedures required by the contract, for example in the case of submitting a cost claim. If these procedures are not adhered to by the contractor a cost claim may be refused. This would mean that a cost increase is experienced by the contractor, which will have a negative effect on his actual site productivity level. That is: the denominator increases without a similar increase in the numerator.
Element: Production process
Source: Contractor
Impact: On the VTSC-project two cases occurred in which a cost claim was submitted too late and, consequently, not granted by the consultant. The cause of this late submission was the fact that the project management was too late with submitting information needed by the branch office to formulate the cost claim.

Productivity factor: Link office - site
Contents: Optimal site performance partly depends on the extent to which the various office departments function satisfactorily towards to site.
Element: Production process
Source: Contractor
Impact: On the VTSC-project a lack of equipment was experienced, partly because of the fact that the equipment department had equipment employed on other projects. Friction existed between the VTSC-project management and the foreign head office, since orders were not placed in the correct way. Moreover, feedback and support from the branch office was limited until the Sheraton project was finished.

Productivity factor: Project organisation
Contents: In appendix C the degree to which a contractor was able to organise the production process efficiently was said to be a determinant of the contractor's cost level.
Element: Production process
Source: Contractor
Impact: On the VTSC-project the organisation was kept to a minimum. Several persons on the highest levels had double tasks. The work load was heavy. Supervision for the work on site was minimal.

Productivity factor: Motivation
Contents: The degree of motivation workers have for their job influences the working sphere and quality and timeliness of their work. If workers are not completely committed to their job and to the company they work for, the production process is more vulnerable to delays and thus to cost increases.
Element Input factor: labour; Production process
Source: Labourers
Impact: Motivation of the labourers in Iringa was experienced as very limited. Earning a living is the main motivation; very little dedication to their job (with a few exceptions). Bonus system was used to increase productivity. However, the impact is limited and only temporary. (Example: site manager asked some labourers to work overtime on a Sunday from 8:00 till 16:00 hours. Overtime and an extra hour would be paid. The labourers said yes, but did not show up on the required day).

Also on national level the lack of motivation among labourers is acknowledged as a problem.[3]

Productivity factor: Health conditions
Contents: The state of health determines the ability of a person to work, determines its speed of work and thus the time needed for and labour costs of a certain construction activity.
Element: Input factor: labour
Source: Labourers
Impact: Health conditions of labourers from Iringa were experienced as a problem on the VTSC-project. It is considered a general problem with respect to local labourers by the company. Measures taken on the Iringa-site included:

- provision of lunch ;
- supervisor has given accountant amount of money for medical expenses of labourers. They can borrow money from this which is compensated via their wages.

Productivity factor: Stealing materials
Contents: This factor can cause unforeseen delays in the production process and increased materials costs, due to the fact that new materials have to be purchased. In case labourers of the contractor's organisation are involved this may lead to increased labour costs also (e.g. recruitment and training of new labourers).
Element: Input factor: materials, labour; Production process
Source: Labourers
Impact: The influence of this factor was very severe in Iringa. Especially in the case of the imported materials this factor caused delays and extra costs (e.g. new roofing sheets had to be imported in Denmark; expected to take two months before sheets would be available on site; this affected time schedule, especially since the schedule was already tight due to other reasons). Moreover, the most skilled labourers were found to be responsible for the stealing. They had to be fired, but this constituted a severe loss in light of the already low quality level of the labour component on site.
Extra watchmen were hired; better control system for in- and outgoing materials was implemented. This also caused extra, unanticipated costs. The stealing also causes extra costs when a case went to trial. According to the Tanzanian system the accused has the right to half his salary until his guilt has been proven in court.

Productivity factor: Knowledge how to use equipment
Contents: Wrong use of equipment can lead to breakdown of the equipment, increasing the equipment costs and causing delays.
Element: Input factor: equipment; Production process
Source: Labourers
Impact: On the VTSC-project some equipment items broke down. According to specialists (equipment department SJI) this was very difficult if you would know how to handle the items concerned. The management and supervisors on the VTSC-project experienced no appreciation for equipment and tools provided by them to the labourers.

Productivity factor: Absenteeism
Contents: Unannounced absenteeism can influence the progress of the production process.
Element: Production process
Source: Labourers
Impact: Occasionally labourers on the Iringa-site were absent unannounced, but this has not severely affected the work. Usually other labourers were available. However, in case workers with experience and knowledge were absent who were being replaced by new workers, this negatively affected the progress of the work (extra instruction and supervision required).

Productivity factor: Cultural elements

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[3] Ministry of Works (1991), p.20.

Contents: Certain cultural elements among labourers may influence the production process on site. For example: through country-specific public holidays.
Element: Production process
Source: Labourers
Impact: Tanzania has 12 official public holidays.[4] Employers are obliged to pay full wages on these days. According to the contract between SJI and the client of the VTSC-project, the former has to 'have due regards to all recognized festivals, days of rest and / or other customs'.[5] However, due to the tight time schedule work continued on some public holidays. However, in such cases labourers were always recruited on a voluntary basis. Cultural elements as well as their influence on the work are hard to determine. Moreover, it would require time which was not available here. Further research is needed here.

Productivity factor: Competition
Contents: The degree of competition has an influence on the final tender price and construction period submitted by the different contractors involved in tendering for a project. This again has an influence on degree of cost control required, since the tender serves as a guide line for this. Sharp prices and construction periods will require tight control.
Element: Input factors: labour, materials, equipment, subcontracting; Production process
Source: Other contractors
Impact: In the case of the VTSC-project three foreign companies were competing for the project. SJI was very anxious to get the contract and has therefore accepted a relatively low price and short building time. Various parties involved in the construction process think both price and time are not realistic considered the circumstances. In general, competition in the Tanzanian construction sector is high at the moment.

Productivity factor: Use of subcontractors
Contents: The contractor depends on external sources in case of the use of subcontractors and thus on extra external factors influencing the control of his building process. Many of the internal and external factors affecting the main contractor may also affect the subcontractor. However, the extent to which may differ (due to company characteristics). Although for the subcontractors certain influences may lead to increased cost, this does not mean that the main contractor also automatically experiences these increase costs. However, if a subcontractor experiences delays in his work this can also lead to delays in the work of the main contractor. This again, can have a negative effect on the main contractor's site productivity level.
Element: Input factor: subcontracting; Production process
Source: Other contractors
Impact: In case of the VTSC-project two subcontractors have been used. One for the elevated steel tank, the other for the electrical work. SJI had agreed a fixed tender sum with both of them. This means that cost increases for the subcontractors do not automatically affect SJI. Moreover, work of one subcontractor (the elevated steel tank) did not very much depend on work of SJI and vice versa., making cost control even less necessary.
Initially a subcontractor would also be used for the mechanical work. However, this subcontractor was not approved of by the client / consultant. Disapproval was given *after* the contract was won. SJI decided to do the work herself, supervised by someone of the organisation initially chosen as a subcontractor. No information was available for this research if this change led to an increase in costs of the work.

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4 These are January 1, January 12, April 26, May 1, July 7, December 9, December 15 and 26, Eastern 2 days, Idd-ul-Fitr 2 days, August 8, Maulid 1 day. Total public holidays: 14.

5 FIDIC. *Conditions of Contract. Part II - Special Conditions.* Clause 34.11, 1994, p.12.

Productivity factor: Quality tender documents
Contents: The contractor bases his tender on the tender documents as provided by the client / consultant. After signing the contract this tender is the basis for further planning, including cost planning. In case any mistakes occur in the tender documents of the consultant, which have not been noticed by the contractor during tendering, this means that the contractor may have to realise a planning which may not be realisable in practice. According to general contractual arrangements the contractor is responsible for any extra costs incurred by such a situation. Mistakes in the tender documents can also cause delays, since changes will have to be discussed between contractor and consultant and included in the planning / work schedule.
Element: Input factor: labour, materials, equipment, subcontracting; Output; Production process
Source: Client / consultant
Impact: In this project the BOQ of the consultant was very roughly made. A lot of items concerned lump sum amounts.[6] No severe effects were found here on the VTSC-project.

Productivity factor: Quality of drawings
Contents: Also the drawings are used by the contractor to prepare his planning, both before and during the production process. These drawings should thus also be accurate.
Element: Input factor: labour, materials, equipment, subcontracting; Output; Production process
Source: Client / Consultant
Impact: In this project relatively many mistakes occurred on the consultant's drawings. However, SJI was obliged to make working drawings before starting the operations. This was meant as a control tool, and as a way of instructing the foremen on site (clear, simple drawings). SJI did not always prepare these drawings. In case of roof trusses this caused rework, delay and increased labour and materials costs. A cost claim was not accepted by the consultant due to the fact that SJI was supposed to prepare working drawings. This means that a cost increase resulting from a fault of the consultant's drawings is thus the responsibility of the contractor. This shows the necessity for the contractor to check the quality of these drawings.
Faults in drawings led to changes in design introduced via Site Instructions. Until the end of August there have been 34 S.I. According to the quantity surveyor on site this was relatively a lot.

Productivity factor: Type of project organisation
Contents: The type of project organisation determines when a contractor is involved in the project and to what degree he can still influence the cost level of the production process.
Element: Input factors: labour, materials, equipment, subcontracting; Output; Production process
Source: Client
Impact: The VTSC-project was based on the traditional project organisation type, in which a contractor is not involved until the tendering stage. His cost level is partly determined by the design of the client and consultant on which he has no influence. Other organisation types may give a lower initial cost level for production.

Productivity factor: Role of foreign donor
Contents: Foreign donors have links with the local government. This could have a positive effect on bureaucratic procedures etc.
Element: Production process
Source: Client / consultant

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6 Lump Sum items are not remeasured by the consultant during production. The actual price of the work could differ negatively or positively from the amount mentioned in the BOQ. This means that the contractor can have a loss or a profit. The disadvantage of this system for the contractor is that it costs a lot of time to unravel the items by himself during tendering. The advantage is that it gives the contractor the right to measure extra work for these items on days work basis, which in most cases gives better rates.

Impact: The fact that this project is financed by DANIDA has limited the problems with harbour authorities in DSM. On request of DANIDA, the Ministry of Finance has solved problems with the harbour authorities.
Furthermore, foreign-funded projects are exempted from payment of import duties and sales tax. However, for some time confusion on whether or not this measure applied to the subcontractors on the VTSC-project existed at the project management of SJI.

Productivity factor: Late payments
Contents: Late payments by the client may endanger the contractor's financial position. It may cause delays in the production process, or lead to extra financing costs for the contractor. Late payments can result from both the client (late transfer of money) and the consultant (late issuing of payment certificate).
Element: Production process
Source: Client / consultant
Impact: No serious impact noticed on the VTSC-project. In chapter 6 it was already mentioned that due to its foreign-funded projects, SJI suffers relatively little from late payments. Moreover, she is financially able to cover any late payments, thanks to financial backing of the foreign head office.

Productivity factor: Change in labour costs
Contents: In general, labour costs can change during construction time for example due to negotiations with the labour organisation, whether on national, sectoral and/or company level. This directly affects the site productivity level.
Element: Input factor; labour
Source: Labour organisations; Government
Impact: In Tanzania the government sets the minimum wage level as well as other conditions of employment. These changes are made public through government notices int he local newspapers. The Association of Tanzania Employers gives notice of any such changes to her members. Although private employers are not obliged to follow these changes, most companies do in practice. This is a result from the power of OTTU, the labour union. According to the law every company has to have OTTU representatives on its premises. The influence of these representatives may change from company to company. In general, yearly wage negotiations should take place. Also, a voluntary agreement should be strived at, in which agreements on wages and labour conditions between the company's management and the OTTU representatives are laid down. SJI also has these OTTU representatives on site. Wage negotiations take place annually. SJI always pays at least the minimum wage of the government, which means wage changes will occur once a year. In June 1995 the Tanzanian government has increased the monthly minimum wage from 10,000 Tsh. to 17,500 Tsh.. SJI has adjusted its wage scales to this measure.

Productivity factor: Degree of corruption
Contents: Corrupt practices can make the process dependent on the mood of officials and can increase costs.
Element: Production process
Source: Government
Impact: No real influence noticed for this case study.

Productivity factor: Infrastructure
Contents: This factor concerns both the availability of a good road network and of water and electricity. The former is important for timely supply of inputs to the site. The latter is important for an efficient and timely production process. Bad roads can increase the wear and tear of vehicles and, consequently, the costs of transport. Moreover, they could lengthen the time needed for transport. The state of the road work as well as the availability of water and electricity to the site, should thus both be considered before start of a project and planned for (both in costs and time).
Element: Production process

Source: Government
Impact: No problems were experienced by the Iringa-site with respect to the road network: the TANZAM highway is in a good state. Relatively could transport was available for the project. Sometimes use could be made of air transport from Dar es Salaam. Problems were experienced though with water and electricity supply. There was no water in the main line. Water had to be collected with trucks in the Ruaha river, transported to the site and stored in water tanks. Moreover, the voltage of the electricity was too low, causing problems with the running of computers and the fax. This was solved by using generators during working hours. No cooperation was experienced from Maji water) and TANESCO (power), both government organisations, in solving these problems.

Productivity factor: Government measures
Contents: Quickly changing measures and regulations and/or unclearness in the exact contents and implications of these measures / regulations may cause delays in the production process.
Element: Production process
Source: Government
Impact: On the VTSC-project confusion existed at the start of the production phase whether or not the exemption of import duties and sales tax also applied to the subcontractors. Moreover, the government changed the income tax levels two months in a row. The change had a negative effect on the labourers' wages, causing unrest among these labourers.

Productivity factor: Degree of skills and knowledge
Contents: Lack of skills and knowledge among labourers requires extra training on the site. In case the required training is not (totally) planned for, it may result in a longer production process than anticipated. This negatively affects the site productivity level.
Element: Input factor: labour, subcontracting; Production process
Source: Education institutes
Impact: The degree of skills and knowledge among labourers from Iringa was experienced as very low. Skills and knowledge were experienced as lower than in Dar es Salaam. On-the-job-training and learning-by-doing was necessary for many construction activities. This required extra time. The foremen and a few fundi's came from the Sheraton site. They spread their knowledge among the less skilled workers. This limited the effect of the low skill and knowledge level among local labourers. However, for achieving the required quality level continuous supervision was needed.

Productivity factor: Availability skilled labour
Contents: This factor has influence on the amount of training needed, the amount of supervision needed and the number of people which are available for transfer of skills/knowledge on unskilled labourers. These three aspects again have influence on the progress and quality of work during the production process. Low quality may result in rework, affecting the costs of direct inputs involved in the work as well as the output, since the same amount of work has to be done twice.
Element: Input factor: labour, materials, equipment, subcontracting; Production process
Source: Education institutes
Impact: Availability of skilled labour in Iringa is experienced as very limited. For example, people claim to be carpenter, but have no skills what so ever. This requires extra training and more than expected/planned. For the recruitment of skilled and unskilled labour the project management depended on the local foremen, who had more knowledge of the Tanzanian situation and the situation in Iringa in specific.
The availability of skilled labour from Dar es Salaam was limited due to the Sheraton project going on at the same time.

Productivity factor: Availability qualified supervision
Contents: Adequate supervision, both qualitatively and quantitatively contributes to an efficient and effective process. It can prevent any of the problems mentioned under the productivity factors 'Degree of skills and knowledge', 'Availability skilled labour', 'Wastage of materials', 'Knowledge how to use equipment'.

Element: Input factor: labour, materials, equipment, subcontracting; Production process
Source: Education institutes
Impact: The foremen on the Iringa-site had the following education / experience:
Mason foreman: Dar es Salaam Technical college, 7 years experience (DSM, Morogoro); Carpenter foreman: Bagamoyo technical school, 11 years of experience; Carpenter foreman: Dar es Salaam technical school, 5 years experience; General foreman: technical secondary school; 20 years of experience at SJI. The supervisors / managers had the following experience:
Assistant site manager: Lower secondary school, educated as carpenter and joiner in Denmark, several years of experience in carpenting. Works in Tanzanian since 1991; Project manager: educated as civil engineer in Denmark. Working experience since 1990; working as production manager at SJI-Tanzanian branch since 1993; Structural supervisor: 9 years of experience on construction sites in Tanzania and other African countries.
The number of foremen and supervisors versus the amount of labourers on site diminished during construction time. This is schematically depicted in figure O.5 in appendix O. Both by the project management and by the consultant's representative on site the number of supervisors was considered insufficient. After completion of the Sheraton project an extra expatriate was assigned to the VTSC-project.

Productivity factor: Influence labour organisations
Contents: The degree of influence of the labour union determines the position of labourers vs. management and consequently the level of wages and labour conditions. These latter two aspects directly affect the site productivity level. Moreover, a strong influence of the labour organisations may result in, for example, strikes, delaying the production process.
Element: Input factor; labour; Production process
Source: Labour organisations
Impact: See for general information productivity factor 'changes in labour costs' and 'labour conditions'. Impact of labour organisations on Iringa site is experienced by the project management as very low. Influence OTTU not as big as in DSM.

Productivity factor: Strikes
Contents: Strikes can cause serious delays in the production process.
Element: Production process
Source: Labour organisations
Impact: No strikes occurred on the VTSC-project. According to a SJI employee in the branch office, occupied with labour matters, strikes are not a common phenomenon in Tanzania. The same employee mentioned the fact that OTTU calls upon the labourers on the site and informs them about matters, as reason for this 'strike-less' situation. According to this same employee no strikes occurred at SJI for the past several years. However, a newspaper article revealed that on the Sheraton project a strike did occur (January 1995).

Productivity factor: Change in material prices
Contents: Changes in the prices of materials directly influences the site productivity level.
Element: Input factor: materials
Source: Material suppliers
Impact: This factor had a strong influence on the VTSC-project. Materials were experienced as the most uncertain cost factor. For example: cement: tender price 2600 Tsh. / bag (August 1994); price August 1995 3850 Tsh. / bag. Especially since cement is a crucial material, used in large quantities, this price increase had a considerable influence. The strong price increase only concerned *local* materials. For imported materials contracts were used containing fixed prices.

Productivity factor: Quality of materials
Contents: If a too low quality (that is: a quality level which is not satisfactory in light of contract requirements)is established by the consultant with respect to the materials used on site, the

contractor is obliged to purchase new materials. The extra costs have to be paid by the contractor. The progress of the production process is also affected by this quality level, since the purchase of new material takes time, which most likely will not have been planned for.
Element: Input factor: materials; Production process
Source: Material suppliers
Impact: This factor only applied to the VTSC-project for local materials. A bad cement quality caused a delay of 6 weeks. Moreover, new cement had to be bought, increasing the total costs for this material. Also the quality level of aggregate obtainable within the Iringa region was sometimes too low.

Productivity factor: Reliability supply
Contents: Whether or not a supplier delivers the right quantity on the right time determines to a certain extent the progress of the production process.
Element: Production process
Source: Material suppliers; Equipment suppliers
Impact: During the VTSC-project it proved to be very hard to make an agreement with local material suppliers. Delays in the supply of imported materials were only experienced during the beginning of the project due to delays in the clearing of these materials. For the supply of imported materials SJI depends on its foreign head office, which has an extensive network abroad. See also productivity factor 'import of materials'.

Productivity factor: Availability materials
Contents: When planning a project it has to be considered when and where the materials needed can be obtained. Delivery times have to be planned for, especially in the case of imported materials. If not, this may result in delays in the production process.
Element: Production process
Source: Material suppliers
Impact: In the case of the VTSC-project many materials and products had to be imported according to contractual arrangements. See further also productivity factor 'import of materials'. Sometimes sand and aggregate were available in small quantities only, but overall this has not caused delays on site. The availability of local materials also depends on the productivity factor 'Knowledge where to buy materials'.

Productivity factor: Change in equipment prices
Contents: Changes in equipment prices include changes in rental rates, changes in fuel prices, changes in prices of spare parts etc.
Element: Input factor: equipment
Source: Equipment suppliers
Impact: On the VTSC-project equipment was supplied by the equipment department. Internal rental rates were used. Changes in the local rates of this equipment department are based on changes in fuel prices; changes in foreign rates take place every 12 months and are based on price increase of spare parts and material costs. On the VTSC-project, fuel was not supplied by the equipment department, but bought by the project personnel itself. A direct influence was experienced from the increase in fuel prices. The tender price for fuel was 240 Tsh./l. (August 1994). A year later the price was 300 Tsh./l. However, the amount of equipment on site was much less than anticipated, limiting any effect of an increase in the equipment prices, caused by whatever factor.

Productivity factor: Quality equipment
Contents: When the quality of the equipment used on site is low, it may result in break downs. See also productivity factors 'availability of spare parts' and 'maintenance'. The site productivity level may be affected through delays in the production process.
Element: Production process
Source: Equipment suppliers
Impact: See productivity factor 'maintenance'. The VTSC-project used internal

equipment. It was not possible to look into detail into the quality of this equipment and the effectiveness and quality of the maintenance activities of the equipment department at SJI. However, the list of SJI equipment in appendix L shows that most equipment is relatively young. Moreover, the project management did not indicate any problems with the initial quality of the internally rented equipment on site. Due to the limited availability of equipment form the equipment department, the site sometimes had to rely on other, local sources of equipment. Items from these sources were experienced on the Iringa-site as having a relatively low quality.

Productivity factor: Availability equipment
Contents: Equipment needs to be available on time in order for the production process to run without delays. See also productivity factor 'Availability of materials'.
Element: Production process
Source: Equipment suppliers
Impact: The VTSC-project experienced a limited availability of equipment due to: - equipment being employed on other project; - equipment had to be shared with the Mbeya site. In several cases the limited equipment led to shortages. For example: a delay of ten days was experienced in making the first floor slab of the workshop. Especially items such as formwork and scaffolding were lacking. These items were very needed for many construction activities.

Productivity factor: Availability of spare parts
Contents: A lack of spare parts in case equipment breaks down can cause delays in the production process.
Element: Production process
Source: Equipment suppliers
Impact: This factor has been a problem on the VTSC project. It caused delays. Some equipment was wrongly used by labourers, causing very unlikely break-downs. In Tanzania little spare parts are available on direct basis, especially not specialty items. SJI has to obtain most of her spare parts from Denmark. This, however, brings with a relatively long delivery time. Since breakdown in general is not anticipated nor planned for, this factor in general will clearly affect the site productivity level.

Productivity factor: Interest level / Loan conditions / Availability finance
Contents: All three productivity factors can delay the production process. They can hinder adequate financing of the work on site.
Element: Production process
Source: Financiers
Impact: The VTSC-project depended for its cash flow on the Sheraton project. Delays in client's payments on this project caused some cash flow problems on the VTSC-project. Overall, SJI arranges its finance through the foreign head office. For running costs a local account is available.

Productivity factor: Environmental conditions
Contents: Contains all factors which occur due to certain climatic or geographical conditions in the environment of the project. For example, heavy rains can delay the progress of the project. Certain soil conditions can require special measures for heavy equipment, increasing the costs related to the use of this equipment. Strong wind can cause accidents among labourers and should thus be accounted for on time, for example, by stopping the work or by providing shelter. Rain and wind can also affect the materials stored on site. An adequate storage system will be needed.
Element: Input factor: labour, materials, equipment; Site; Production process
Source: Environment
Impact: Hardly any influence of rain, although expected. Not planned for in time schedule (competitive reasons). Process extra vulnerable because of this. When rain had been more

severe it could have caused unanticipated delays. According to monthly reports of the project and assistant site manager, they tried to solve this by working overtime on free days in advance. A positive influence was experienced from the soil conditions on the Iringa-site. The soil proved to be much stronger than expected: it was possible to dig in vertical direction without needing shutters. This caused a saving on equipment cost for this construction activity. Strong wind was experienced sometimes, making work on top floors and roof risky sometimes.

Productivity factor: Size of building site
Contents: The size of the building site has an influence on the easiness of control over the site activities and the number of people which have to be involved for this purpose.
Element: Site
Source: Environment
Impact: The site in Iringa was relatively compact. However, the fact that several buildings were worked on at the same time negatively affected the controllability of the site. In Mbeya, the site was much bigger and control more difficult. Here, it was difficult to determine the precise number of labourers on site, or hours a machine had been used etc. The foremen on this site tended to state a higher number of labourers than was the case in reality. In this case they could pocket the extra wages paid. Due to a lack of supervisors these practices were hard to control by the project management.

Productivity factor: Vulnerability site
Contents: The vulnerability of the site has to do with its vulnerability to theft and certain weather conditions (e.g. wind) etc.
Element: Site
Source: Environment
Impact: With respect to theft the site in Iringa was very vulnerable. Little attention was given to this at the start of the production process. With respect to weather conditions, like wind, the site was fairly protected by surrounding buildings.

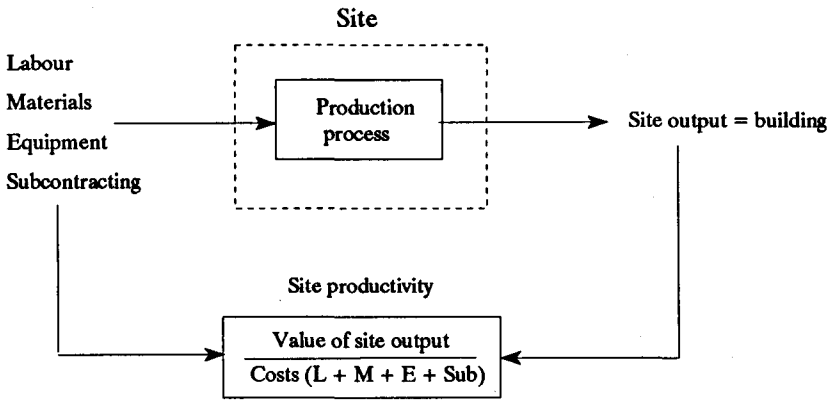
Appendix **P**

The productivity elements on the VTSC-project

P.1 Introduction

In chapter 2 the basic productivity concept has been applied to the production process on a construction site. This can be summarised as done in figure P.1 below.

Figure P.1 Site productivity



In this chapter the productivity elements of figure P.1 are reviewed for the Iringa-site of the VTSC-project. This is done by considering the characteristics of each of the productivity elements as applicable to this site. First however, a brief presentation of the VTSC-project provided.

P.2 The VTSC-project

In box P.1 basic data concerning the VTSC-project are presented. The project is part of the development programme of DANIDA, a Danish development organisation, which aims at improving the vocational training facilities in Tanzania. DANIDA acted as a client during the entire project. Funds were made available by the a foreign donor (Royal Danish Embassy). Also the consultant and the two subcontractors concerned foreign organisations. The consultant made use of a local architect (ARDHI-institute).

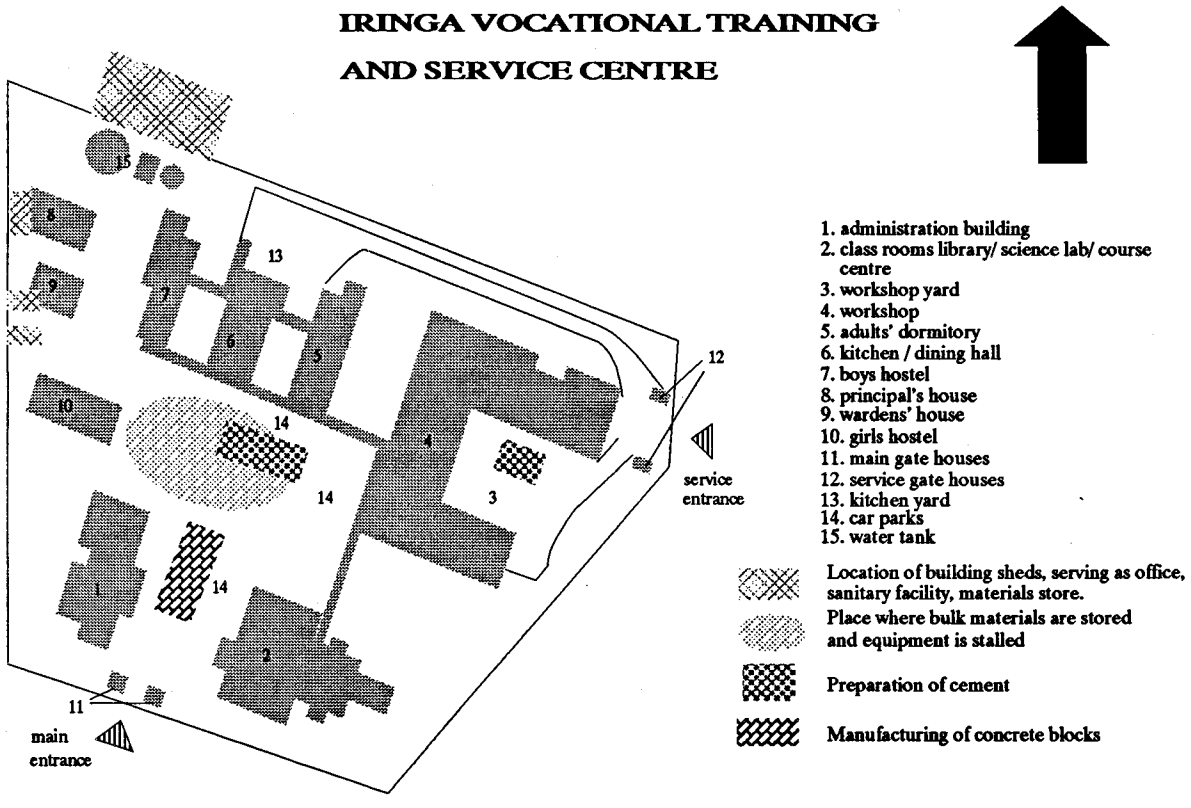
Box P.1 Basic data on the VTSC-project

Project:	Rehabilitation and construction of Vocational Training Centres in Iringa and Mbeya
Main contractor:	Skanska Jensen International
Client:	DANIDA Vocational Training and Support Programme
Funding agency:	Royal Danish Embassy
Recipient:	Ministry of Labour and Youth Development
Consultant:	COWIConsult in association with ARDHI Institute (Architects)
Subcontractors:	ICIL (electrical works) / MMK (elevated steel tank)
Contract value (awarded):	31,139,563 DKK (100% paid in foreign exchange, 1 DKK = 83 Tsh.)
Construction period (awarded):	14 months

P.3 The site output

The site output in Iringa is a Vocational Training and Service Centre (VTSC). This centre consists of several buildings, as presented in figure P.2 below.

Figure O.2 Plan of Vocational Training and Service Centre in Iringa



The administration building, the class room complex, the workshop, the boys hostel and the adults' dormitory all have one floor. The course centre hostel, dining hall, boys hostel, workshop complex and class room complex are linked via covered walkways. The total area built is approximately 3,400m².

Enclosure I at the end of this appendix contains a photo presentation of the (unfinished) works, which will give more insight into the scope and character of the work.

P.4 The site[1]

Figure P.2 in the previous subsection also gives an indication of the site lay-out during the production process. The total site area amounts to, approximately, 12,363 m^2. As said, the site is located in Iringa town. Iringa is situated in the Southern Highlands, approximately 500 km. south-west of Dar es Salaam. The town is situated at 1560 m., on the ridge of an escarpment. This escarpment borders the Ruaha valley, named after the Ruaha river which runs through it.
Iringa can be reached by road and by air. The most important road from the viewpoint of SJI and the VTSC-project, is the TANZAM highway, passing Iringa town through the Ruaha valley. This road is in a relatively good state, especially compared to other roads in the country. This is an important factor considering the frequent transport which was needed between Dar es Salaam and Iringa.

Iringa has two different seasons. The period from May to November is a dry period; the period from December to April is a rainy season. On construction projects this rainy period should certainly be considered when preparing the project's time schedule. The harsh rains can have a serious delaying effect on the construction work on site. The average rainfall per annum amounts to 750 mm. The average temperature in Iringa is relatively low: 19° C. This relatively moderate climate is a positive factor compared to, for example, Dar es Salaam and can have a effect on the speed of work of labourers.

The current population of Iringa amounts to 110,000, of which 53% female and 47% male. The majority of the people finds its subsistence in the agricultural sector. The industrialisation has been limited so far. Very few people are employed in the formal sector: approximately 20%. The largest formal sector employer is the government. The informal sector employment consists of craftsmen, artisans and small-scale traders. Several educational facilities are available in Iringa town, among which primary schools, secondary school, and institutes offering advanced vocational training. Despite these, the project management on the VTSC-project experienced the skill and knowledge level among local labourers from Iringa as limited compared to Dar es Salaam.

The availability of building materials and equipment is very limited in the Iringa region. Some small shops can be found in Iringa town. These shops only sell small equipment items, such as tools. According to the management on the VTSC-project many of the items sold by the shops are of a low quality level. Still, the project had to rely on these items on several occasions, since not everything could be obtained from Dar es Salaam on short notice. Materials bought in the region only concerned sand, and aggregate. Some treated timber was also bought locally, but relatively far away from Iringa, due to a low quality of timber in Iringa town. Due to contractual arrangements most materials had to be imported. This considerably limited the effect of the lack of locally materials on the work going on on site.

Iringa town is connected to the national power grid. The VTSC-project experienced problems with the power supply, especially due to a too low voltage. The project relied on generators most of the time. The water supply system in Iringa has a lack of capacity. SJI therefore collects water from the Ruaha river, using water tanks on trucks and storing it on site. In both cases the responsible local authorities did little to change the situation, despite promises.[2] Due to a lack of tanks as well as water trucks on

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1 Part of the data presented here are taken from: Dalen, A. van. *Analysis of the provision of economic infrastructure, related to industrialisation, in large regional towns in Tanzania.* 1996, p.71-72.

2 Based on minutes of site meeting between consultant and contractor in May, June and July 1995.

site the water shortage had its effect on the concrete works going on at site: only one place at a time could be provided with water for conditioning of the concrete.

P.5 The production process

As written in chapter 4, the framework within which the production process takes place, partly depends on how the process functions have been executed until the start of this process. For the VTSC-project it was not possible to thoroughly evaluate all these process functions. At the time this research started, the production process was already seven months under way. The initiative, design and tender phase, as well as part of the construction phase had already been completed. Still, during the production process a rough impression could be obtained on some concerning some of the process functions.

P.5.1 The design phase

Several mistakes occurred in the drawings of the consultant's architect. In some cases this led to delays in the production process and even wastage of direct inputs, both negatively SJI's site productivity performance. The extra costs could not be claimed with the client, since according to the contract SJI was obliged to prepare working drawings before starting any construction work. Only after approval by the consultant work could start. SJI did not always follow these procedures.

P.5.2 The tender phase

During the tender phase SJI stated to have experienced relatively much competition from foreign contractors. This has had its effect on the tender sum and construction period offered by SJI. According to several people involved in the project these were unrealistic considering the circumstances under which the project had to take place.

In general, the tender phase results in the signing of a contract by both the client and contractor. On the VTSC-project a stipulated lump sum contract was used. Under such a contract it is in the best interest of the contractor to install a cost control system. This will enable him to economise on the (direct and site) costs of the direct input factors as much as possible and, in this way, optimise his profit margin and site productivity level.

The conditions of contract under which SJI works on most of its projects are the FIDIC conditions.[3] The general conditions of this contract comprise several clauses which are important in view of cost control by the contractor. Box N.1 contains clauses which clearly indicate the need for accurate cost control on site when working under this type of contract. Moreover, the clauses show that this cost control has to be accurate and timely, and that it has to include causes of possible cost deviations for the purpose of submitting effective cost claims. Under a fixed contract such claims are the only way for the contractor to cover unanticipated costs (and thus to still realise the estimated site productivity level). Therefore, knowledge of contractual procedures is important from the viewpoint of site productivity.

[3] FIDIC = Fedération Internationale des Ingenieurs-Conseils.

Box P.1 Clauses regarding cost aspects on construction projects

Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any Clause of these Conditions or otherwise, he shall give notice of his intention to the Engineer, with a copy to the Employer, within 28 days after the event giving rise to the claim has first arisen.

Upon the happening of the event referred to in Sub-Clause 53.1, the Contractor shall keep such contemporary records as may reasonably be necessary to support any claim he may subsequently wish to make. Without necessarily admitting the Employer's liability, the Engineer shall, [....], inspect such contemporary records and may instruct the Contractor to keep any further contemporary records as are reasonable and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer to inspect all records kept pursuant to this Sub-Clause and shall supply him with copies thereof as and when the Engineer so instructs.

Within 28 days, or such other reasonable time as may be agreed by the Engineer, of giving notice under Sub-Clause 53.1, the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which t he claim is based. (...).

Source FIDIC (1987), p. 24-25.

On the VTSC-project two cost claims were found to be submitted too late to the consultant, negatively affecting the actual site productivity level. Cause of this was that information needed for the formulation of the claim was submitted too late by the project management to the branch office.

P.5.3 The construction phase

With respect to the construction phase attention is paid to technical aspects and organisational aspects.

P.5.3.1 The construction method

The construction method used is the same for all buildings: a framed structure of reinforced concrete columns, beams and wall infill of concrete blocks. The blocks are 190x190x290 for load-bearing walls (thickness 190 mm) and 90x190x190 for non-load-bearing walls (thickness 90 mm). The roof structure consists of trusses made on site from treated soft wood. Profiled galvanized iron sheets, imported from Denmark, are used for the roof finishing.
Inside plaster finish is used on all concrete block walling, columns, beams and concrete ceilings. The first layer consists of 12 mm cement/sand (1:4). The second layer consists of 3 mm cement lime putty (1:5). This plaster finish is steel trowelled. Ceilings are finished with gypsum board or soft board. For the outside surfaces (brick and concrete walling) tyrolean rendering is used. The first layer consists of 12 mm cement/sand (1:4), the second one of 5-10 mm cement and washed sand (1:4). This rendering is sprayed on the surfaces. All paving is done with a sand-cement mixture.
In enclosure II at the end of this appendix the time schedule of the project has been included which indicates the sequence of construction activities on site.

Most of the work was done by manual labour. Only very limited equipment was used. A truck with crane was used to transport the roof trusses from the ground to their required position. For concreting work, 5 concrete mixers were available. The concrete mixers were operated manually. For transport of the concrete from the mixer to the casting place, three dumpers were available. For large concrete works the concrete was casted, using a concrete pump hopper and the truck with crane. Furthermore, some trucks were available for transport of locally bought materials and water (Ruaha river).

P.5.3.2 The project organisation

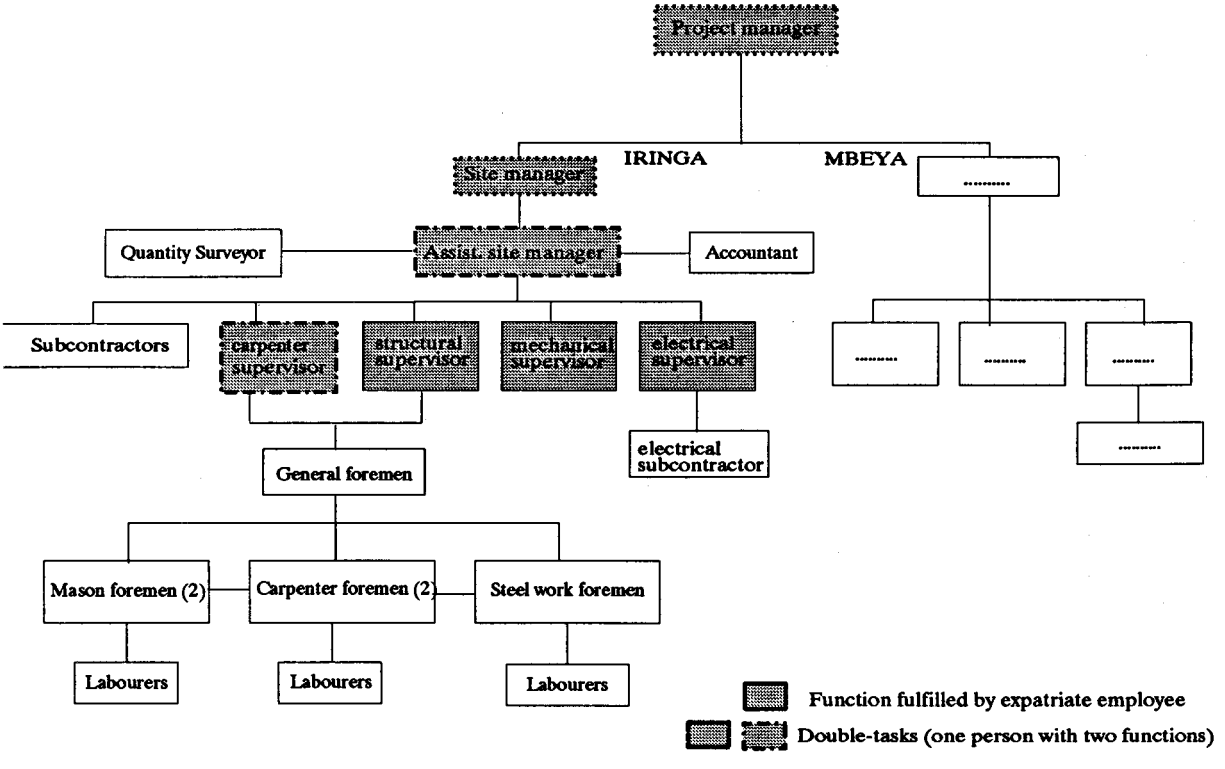
Figure P.3 shows the internal project organisation for the VTSC-project. This chart shows the situation *as planned before the start* of the project. During the project changes have taken place in the organisation structure. First of all, it proved that the mechanical and electrical supervisor were not on site permanently as agreed beforehand. In reality, they were also engaged elsewhere within the company. Second, in month 10 of the project an assistant site manager was assigned on the Mbeya site, relieving the task of the project manager, who - from that moment - could devote his attention more to the Iringa site.

No official task descriptions were available on the VTSC-project. This caused confusion among the project's management at the beginning of the project (based on statements of the management itself). This was strengthened by the fact that some persons are supposed to fulfill two functions (see also figure P.3).

As shown in figure P.3 the project manager had to manage two sites at the same time. Moreover, he had been appointed site manager in Iringa. Since this involves a double task, a separate assistant site manager was appointed in Iringa, who was responsible for the daily management on site whenever the site/project manager was not around. The major tasks included in this daily management are:
- deciding on work to be executed every day, in close collaboration with the structural supervisor;
- preparing time schedules and discussing these with the project manager;
- filling in daily site reports;
- taking care of any problem which may appear on site.

The project manager's main responsibilities are (with respect to both sites):
- the overall performance on the project, that is: progress, cost and quality performance;
- timely ordering and delivery of materials on site;
- reporting to the branch management on the project's performance.

Figure P.3 Organisation structure on VTSC-project



Considering the double task of the site/project manager and the irregular presence of the electrical and mechanical supervisor, this meant that the assistant site manager and the structural supervisor were the *only* permanent supervisors available, now and then assisted by the site manager/project manager. The assistant site manager gave his orders with respect to the work to be done to the structural supervisor, who again gave orders to the general foreman. The general foreman was in charge of 5 common foremen. Also direct communication between the common foremen and the site management could take place, due to an informal and small-scale project organisation. The foremen were responsible for transferring the orders from the site management to the labourers. Their role in this was very crucial: most labourers hardly spoke any English whereas the foreign site management did not speak sufficient Swahili to transfer the orders themselves. The foremen also directly supervised and assisted in the execution of the construction activities, in close collaboration with the structural supervisor.

Meetings with the foremen took place irregularly and in an informal way, despite wishes of the assistant site manager to have a more formal organisation at this point. According to the assistant site manager the Tanzanian foremen are not used to these kind of formal organisation structures. This, and lack of time, were given as reasons why organisational changes at this point were never introduced.

P.5.3.3 Relation between the site and the branch office

For an optimal performance the site depends on:
- its relationship with the various departments within the branch office in Dar es Salaam;
- its position and priority compared to other projects executed at the same time.

Figure P.4 (next page) shows the office departments with their function towards the various projects, including the VTSC-project.

The contract manager has both a controlling/advising and supporting function. The contract manager can give advise to a project manager if considered needed, but eventually the latter remains responsible for the project's performance.

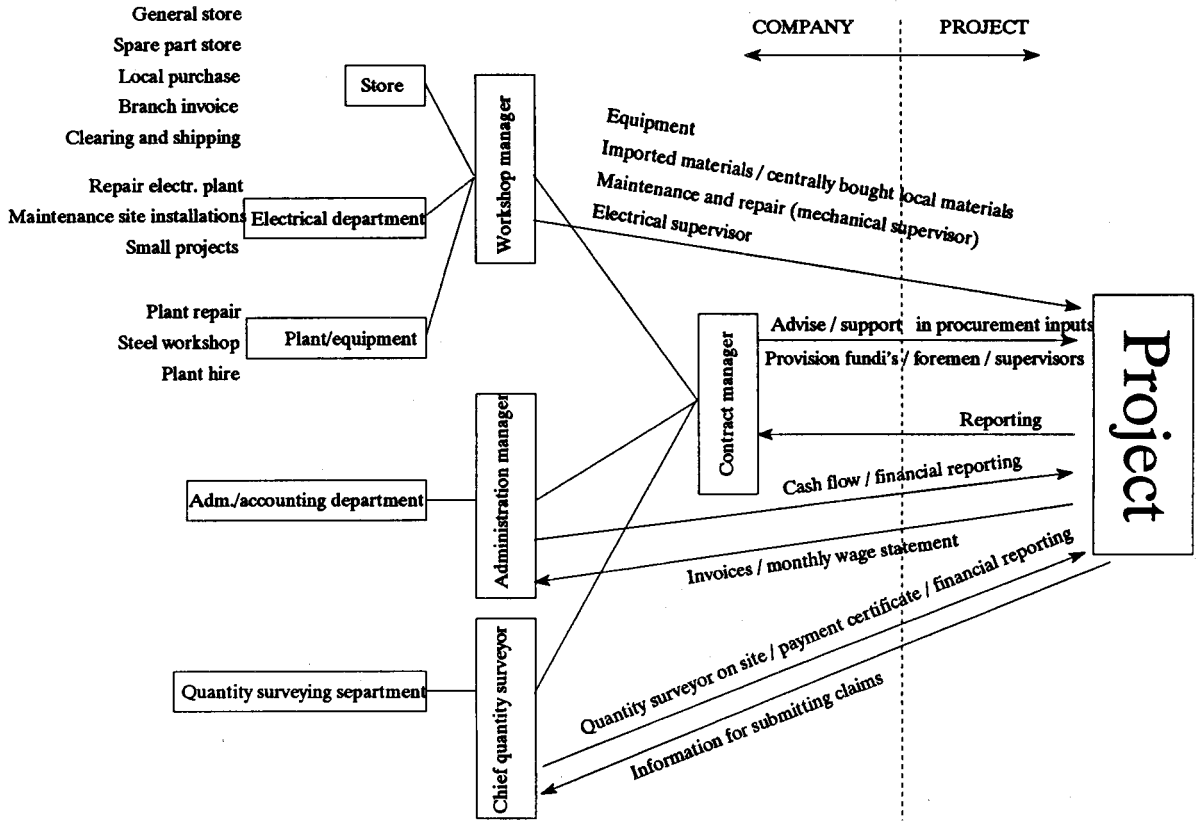
The supporting function of the contract manager concerns his relation with the various office departments as depicted in the figure above, as well as with the foreign head office. In case the site needs certain equipment or materials etc. contact between the departments and the site takes place most of the time with involvement of the contract manager. Since the contract manager has an overall view on the various projects and departments he is the key figure in the allocation of resources among projects.

All materials which are not obtained by the site itself are:
- if locally available, bought by the Local Purchase Officer at the branch office;
- if not locally available, bought through the head office in Denmark.
  In this case the materials are first transported from the harbour to the workshop in Mbagala. From here the materials are distributed to the sites. The store manager is in charge of the shipping and clearing of the imported materials.

On some projects certain building products may be manufactured by SJI itself in its workshop. A special department is established in such cases. Nothing was manufactured internally in the case of the VTSC-project.

Large equipment for the VTSC-project is internally rented from the plant/equipment department, which is part of the workshop. A schedule of when which equipment is needed is submitted to this department before start of the project. This department is responsible for an optimal distribution of the equipment among the various sites. During production on site the plant/equipment department is also responsible for maintenance and repair. A visit to the site by someone of this department is usually paid once a month for check-up of the equipment and determination of the number of hours the various equipment items are used.

Figure P.4 Link between the various departments within the company and the VTSC-project



The accounting department receives all the invoices with respect to the VTSC-project, both from the site itself and from other departments in the office. Each month a financial report is prepared, including all the project costs until that month. This report goes to the administration manager, who distributes it to the general manager, the contract manager and the project manager. All cash flow needed by the management on a project is also arranged through this administration manager.

It was not possible to judge for every department within the office its functioning with respect to the various sites in general and the VTSC-sites in specific. This would have required more time than was available, especially since this judgement would also have to include the functioning of the foreign head office in Denmark.
On the VTSC-project the relation with the various office departments was negatively influenced by the fact that another project of SJI going on at the same time, the Sheraton project, was given priority. The VTSC-project was for its cash flow partly dependent on payments on the Sheraton project. This sometimes caused a lack of money. The Sheraton project also had other impacts on the VTSC-project:

- relatively few skilled labourers and foremen were available during the first period of the project, since most of them were engaged on the Sheraton project;
- the structural supervisor was not available until late January, when the project was already two months started; This means only one supervisor was permanently available during this first time (the assistant site manager), assisted by the project manager.
- the Sheraton-project was given priority in clearance of materials etc. from the harbour, causing some items to arrive late on the VTSC-project;

- not all equipment and plant needed for the VTSC-project was available on time and sometimes not at all, because it was occupied on the Sheraton project;
- little attention was given to problems occurring on the VTSC-project, both by the branch office and the foreign head office.

These problems provide a first insight into which areas deserve attention in the improvement of the functioning of the office departments towards the sites.

P.6 The direct input factors

In this section the direct input factors as used on the VTSC-project are presented. Included in the presentation are the characteristics of each input factor, the costs involved and to what extent certain characteristics may affect the total costs of the input factor. However, first insight is provided into the share of the costs of these direct input factors within the tender sum of the VTSC-project (see table P.1).

Table P.1 Structure of costs on the VTSC-project

Cost item	Share in (direct + site costs) (%)	Share in total tender sum (%)
A.		
Basic tender cost (= direct costs)	75.4	58.3
Labour	*1.6*	
Materials	*52.6*	
Equipment	*4.6*	
Subcontracting	*16.6*	
B.		
Oncost I (e.g. temporary facilities, camp, site administration etc.)	14.1	10.9
C.		
Oncost II (e.g. all costs of expatriates)	10.5	8.1
(B + C) = indirect costs		
Direct costs + indirect costs (A + B + C)	100	77.3
D.		
General project costs (e.g. retention bond, performance bond, taxes, insurances)		13.1
E.		
Company costs (overheads branch office + foreign head office)		4.2
F.		
Risk		0.8
G.		
Profit margin		4.6
Total (=tender sum)		100

Source Summary of tender - VTSC-project Iringa/Mbeya.

NOTE: According to Gobourne (1980) 'oncost' refers to those costs incurred by the use of direct input factors which cannot be directly attributed to the production on site.

It should be noticed that the percentiles in this table are based on the costs of the *entire* project, that is for the Mbeya and Iringa site *together*. Separate cost overviews for each of the two sites were not available. However, the only interest here are the type of costs and their share in the total costs. It may be assumed that these also apply to each separate part of the project.
The grey part of the table covers the costs as they are to be included in the site productivity concept (see also appendix C). The basic tender costs represent the direct costs incurred by the use of the direct input factors. Oncost I and II together form the indirect costs, incurred by the use of the same input factors.As shown in table P.1 the labour component has a relatively very small share in the total direct costs (1.6%). This is due to the relatively low wage level in Tanzania. The equipment component also has a small cost share (4.6%), due to the labour-intensive equipment method used on the project. Materials have a relatively large share in the total direct and site cost (52.6%). The subcontracting component also has a considerable share in the total direct and site costs (16.6%), of which the largest share comes from the electrical subcontractor. The table also shows that the direct and site costs together make up 77.3% of the tender sum. This shows the relevancy of control of these costs.

P.6.1 Labour

Direct labour on the VTSC-project included both skilled and unskilled labourers. With respect to the former a severe shortage was experienced. First of all, due to the overall lack of skilled labour in Tanzania. Second, the level of skills of labourers from Iringa was experienced as even lower than in Dar es Salaam (based on opinion project management). Third, a lot of permanently employed skilled labour of SJI was employed on another project (the Sheraton project). A few skilled people, including some foremen could be recruited from Dar es Salaam. Due to the lack of skilled labour unskilled labourers had to be trained for skilled jobs.

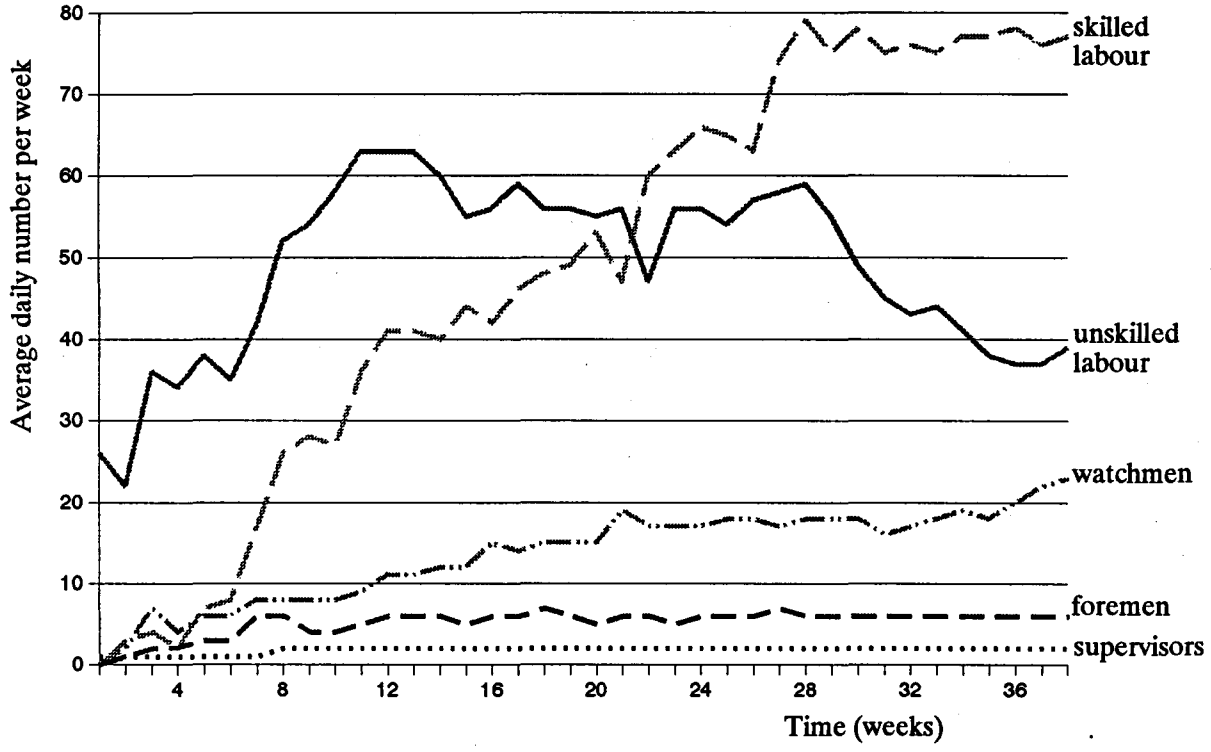
Indirect labour on the VTSC-site included:
- supervising personnel: foremen, supervisors/managers,
- administrative personnel: accountant, time keeper, store keeper, quantity surveyor, secretary,
- supporting personnel: cleaners, watchmen, drivers.

Figure O.5 shows the average daily number of skilled and unskilled labourers per week for the VTSC-project. Unskilled labour was used for excavation and concreting jobs, explaining its dominance over skilled labour during the first part of the production process. In later stages of the project the work required more skilled labour. Moreover, the number of skilled labour was higher at that time due to on-the-job training of unskilled labourers. Little control was exercised over the number of labourers on site due to the low wage costs involved. However, an increase in the amount of labour should be accompanied by an increase in the amount of supervision. Figure P.5 (next page) shows that this was not the case for the VTSC-project. Overall, the proportion supervisors : foremen : labourers varies from 1 : 3 : 40 in the first eight weeks (start-up phase) to 1 : 3 : 65 in a later stage of the project.

Remarkable in figure P.5 also, is the steady increase of watchmen during the period concerned. It proved that the Iringa site suffered severely from theft of materials. Moreover, it proved that the most skilled workers were involved in this theft. From the viewpoint of the labour costs, this factor had the following consequences for the actual site productivity level:
- increase in labour costs due to recruitment of extra watchmen,
- delays and consequently cost increases, due to extra training needed by labourers who were employed to replace the skilled labourers dismissed for theft.

Considering the characteristics of labour in Tanzania in general and on the VTSC-project in specific, the ratio labourers : foremen : supervisors is not very optimal. This judgement can be supported by several factors. First of all, a gap existed on the VTSC-project between the high-skilled -foreign- supervisors on the one hand and the low-skilled -local- labourers on the other. This gap was partly formed by the language difference. The supervisors / managers were not or hardly acquainted with the Swahili language, whereas the knowledge of English among the labourers was also very limited. This language gap was bridged by the English-speaking, Tanzanian foremen. Another factor causing the gap was that most labourers, as well as some foremen, did not understand the technical drawings as

Figure P.5 The daily average number of labourers, foremen and supervisors on site in Iringa



Source Daily site reports VTSC-project 5-12-1994 until 25-8-1995.

prepared by the consultant. This is one reason why it is important that the contractor prepares working drawings, which it can use in the communication with the foremen and labourers.
Other factors having influence on the 'supervisor/foremen/labour' ratio on site concern the average quality of the Tanzanian labour available on the VTSC-project. The following main problems were experienced by the foremen and supervisors with respect to the labour component:[4]

- *low average skill level / inadequate availability of skilled people*
  The labourers from Iringa were found to have a lower skill level than labourers in Dar es Salaam. A few skilled labourers and foremen were therefore taken from Dar es Salaam, but their availability was, as indicated before, also limited. The skilled people were used to spread knowledge among the less-skilled. Much on-the-job training was needed, which required extra people and time. The work to be executed had to be clearly explained and shown. And even then close guidance and monitoring was still needed to make sure the work was performed as required by the consultant/client.
- *low motivation.*
  The motivation among labourers was experienced as relatively low. Earning a living is the main motivation. Little to no specific dedication to construction work was experienced (with a few exceptions). Even the bonus system proved to have its limitations. For example: a few labourers agreed to do overtime on a Sunday, paid at overtime level plus one extra hour. On the specific day

[4] It is acknowledged that the judgment of the foreign, western-oriented supervisors may be influenced by their experience with labourers in developed countries, whose attitude, caused by various environmental factors, may be very different from those in developing countries. In fact, a difference in attitude and values showed sometimes between the foreign management and the local labourers. However, the foremen, of Tanzanian origin, mentioned the same problems as the foreign supervisors, which gives the judgments of the latter more validity.

they did not show up. Moreover, the bonus system in general has its limitations, since speeding up the work above a certain limit may affect the quality level of the work executed.

An overview of costs incurred by the use of (direct and indirect) labour can be found in enclosure III at the end of this appendix.

P.6.2 Materials

A contractual clause obliged SJI to use as much as possible imported materials from Denmark on the VTSC-project. Moreover, the materials had to be 100% manufactured in Denmark. Only in case materials were not manufactured in Denmark other origins were accepted. A few selected items (sand, aggregate, cement and treated timber) could be obtained locally (in Tanzania).

The relatively high costs of imported materials compared to local materials affect the cost level of SJI. However, this only plays a role in winning a contract. The relatively long delivery time involved in imported materials

The biggest problem experienced with the material component was the frequent stealing and disappearing from materials stored on site. In subsection 7.5.1 it was mentioned that this problem was caused by SJI's own local labourers. Implications of this on the actual site productivity level were mentioned there. However, the stealing and disappearing of materials also has the following two implications for this actual site productivity level:

- increase in material costs due to purchase of new materials,
- costs of delays in case imported material had to be replaced: the delivery times of, for example, roofing sheets amounted to two months. This caused a delay in the production process.

Cause of the frequent disappearing of materials was a lack of adequate storage methods on site.

P.6.3 Equipment

The entire group of equipment on the VTSC-project comprised:

- large equipment items: e.g. truck with crane, 3 dumpers, 5 concrete mixers, block making machine 2 store containers, 5 office containers, 1 generator, 3 water tanks and 1 diesel tank, 2 trucks (for transport of materials and water); 2 pick-ups,
- auxiliary items: formwork, scaffolding and shutters,
- small equipment items or tools, like trowels, hammers, vibrators etc.

All large items were rented internally from the equipment department. Most small equipment items (except vibrators) were bought locally, in Iringa. Plywood for the preparation of formwork had to be imported. Scaffolding was supposed to come from the equipment department of the branch office. However, due to the priority given to the Sheraton project the scaffolding was not available to the VTSC-project.

Overall, the lack of equipment was responsible for some delays in the production process. For example: it caused a delay of ten days in the preparation of the first floor slab of the workshop. Delays especially mean an increase of the time-dependent site costs and will thus affect the actual site productivity level.

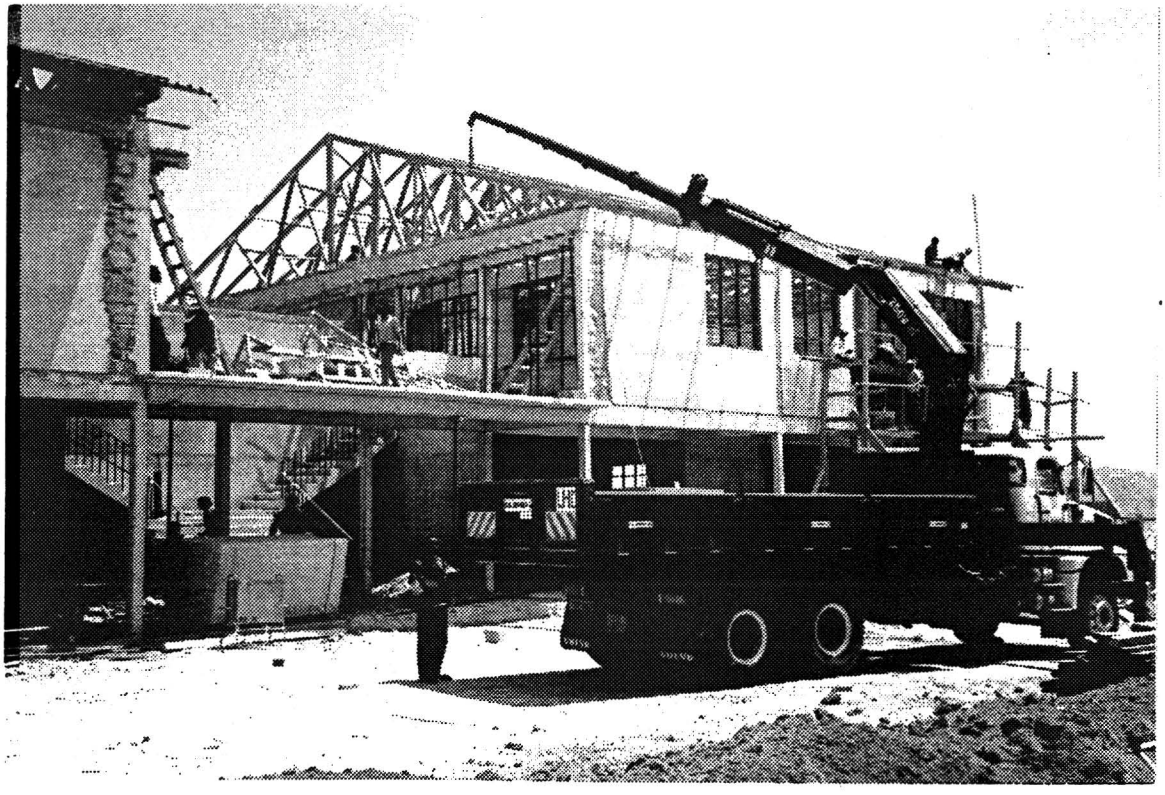
More information on the costs as incurred by the use of equipment on site can be found in enclosure III at the end of this appendix.

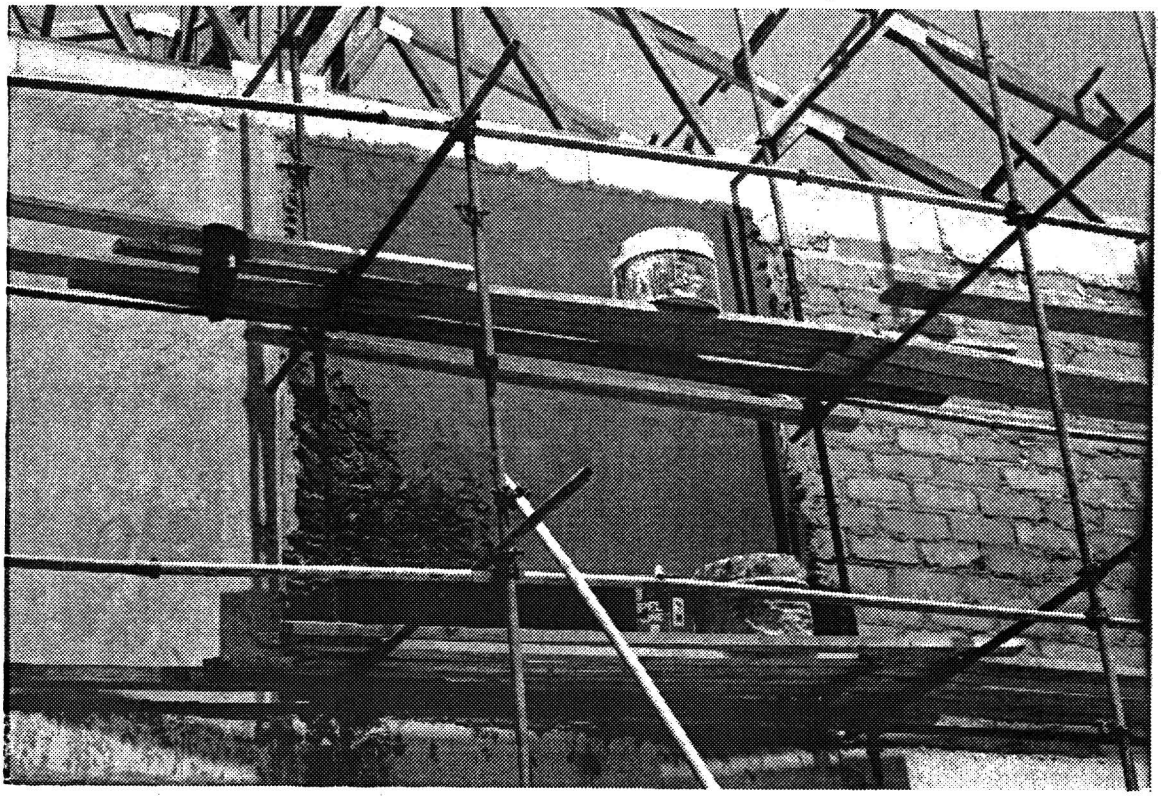
P.6.4 Subcontracting

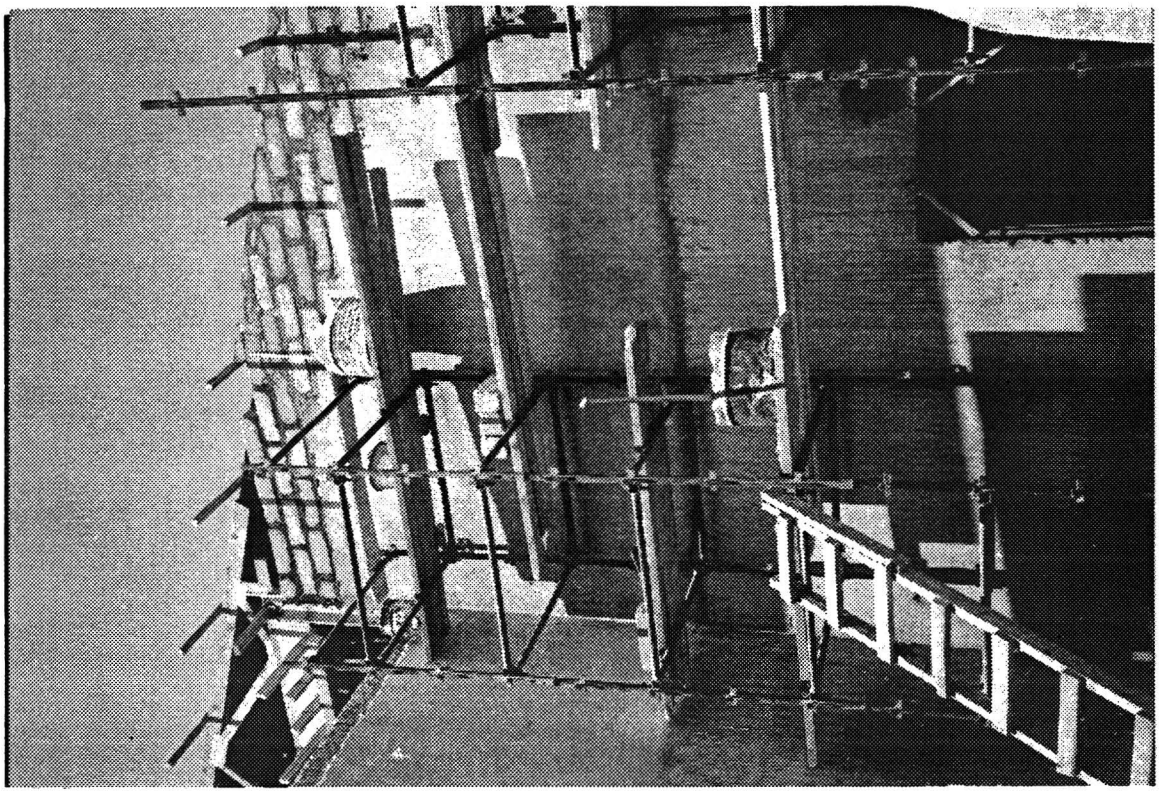
Two subcontractors were used on the VTSC-project: one for the electrical works and one for the elevated steel tank. Both subcontractors were of foreign origin. Their contracts with SJI concerned a fixed lump sum contract. Control of the subcontracted costs by SJI was therefore not necessary. For both subcontractors progress control was more relevant. First of all, to make sure progress did not interfere with the progress of SJI's work and vice versa. Especially with the electrical subcontractor this

was important. Contacts with this subcontractor therefore took place at a regular basis. Secondly, progress control was needed to check on the accuracy of interim certificates submitted by each subcontractor and to make sure that SJI was not making any more costs per month then anticipated. Overall, contacts between the subcontractors' employees on site and the project management of SJI took place in an informal way. No problems were experienced with respect to this direct input factor on the Iringa-site.

Enclosure I Photo presentation of the VTSC-project

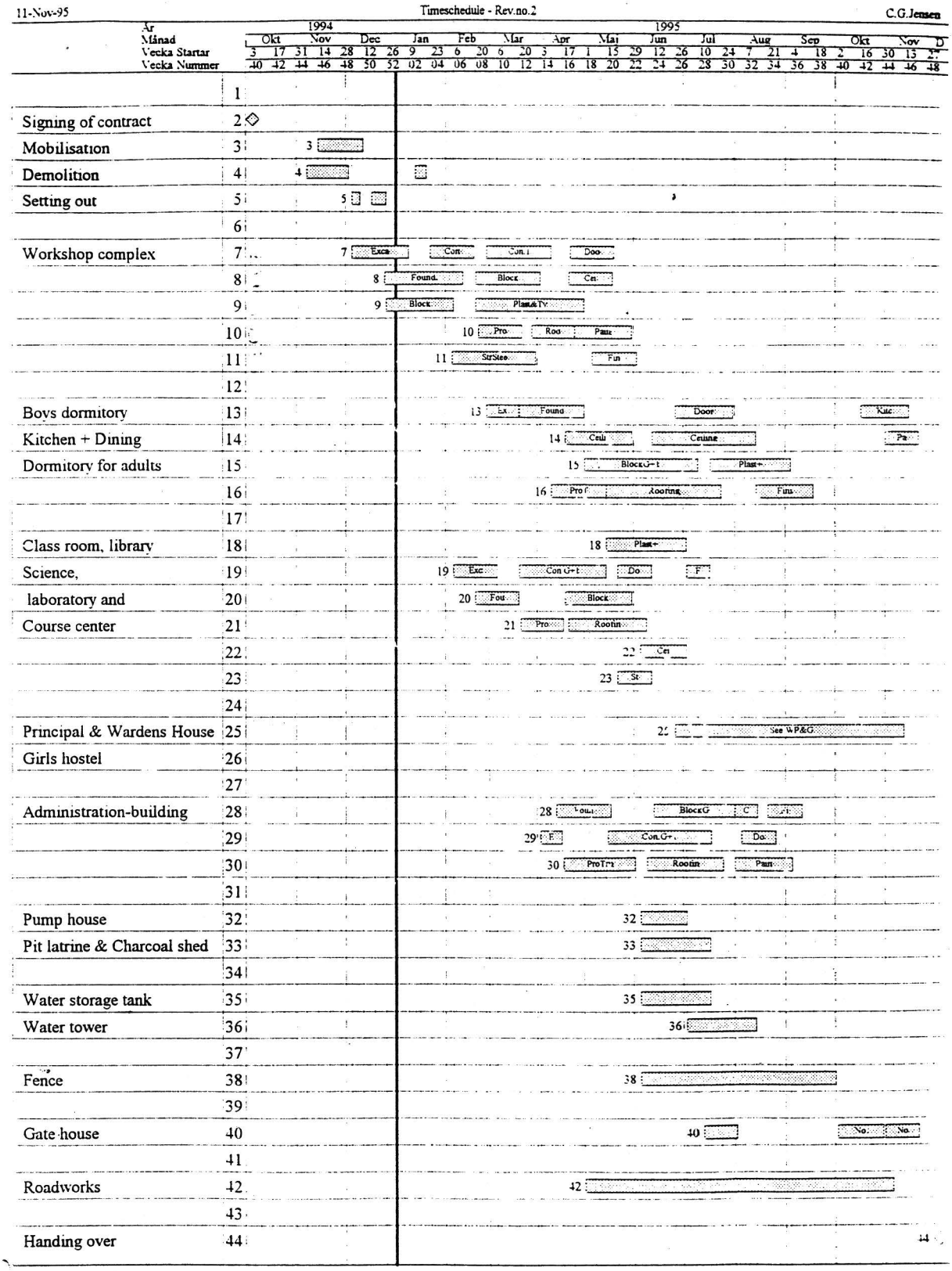






Enclosure II Original time schedule of the VTSC-project, Iringa-site.

VTSC - IRINGA



Enclosure III Costs incurred by the use of (direct and indirect) labour and equipment on building sites of SJI

Local labour component
For both permanent and casual labourers the hourly wage is determined by aggregating items 1 to 4 below:

Basic salary
Nine wage groups are distinguished, each with its own basic wage level. An overview of these groups can be found in table III.1.

Qualified allowance
Paid to the highest seven wage levels only. Changes according to skill level.

Treatment allowance
Meant for compensation of medical costs in case of illness. Fixed amount for all permanent and casual labourers.

Housing allowance
Financial compensation for costs of housing by the employee. Ten percent of basic salary of each wage group.

Items 1 to 4 are summarised in Table III.1 below. As can be seen, nine wage scale are distinguished at SJI. The amounts in table III.1 are the amounts as valid at the start of the VTSC-project in December 1994. The daily rates are obtained by dividing the monthly rates with 26. Public holidays[5] are fully paid. Overtime on normal working days is paid one and a half times the basic salary; overtime on public holidays and during weekends are paid two times the basic salary.

The supervisor on site can decide to pay a bonus. For each wage scale the maximum bonus payable has been fixed. The amounts can be found in table III.1 also. The weekly bonus is obtained by dividing the monthly bonus with 4.

Compared to 1993 the basic salaries have been increased with 25%, except the lowest wage scale which has gone up with almost 43%. This is caused by the fact that this wage group is paid the official minimum wage set by the government. From 1993 to 1994 the government has increased this minimum age from 7,000 Tsh. per month to 10,000 Tsh. per month. Per 01/07/1995 the minimum wage has been set on 17,500 Tsh., in accordance with government measures (an increase of 75%). This has been taken over by SJI as per 01/07/1995.

5 These are January 1, January 12, April 26, May 1, July 7, December 9, December 15 and 26, Eastern 2 days, Idd-ul-Fitr 2 days, August 8, Maulid 1 day. Total public holidays: 14.

Table III.1 Salary scales as valid at SJI per 01-07-1994

Group	Basic Salary	Qualified Allow. Month	Day	Treatment Allow. Month	Day	Hous Allow. Month	Bonus Month	Week
Key personnel, excellent foremen	24,125	8,125	313	2,600	100	2413	10,800	2,700
Other foremen	15,750	7,500	288	2,600	100	1,575	8,400	2,100
Very good skilled	14,125	3,250	125	2,600	100	1,413	4,800	1,200
Good skilled	12,500	2,050	79	2,600	100	1,413	4,800	1,200
Drivers LD + HD without trailers	14,125	3,438	132	2,600	100	1,413	7,800	1,950
HD drivers with trailer - operator	14,125	7,500	288	2,600	100	1,413	8,400	2,100
Workshop	15,750	10,500	404	2,600	100	1,575	8,400	2,100
Labourers	10,300	0	0	2,600	100	1,030	3,240	810
Watchmen, students, other unskilled labourers	10,000	0	0	2,600	100	1,000	3,000	750

Source Accountant department SJI - Tanzania branch

Permanent labourers also are entitled to payment of:

Annual leave
The annual leave comprises 28 days, which are fully paid. An amount of 3000 Tsh. is to be paid every second year as compensation for travel expenses. Labourers working with the company for less than two years are not entitled to this amount of money.

From the gross salary of both casual and permanent employees the following deductions have to be made:
Income tax
The level of income tax is set by the government (Ministry of Finance). Nine income groups are distinguished in the income tax system. Rates applicable as per August 1995 are presented in table III.2 (next page).

Table III.2 Level of income tax as per August 1995

Income tax block	Applicable tax rates
0 - 17,500 Tsh.	NIL
17,501 - 32,500 Tsh.	7.5% of the amount exceeding 17,500 Tsh.
32,501 - 47,500 Tsh.	1,125 Tsh. plus 10% of amount exceeding 32,500 Tsh.
62,501 - 77,500	2,625 Tsh. plus 15% of the amount exceeding 47,500 Tsh.
77,501 - 92,500	4,875 Tsh. plus 17.5% of the amount exceeding 62,500 Tsh.
92,501 - 107,500	7,500 Tsh. plus 20% of the amount exceeding 77,500 Tsh.
107, 501 - 122,500	14,250 Tsh. plus 25.5% of the amount exceeding 107,500 Tsh.
Over 122,500 Tsh.	18,375 Tsh. plus 30% of the amount exceeding 122,500 Tsh.

Source Ministry of Finance, Public Notice on individual income tax rates. Sunday News, Aug. 27, 1995.

National Provident Fund (NPF)
Ten percent of the gross salary is paid to the NPF on a monthly basis. The employer also has to add 10% himself. When the labour engagement is terminated before reaching the retirement age, the pension built up so far is paid to the labourer. This system only applies to private firms. Government organisations and parastatal companies have their own pension schemes.

For permanent labourers the following is also deducted from the gross wage:
Two percent deduction for OTTU (union) membership.

When calculating the wage costs for the employer, deductions of income tax, OTTU membership and NPF should *not* be included.

Other costs involved with the labour component on the VTSC-project include:
Costs of providing lunch for the labourers.
Lunch is provided for two reasons: (1) to make sure that all labourers are on time to start work again, and (2) to make sure the labourers eat sufficiently and healthy. Their state of health can influence their performance on site. This is thus a cost- and time-saving measure.

Costs of temporary facilities for labourers
On the VTSC-project this included toilets only.

In case a labourer is transferred from his original working place to a working place elsewhere in the country, this labourer is entitled to payment of:
Out of station allowance or costs of housing
On the VTSC-project skilled labourers and foremen permanently employed by SJI in Dar es Salaam, were transferred to Iringa for the entire period of the project. The costs of housing for these labourers and foremen were paid by SJI.

In some cases labourers are also entitled to payment of:
Transport Allowance
The employer could also choose to arrange transport facilities himself, in which case no individual transport allowance has to be paid. On the VTSC-project neither of them was paid, since the labourers

all came from Iringa town.

Finally, SJI has to pay:
Vocational Education and Training Levy
This Levy was introduced in 1995 as a financial contribution to meeting the locally identified requirements for skills, training and craftsmanship. The Levy equals 2% of the monthly total gross emoluments payable by the employer to all employees and must be paid at the end of each month.

Payment of this levy takes place on branch office level.

Foreign labour component
As a foreign company SJI employees relatively many expatriate employees, especially on the higher positions. On the VTSC-project the following costs occurred:
Salary costs
This salary is paid in Danish Kroner and put of a Danish account.
Costs of housing, travelling and social costs
These items have to do with all costs made by the expatriate employee during their stay in Iringa.
Training Levy
Ten percent of the total salaries of all expatriate employees working with a company has to be paid monthly to the Tanzanian government. This amount is meant for the training of local people who, in the future, can replace the foreign personnel.

Equipment costs
In section P.6.3 a division has been made into:
- large equipment items, like trucks (with crane), dumpers, concrete mixers, vibrators, (1)
- auxiliary items, like formwork and scaffolding, (2)
- tools, like trowels, hammers etc. (3)

ad (1)
Large equipment items are internally rented from the equipment department. For each item an hourly rate is set. Idle hours, that is hours during which the equipment is not used, but still standing on the site, are charged at a special rate. The rates cover the following major items:
1. Hourly rental rate:

1a. Depreciation
1b. Maintenance and service costs needed on the basis of normal wear and tear of equipment/plant.
1c. Costs of spare parts.
1d. Fuel.
If a project is located relatively far from Dar es Salaam, like the VTSC-project, fuel is bought and paid by the site. In such case fuel costs are not included int he rental rates.
1e. Overhead costs.
These cover all the administration and personnel costs of the plant and equipment department.

The rates for a certain project are flexible. Local rates are adjusted with the percentile increase of the local fuel price. Foreign rates are adjusted every 12 months based on increase of spare parts and material costs.

Other costs to be payed by the site are:
2. Cost of transport to and from the site.
3. Costs of mistreatment and theft.
4. Insurance registration fee
5. Wearing of parts, like cutting edges, teeth etc. on earth moving equipment

ad (2)
Cost of auxiliary items such as formwork and scaffolding are formed by:
- costs of materials needed and,
- costs of labour needed
to prepare the items on site for use.

ad (3)
Tools are bought locally. Costs are formed by sales price of suppliers.

Appendix Q

The 3T-file

This appendix presents the principles of the 3T-file of SJI. The article 'A new way of thinking and building' has been taken from the annual report of Skanska AB, 1992, p. 13. In figure Q.1 and Q.2 the principles of th 3T-file are schematically presented. Both figures have been taken from the original 3T-file, but have been translated from Danish into English.

Think Total Time

A new way of thinking and building

Skanska is implementing the biggest, most far-reaching reform project in the history of the Group: 3T.

The introduction of 3T signifies a new way of thinking and working. Time becomes the focus. Time is the only non-renewable resource.

He who wins time also wins quality and lower costs. This is demonstrated by experienced from American and Japanese industry, among others. Skanska is now introducing time as a control mechanism in the construction industry.

The task of implementing this change affects the entire construction process -from concept to delivery of the final product. Methods as well as materials must be chosen with an eye toward reducing elapsed time.

Working with time as a control mechanism always looking for the fastest way towards one's goal. It also means raising quality, since all tasks must be performed properly from the start.

By utilizing time more efficiently, thus raising quality and lowering a rapidly changing market.

The purpose of 3T is to create the greatest possible value-added for the client, thereby enhancing Skanska's competitiveness. 3T is our tool.

The goal of the Swedish Construction business area is to shorten average production time by one third before 1995 and to turn over the projects to the client with zero defects int he final inspection. Equally aggressive goals have been set by other business areas.

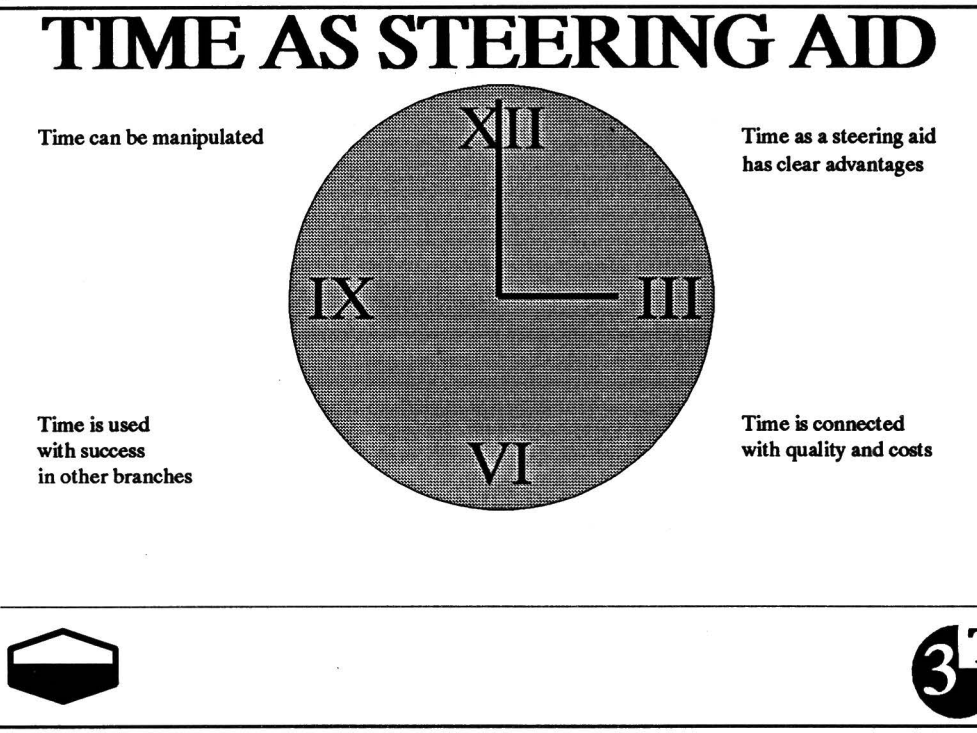
The shift to 3T will be visible at all levels throughout the Skanska Group. An extensive training program will support this process.

Skanska's consultants, suppliers and subcontractors will also be affected by these efforts to bring change.

3T has been developed internally at Skanska over a two-year period. Results from a number of construction projects have already demonstrated that Skanska is on the right path. This has laid the groundwork for a broad introduction of the new concept targeted ti the outside market.

3T is a continuous process. It signifies steady improvements and a transformation of out working methods that is still only just beginning.

Figure Q.1



Source 3T-file, SJI-Tanzania branch.

Figure Q.2

Source 3T-file, SJI-Tanzania branch.

Appendix

R

Incoming and outgoing documents during the tender and construction phase

Figure R.1 Incoming and outgoing documents during the tender phase

Tender phase							
Incoming documents and forms				**Outgoing documents and forms**			
Document / form	Subject(s)	Coming from	Going to	Document / form	Subject (s)	Coming from	Going to
Drawings	Architectural, structural, mechanical and electrical drawings	Consultant	ontractor	Tender	Bill of Quantities Summary of Tender Work programme Labour schedule	Contractor (foreign head office in consultation with management branch office)	Consultant
Tender documents, vol. 1	Invitation to Tender Instruction to Tenderers Conditions of Contract, part I Conditions of Contract, part II Form of Tender Schedule of Supplementary Information Contract Forms	Consultant	Contractor				
Tender documents, vol. 2	Technical Specifications	Consultant	Contractor				
Tender documents, vol. 3	Measurement and payments Bill of Quantities, Iringa	Consultant	Contractor				
Tender documents, vol. 4	Measurement and payments Bill of Quantities, Mbeya	Consultant	Contractor				
Tender documents, vol. 5	Drawing list	Consultant	Contractor				
↓	↓	↓	↓	↓	↓	↓	↓
RESULT: Contract: General Conditions (part I); Specific Conditions (part II); Supplementary information; Form of Tender							

Figure R.2 Incoming and outgoing documents during the construction phase (preparation part)

Incoming documents and forms					**Outgoing documents and forms**				
Documents / forms	Subject(s)	Frequency	Coming from	Going to	Documents / form	Subject(s)	Frequency	Coming from	Going to
Drawings	See table R.1	-	Consultant	Project manager	Time schedule	Planning of various construction activities in time	-	Project Manager	Contract Manager Consultant
Tender documents (vol. 1 to 5)	See table R.1	-	Consultant	Project manager	Plant delivery schedule	Estimated needed equipment and plant during construction time	-	Project Manager	Equipment department Mbagala Foreign head office
Contract	See table R.1	-	Consultant / Contractor	Project manager	Direction to Purchase	Ordering form for imported materials, products, equipment and /or tools	whenever needed	Project Manager / Contract Manager	Foreign head office
Tender	See table R.1	-	Contractor (foreign head office / management Tanzaniaoffice	Project Manager	Local Purchase Order	Procurement of local materials, products, equipment and /or tools	whenever needed	Project Manager / Contract Manager	Local Purchase Officer
Index of Accounts	List of indices to be used by booking all project expenses. Prepared for each project, based on overall company index of accounts	-	Administration Manager / foreign head office	Project Manager / Accountant on site / accounting department	Cash flow overview	Overview of estimated cash flow needed per month	-	Project Manager	Administration Manager / Consultant

Figure R.3 Incoming and outgoing documents during the construction phase (production part)

Incoming documents and forms					**Outgoing documents and forms**				
Documents / forms	Subject(s)	Frequency	Coming from	Going to	Documents / form	Subject(s)	Frequency	Coming from	Going to
Monthly financial report	Statement of financial project situation	Monthly	Administra-tion manager	Project Manager	Daily site reports	Weather conditions; Labour on site (own / subcontractors); Jobs in progress; Completed jobs; Incoming / outgoing equipment, materials; drawings / documents received / Orders from consultant	Daily	Assistant Site Manager	Contract Manager
Invoices	Invoices paid on site fro materials, products and / or tools	-	Suppliers	Accountant on site	Monthly Status Report	Progress of Work / Payments / Variation orders / Claims / Work for third party / Insurance claims / Design and documentation / Client and consultant / other issues / general reamrks regarding work	Monthly	Project Manager / Assistant site manager	Contract Manager
Cash Flow overview	Overview of all cash flow needed per mont: estimated versus actual. Based on indiex of accounts	Monthly	Accountant on site	Project Manager / Assistant site manager	Payments Schedule	Overview of payments, both in local and foreign currency, submitted and received from client	Monthly	Project Manager	Contract Manager
Site instructions	Ordering for alterations and /or variation in original work	Irregular, whenever applicable	Consultant	Project manager / assistant site manager	Work Programm e (revised versions)	Time schedule construction activities, covering entire construction period	Monthly or whenever revision is made	Project Manager	Contract Manager Consultant

(Figure R.3 continued)

Incoming documents and forms					Outgoing documents and forms				
Documents / forms	Subject(s)	Frequency	Coming from	Going to	Documents / form	Subject(s)	Frequency	Coming from	Going to
Site minutes	State of affairs on project, as discussed in meeting between conusltant, client and contractor	Monthly	Consultant	Project Manager / Contract Manager	Manpower Chart	Overview manpower on site and needed in future	Monthly	Project Manager	Contract Manager
					Updated Budget	Revision initial budget	Every second month	Project Manager	Contract Manager
					Cost Control Report	See example appendix Q	Every second month	Project Manager	Contract Manager
					Checklist site performance	Judgment progress work / relations client, consultant, labour union, authorities / quality work / resources (management, labour, amterials, plant, drawings) / economy / reports submitted	Every third month	Project Manager	Contract Manager
					Cash flow prognosis	Estimation of cash flow needed during remaining construction period.	Every third month	Project Manager	Contract Manager / foreign head office
					Invoices	Invoices paid on site for materials, prodcuts and / or tools	-	Accountant on site	Accounting department

(Figure R.3 continued)

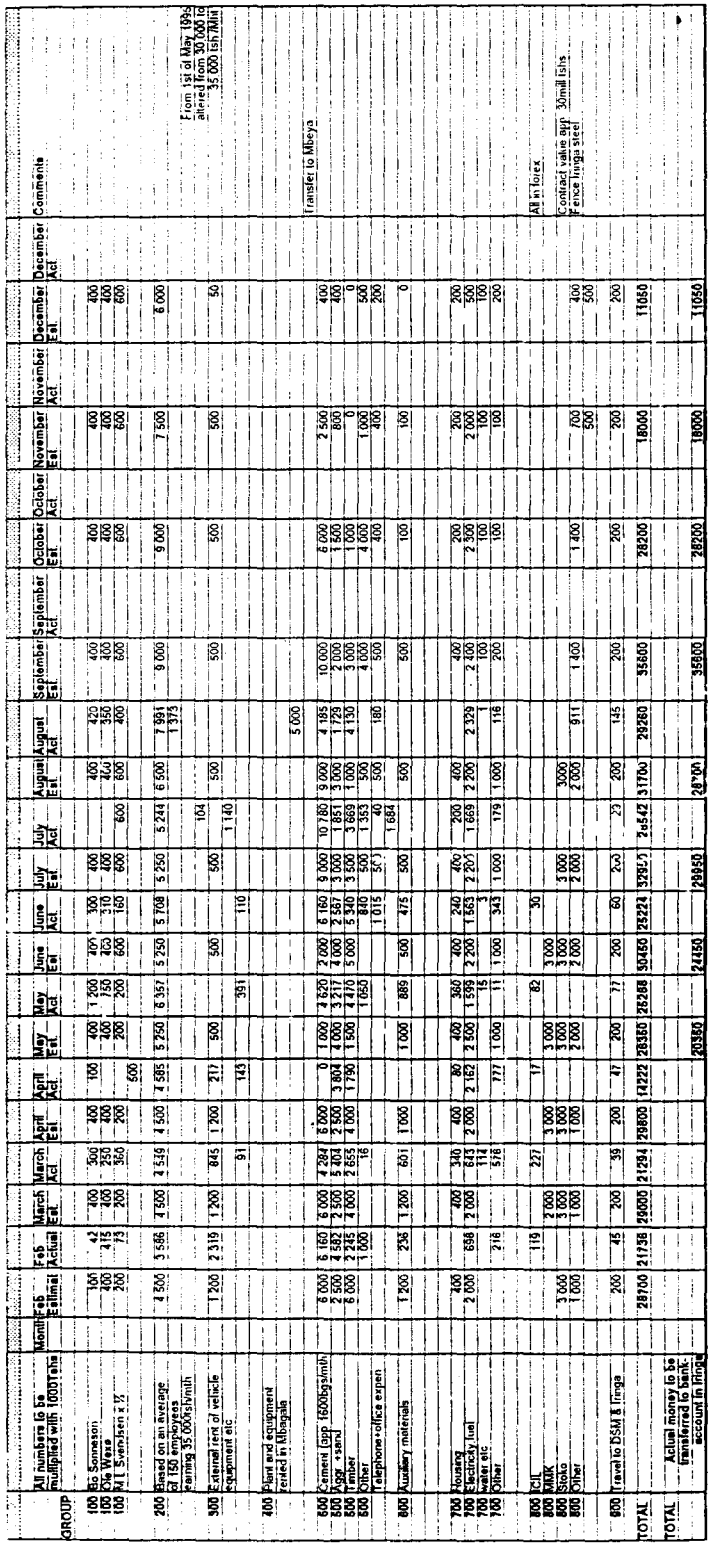
Incoming documents and forms					**Outgoing documents and forms**				
Documents / forms	Subject(s)	Frequency	Coming from	Going to	Documents / form	Subject(s)	Frequency	Coming from	Going to
					Monthly wage statements	Overview of wages paid to permanent and causal employees	Monthly	Accountant on site	Contract Manager
					Interim valuations	Value of finished work until valuation date	Monthly	Quantity Surveyor on site	Contract Manager
					Delays & disruption schedule	See example appendix R	Whenever delays occur	Project Manager / Quantity Surveyor	Contract Manager
					Cash flow overview	See example appendix R	Monthly	Project Manager / assistant site manager	Administrati on Manager
					Direction to Purchase	Ordering form for imported items. Based on schedule of materials from Quantity Surveyor	Whenever needed	Project Manager (may go through contract manager)	Foreign head office
					Local Purchase Order	Form for ordering purchase of local items. Based on schedule of materials from Quantity Surveyor	Whenever needed	Project Manager (may go through contract manager)	Local Purchase Officer
					Working Drawings	Drawinsg to be prepared and approved by consultant before start of construction	Based on time schedule	Contractor	Consultant
					Three week rolling time schedule	Short-term planning of construction activities	Every three weeks	Assistant site manager / Project Manager	- (remains on site)
					Wage sheets	Contains calculation of wages individual labourers	Monthly	Accountant on site	- (remain s on site)

Appendix

S

Cost control documents

Figure S.1 Example monthly cash flow overview



GROUP	All numbers to be multiplied with 1000Tsha	Month	Feb Estimat	Feb Actual	March Est.	March Act.	April Est.	April Act.	May Est.	May Act.	June Est.	June Act.	July Est.	July Act.	August Est.	August Act.	September Est.	September Act.	October Est.	October Act.	November Est.	November Act.	December Est.	December Act.	Comments
100	Bo Sonnesn		100	42	100	300	400	100	400	1 200	400	300	400	200	400	425	400	400	400	400	400	400	400	
100	Ole Wase		400	415	400	250	400	400	400	150	400	403	400	310	400	400	400	350	400	400	400	400	400	
100	M L Svendsen x 15		200	73	200	350	200	200	200	200	200	600	200	600	200	600	200	600	600	600	600	600	600	
200	Based on an average of 150 employees earning 35 000sh/mth		4 500	3 586	4 500	4 539	4 500	4 585	5 250	8 357	5 250	5 708	5 250	5 244	6 500	7 991 1 373	9 000		9 000		7 500		8 000		From 1st of May 1995 altered from 30 000 to 35 000 tsh /Mth
900	External rent of vehicle equipment etc		1 200	2 319	1 200	845	1 200	217	500		500		500	104 1 140	500		500		500		500		50		
400	Plant and equipment rented in Mbeya					91		143		391		110				5 000									
500	Cement (app. 1600bgs/mth		6 000	6 167	6 000	4 284	6 000	0	7 000	4 626	7 000	6 180	9 000	10 180	9 000	4 195	10 000		6 000		2 500		400		Transfer to Mbeya
500	Lime / sand		2 500	1 587	2 500	3 401	2 500	3 804	3 000	3 217	3 000	2 587	3 000	3 851	3 000	1 795	3 000		1 500		800		400		
500	Timber		2 000	1 215	2 000	2 855	2 000	1 790	1 500	1 410	3 000	5 340	3 500	3 663	1 000	4 150	4 000		1 000						
600	Other			1 000		16	4 000			1 050		1015	500	1 353	500	500	1 000		4 000		1 000		500		
	Telephone office expen													40			500		400		400		200		
800	Auxiliary materials		1 200	235	1 200	601	1 000		1 000	889	500	475	500	1 684	500		500		100		100		0		
700	Housing		400		400	340	400	80	400	360	400	240	400	200	400		400		200		200		200		All in forex
700	Electricity fuel		2 000	898	2 000	643	2 000	2 162	2 500	1 599	2 200	1 563	2 201	1 669	2 200	2 329	2 400		2 300		2 000		500		
700	water etc					114			15		3		1		1	1	100		100		100		100		Contact valve app 30mill Isls
700	Other			216		516		777	1 000	11	1 000	343	1 000	179	1 000	116	200		100		100		200		Fence hinge steel
800	CIL			119		227		117		82		30													
800	MMK				3 000		3 000		3 000		3 000		3 000		3000										
800	Stoilo		3 000		3 000		3 000		3 000		3 000		3 000		2000	911	1 400		1 400		700		200		
800	Other		1 000		1 000		1 000		2 000		2 000		2 000								500		500		
600	Travel to DSM & Hinga		200	45	200	39	200	47	200	77	200	60	200	23	200	145	200		200		200		200		
TOTAL			28700	21738	29600	21294	29600	14222	28350	28268	30450	23221	32850	26542	31700	29260	35600		28200		18000		11050		
TOTAL	Actual money to be transferred to bank account in Hinga								20350		24450		28950		28700		35600		28200		18000		11050		

Figure S.2 Example structure monthly financial report

Project no..: 253 Created.....: 21.10.94
Project name: Iringa & Mbeya VTC

Real. cost..: 2,345,936,667.55

EXP. STAFF..:	33,698,245.44
LOCAL STAFF.:	253,662,185.60
TRANSPORT...:	142,837,324.20
PLANT EQUIPM:	349,641,298.68
BUILD-IN MAT:	807,370,994.03
AUX. MAT....:	596,418.89
CONSUMABLES.:	369,470,508.91
SUPPLIERS...:	218,308,120.86
CAPITAL COST:	170,351,580.94
:	
:	
:	
:	
:	
:	
:	
:	
Invoiced:	1,850,342,990.50
	2,345,936,667.55

TYPE	TYPE TEXT	AMOUNT	Tshs ONLY	DKK AMOUNT
101	SALARIES	23,031,827.06	23,031,827.06	
102	SOCIAL COSTS	45,775.00	45,775.00	
103	TRAVELLING EXPENSES	6,175,174.59	4,873,700.52	14,032.16
104	OTHER COSTS	962,602.50	962,602.50	
106	TRAINING LEVY	2,306,796.74	2,306,796.74	
108	VETA LEVY	341,829.55	341,829.55	
109	FEES-OTHERS	823,000.00	823,000.00	
150		11,040.00	11,040.00	
SUBTOTAL		33,698,245.44	32,398,971.37	14,032.16
GRAND TOTAL		96,873,421.95	81,741,311.03	182,650.04

TYPE	TYPE TEXT	AMOUNT	Tshs ONLY	DKK AMOUNT
201	WAGES, SALARIES	205,537,117.35	205,537,117.35	
202	CANTEEN	19,658,350.00	19,658,350.00	
203	TRAVELLING EXPENSES	3,453,685.00	3,453,685.00	
204	OTHER COSTS	10,968,754.60	10,968,754.60	
206	NPF	11,152,811.30	11,152,811.30	
208	VETA LEVY	2,195,704.35	2,195,704.35	
209	WAGES INTERNAL DEBIT	535,903.00	535,903.00	
213	TRAVELLING EXPENSES	3,360.00	3,360.00	
250		156,500.00	156,500.00	
SUBTOTAL		253,662,185.60	253,662,185.60	
GRAND TOTAL		395,803,764.15	395,803,764.15	

Figure S.3 Example cost control report

Project no.	COST CONTROL REPORT		Contract Period		Report no.		
					Report as per		
	Budgeted costs		Actual costs		Remaining	Expected Final Result	
Resources	Budget x 1,000 Tshs.	Revised Budget x 1,000 Tshs.	Up to this Report x 1,000 Tshs.	Stock value x 1,000 Tshs.	Costs x 1,000 Tshs.	Cost x 1,000 Tshs.	Balance x 1,000 Tshs.
100 Expatriates staff							
200 Loc./Staff Labour							
300 Transport & Freight							
400 Plant & Equipment							
500 Built in materials							
600 Auxiliary Materials							
700 Temporary inst. and cons.							
800 Sub-suppliers							
900 Head office & Capital Costs							
TOTAL							
			Notes:				
CONTRACT SUM					RESULT		

Figure S.4 Coding system on VTSC-project

ACCOUNT GROUP			INDEX OF ACCOUNTS - SJI IRINGA & MBEYA VOCATIONAL TRAINING CENTRES - PAGE 1
I	II	III	COST AND PROCEEDS: Job No. 253 Date: 10.10.1994
5005	253/553	100	**Expatriates Staff**
		101	Salaries
		102	Social costs
		103	Travelling expenses: Air tickets, hotels, inspection travels etc.
		104	Other costs: Medical, entertainment, gifts, allowances
		105	Short term asistance
		106	Training Levy
		109	Fees: School, other
		130	Mbagala
		150	Extra security expenses
		200	**Local Staff / Labour**
		201	Wages
		202	Social costs
		203	Travelling expenses
		204	Other costs: Medical allowance, workmen's comp. Juwata, accomodation
		205	Housing levy
		206	National Provident Fund (NPF)
		207	Annual leave, notice salaries, ser. allowance
		250	Extra security expenses
		300	**Transport and Freight**
		301	External rent of vehicles
		302	Insurance and registration
		304	Spare parts - vehicles incl. tyres/tubes
		305	External repairs
		306	Sea freight (all freight incl. F.O. Site expenses)
		307	Air freight (all freight)
		308	Local transport
		309	Custom duties and sales tax on importation
		310	Pre-shipment inspection
			Accumulated depreciation

(Figure S.4 continued)

ACCOUNT GROUP			INDEX OF ACCOUNTS - SJI IRINGA & MBEYA VOCATIONAL TRAINING CENTRES - PAGE 1
I	II	III	COST AND PROCEEDS: Job No. 253 Date: 10.10.1994
5005	253/553	700	**Temporary Installation and Consumables**
		701	Tools
		702	Electricity
		703	Fuel and lubricants
		704	Water, Oxygen, etc.
		705	Site installations
		706	Expatriate camp and housing
		707	Labour camp
		708	Clothing and consumables for security
		709	Weather protection
		710	General office expenses
		711	NBO - Alykhan
		712	Manager/guest house
		750	Extra security expenses
		800	**Sub-contractors: General, Mechanical & Electrical**
		801	ICIL
		802	STOKO
		850	Extra security expenses
		900	**Head Office and Capital Costs**
		901	Design - external
		902	Design - own
		903	Building permits and othe rpermits
		904	Bond and guarantees
		906	Insurance - C.A.R., plant & equipment, third party
		907	liability
		908	Insurance - freight
		909	Insurance - others
		911	Fees - Branch registration, audit etc.
		912	Head office, Copenhagen
		915	Capital gain/loss
		916	Home Office
		197	Tax
		920	Compensation insurance - C.A.R.
		921	Compensation insurance - freight
		922	Compensation insurance - others
		923	Travel

(Figure S.4 continued)

ACCOUNT GROUP			INDEX OF ACCOUNTS - SJI IRINGA & MBEYA VOCATIONAL TRAINING CENTRES - PAGE 1
I	II	III	COST AND PROCEEDS: Job No. 253 Date: 10.10.1994
5005	253/553	350	Extra security expenses
		400	**Plant and Equipment**
		401	Rent of plant
		402	Insurance and registration
		404	Spare parts - plant and equipemnt incl. tyres/tubes
		405	External repair
		409	Customs duty and sales tax on importation
		411	External billing
		439	Plant
		450	Extra security expenses
		500	**Building Materials (Build-in)**
		501	Cement
		502	Reinforcement
		503	Concrete products
		505	Aggregate for concrete works
		506	Materials for masonry works
		507	Materials for carpentry works
		508	materials for structural steel works
		509	Prefabricated elements
		510	Cast-in items, bolts and fittings
		511	Miscellaneous materials for structures
		513	Materials for finishing works
		514	Materials for external works
		515	Materials for electrical works
		516	Materials for plumbing works (VVS)
		517	Materials for airconditioning & ventilation Works
		550	Extra security expenses
		600	**Auxiliary Materials**
		601	Form materials
		602	Scaffolding
		603	Barriers
		604	Sheet piling
		605	Miscellaneous auxiliary materials
		650	Extra security expenses

Figure S.5 Delay & disruption schedule

Ref	Cause of Disruption	Part affected	Manner affected	Entitlement	Notices and Correspondence	Additional Resource Assessment Labour	Plant	Other	Total cost of Disruption

Appendix T

Cost control systems

T.1 Introduction

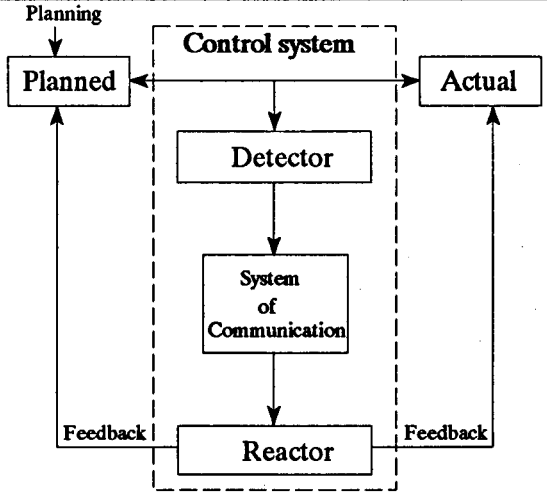
In this appendix the principles of weekly cost control systems are explained. As comparison, the general principle of a monthly cost control system, as currently also used by SJI, has been added. This will provide more insight into the crucial differences between these systems and their different use.
No such thing as *the* cost control system exists, since a lot of environment-specific aspects determine the features of such a system.[1] However, every system will comprise some basic elements. These will also be briefly presented in this appendix. However, first the basic principle of a cost control system in general will be dealt with.

T.2 Basic principle of a control system

Cooke and Jepson (1979) distinguish three elements in a control system:[2]
- a *detector* which registers the required information, which is subject of control in the system; if a certain predetermined limit is exceeded the detector gives a warning signal;
- a *system of communication* which 'provides the means for the signal to be transmitted in undistorted form';
- a *reactor* which responses to the signal and initiates corrective action.

In chapter 2 it was already stated that a control system should be supplemented with planning and feedback elements. Combining this with the three elements of Cooke and Jepson (1979) results in the schematic presentation of a control system in figure T.1.

Figure T.2 Basic principle of a control system



1 Ahuja, H.J. *Successful construction cost control.* 1980, p.2; Shah, P.P. *Cost control and information systems. A complete guide to effective design and implementation.* 1981, p.38.

2 Cooke, B. and W.B. Jepson. *Cost and financial control for construction firms.* 1979, p.18-19.

Each control system can also be unravelled into information and organisation aspects. Information aspects are all oral and written (forms and documents) data flow within the system. Organisation aspects include the persons involved in the system, their responsibilities and tasks as well as their interrelationship.

T.3 Principles of weekly and monthly cost control systems

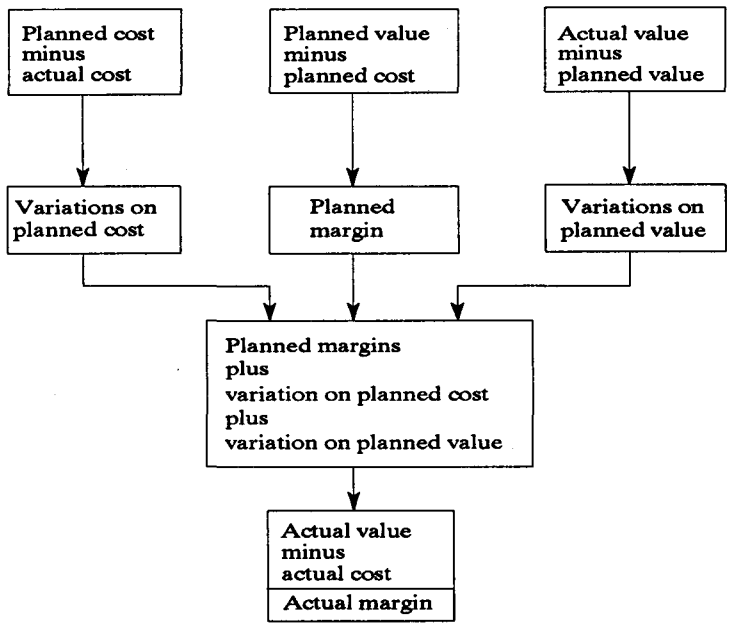
T.3.1 Weekly cost control systems

Within a weekly cost control system the costs are registered and controlled on a weekly basis. Cooke and Jepson (1979) discuss two types of such systems:[3]

- short-term planning orientated *or* pre-target based cost systems, and
- operational cost systems.

The principles of a short-term planning orientated system are depicted in figure T.2 below.

Figure T.2 Principles of a cost-planning orientated cost system



Source Cooke and Jepson (1979), p.108.

Operational cost systems are based on a system of job cards. Before production starts such a card contains a checklist of equipment, materials and labour needed for a specific construction activity as well as work instructions. After completion, the card will also contain the time spent on the specific activity and an overview of resources used. Cooke and Jepson (1979) warn that, in case a work is complex and/or extensive, this system may not be very suitable.

Due to their level of detail and their focus on construction activities, weekly cost control systems are often linked to scheduling systems. Scheduling systems can in general vary from straight-forward bar charts to more complex network-based systems.

[3] Cooke and Jepson (1979), p 108-117.

Pilcher (1976 / 1985) and Ahuja (1980) discuss the principles of a network-based cost control system.[4] Such a system is especially useful when striving at time-cost optimisation: the construction period with the least cost for the contractor. It is important here to keep in mind the difference between direct and indirect costs. Direct costs will increase when a certain minimum construction period is exceeded. There will be a minimum time below which the duration of construction activities cannot be reduced. If it was, the direct costs involved would increase sharply, due to inefficiencies. For example: labourers who are in each others way. Indirect costs have a time-dependent character. That is: they increase with a longer construction period. When striving at time-cost optimisation, this means that a balance between the direct and indirect costs has to be found.

The use of network has some clear advantages over other scheduling techniques.[5] The most important is that it shows those activities which are critical for a timely completion of the work on site and activities which have a so-called float.[6] This distinction is very useful in controlling cost tightly. However, network-based scheduling techniques are rather complicated. They require thorough skills of people involved. This aspect should be considered when choosing for a network-based cost control system.

Pilcher (1976) mentions an example of a cost control system which is linked with an incentive or bonus scheme.[7] Such a scheme is focused on individual gangs or labourers working on a specific construction activity. Therefore, linkage with such a system could best take place with a weekly cost control system. The principles of this linkage are worked out briefly by Cooke and Jepson (1979).[8] Direct production costs are registered for each separate trade (that is: labourers, bricklayers etc.). The difference between a target value and these direct production costs determines the level of bonus paid to each trade. The lower the direct costs, the higher the bonus will be. Since the level of direct costs increases with the time spent, working time has to be speeded up to increase the bonus. Direct production costs, the bonus paid and the non-productive costs together form the total production costs per trade. These costs are set against the respective Bill value, which results in a gain or loss for each trade. The advantage of a cost and bonus related system may be that labourers become more motivated. Two major disadvantages are:

- targets have to be set for some or all trades, including nonproductive items, such as clearing roads, cleaning etc. This requires suitable and realistic planning data to be available to the contractor. Especially for the inproductive items it may be difficult to set realistic targets. Realistic targets for construction operations are especially relevant from a qualitative point of view: if work is speeded up beyond a certain point quality of the work may suffer.
- the system requires accurate time control. It has to be avoided that, for example, foremen transfer time from operations for which a bonus is paid to operations where no bonus is paid, just to increase the level of wages of 'their' labourers. This disadvantage especially occurs when not everybody on the site works for the same goal.

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4 Ahuja (1980), p.104-138; Pilcher, R. *Principles of construction management.* 1976, p.200-218; Pilcher, R. *Project cost control in construction.* 1985, p. 238-258.

5 Morgan, P.R. and J. Bakari. 'Bar-charts to CPM - construction scheduling and Tanzania.' In: *International Journal for Development Technology* 4, 79-91 (1986); Neale, N.H. and D.E. Neale. *Construction Planning.* 1986, p.51-52.

6 Float = margin for the duration of a construction activity. Delays within this margin do no delay the project in total.

7 Pilcher (1976), p.251.

8 Cooke and Jepson (1979), p.105-107.

T.3.2 Monthly cost control systems[9]

Monthly cost control systems are less much detailed compared to weekly cost control systems. Such control systems are foremost focused on financial project control. They compare the value of work completed within the previous month or up until a specific moment, with the costs which have been made by the contractor in achieving this work. Monthly cost control system provide a first insight into whether or not the costs situation on a project is alarming and, if so, which part of the work deserves special attention.

The two crucial persons within a monthly cost control system are the accountant and the quantity surveyor. The former has to keep track of all costs incurred. The quantity surveyor is in charge of the monthly valuation of the work completed.

The comparison of costs and value is the responsibility of the company's management. The same goes for any feedback which has to be given to the site, based on the results of this comparison. Often, one specific person may be appointed to carry out these tasks.

T.4 Basic elements of a cost control system

Despite the fact that no two cost control systems will be exactly the same, every system has to comprise some basic elements:

- *a planning document*
  The format of this planning should correspond with the format of how actual costs are registered.
- *recording sheets and reports*
  Preferably these sheets also contain the planned costs. In this way a comparison between the planned and actual situation will be easier. Depending on the frequency of control, recording sheets cover a period of a week, a month etc. Depending on the organisation aspects of the systems, report may have to included.
- *a cost coding system*
  These systems allocate codes to so-called cost centres. Cost centres can for example be direct input factors (unravelled into the several cost items of a specific input factor) or construction activities. Cost allocation to construction activities will only be possible for direct costs.

  In general, three different type of coding systems can be distinguished:[10]
  (1) an alphabetical system,
  (2) a numerical system,
  (3) a combination of (1) and (2).
  Pilcher (1985) extensively discusses the advantages and disadvantages of each.[11] The alphabetical system provides 26 different codes, whereas the numerical system only has 10 (assuming only one symbol is used). The former system provides more logic, since the initial letter of the activity to be coded can be chosen. For example: B for bricklaying, C for concreting etc. This logic disappears when two or more items have the same initial letter. Also, not all 26 symbols are suitable for use. For example: the letter O resembling the number zero. Moreover, if not the various construction activities, but the various cost sorts are used as cost centres, this logic is less useful.
  The numerical system does not provide the same form of logic as the alphabetical does. The disadvantage of a limited amount of symbols can be met by using two or more numbers in one code. According to Pilcher a combined coding system has many of the above mentioned disadvantages of the separate systems, while not having many of the advantages.

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9 Based on Cooke and Jepson (1979), p.86-102.

10 Pilcher (1985), p.197.

11 Pilcher (1985), p.197-203.