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WORLD MARITIME UNIVERSITY

Malmö, Sweden

**ANALYSIS OF THE PROBLEMS OF
PRODUCTIVITY AND PERFORMANCE OF THE
PORT OF ASSAB**

By

SIMON ARAIA WELDESELASSIE

The State of Eritrea

A dissertation submitted to the World Maritime University in partial
fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE

in

PORT MANAGEMENT

1999

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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DEDICATION

**... TO THE MARTYRS OF ERITREA WHO SACRIFICED THEIR PRECIOUS
LIVES IN THE STRUGGLE TO BRING PEACE, JUSTICE AND PROSPERITY TO
THE NATION AND ITS PEOPLE.**

ACKNOWLEDGEMENT

I am deeply grateful to my sponsors the CDG and the Government of Germany for making this great dream a reality.

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Instructor Melake Tewelde, former Head of Department of Economics and Finance at the University of Asmara, Eritrea.

MAY THE SPIRIT OF MY LATE FATHER ARAIA WELDESELASSIE KEEP OUR FAMILY MORE STRONGLY! AMEN.

Abstract

Title of Dissertation: **Analysis of the Problems of Productivity and Performance of the Port of Assab**

Degree: **MSc**

The port, as a compulsory meeting point between the ship and the goods, plays an essential part in the maritime trade of country, and often than not, in the maritime trade of a region. Of course, the latter role depends mainly on the geographical position of the port. However, the roles that a port can play could be maintained if the port remains efficient in today's tough competitive environment.

The theme of this study is to analyse the major problems of performance and productivity of the Port of Assab and come up with alternative solutions so that the port can maintain its role to the national economy and to the maritime trade of Ethiopia. The dissertation has six main chapters. It started by brief introduction that explains the objective of the study, the problems faced to conduct this study and the method used to carry out the study. Chapter two described briefly the general aspects of the Eritrea's economy, geographical position, history, and general aspects of the port itself.

The significance of this dissertation to the nation is indirect by drawing some recommendations, which would improve the efficiency of the port, which in turn could lead to reduce maritime transport costs. Chapter three deals with this matter.

Chapter four, which is the main focus of this dissertation, investigated the major causes of lower productivity and performance of the Port of Assab especially when compared with international standards. Shortage of skilled people in the essential fields, shortage of finance for investment, deficiency in MIS, deficiency in supervision and motivation, and lack of operational planning have been found to be the major problems of lower productivity in the port.

Cost-benefit analysis of alternative proposals is presented in the fifth chapter although it is more of qualitative arguments instead of quantitative ones.

Finally, there is a conclusion and recommendations. The recommendations so suggested can only be implemented if, and only if, the port is going to serve its traditional and historical hinterland.

Key Words: Impact, hinterland, cost-benefit, performance, Assab Port, Eritrea,

TABLE OF CONTENTS

Declaration	ii
Dedication	iii
Acknowledgements	iv
Abstract	vi
Table of Contents	viii
List of Tables	x
List of Figures	x
List of Abbreviations	xi
I. Introduction	1
II. General Aspects of the Port of Assab	4
2.1 A Brief History of Eritrea	4
2.2 Location, Land, Population and Climate	5
2.3 Economy	7
2.4 Geographical Location of the Port of Assab	9
2.5 Historical Background of the Port of Assab	9
2.6 Port Administration	10
2.7 Infrastructure and Superstructure	13
2.8 Productivity and Performance Indicators of the Port of Assab	16
2.8.1 Indicators of Output	16
2.8.2 Indicators of Utilisation	18
2.8.3 Indicators of Service	19
2.8.4 Indicators of Productivity	20
III. The Role of the Port of Assab to the national economy	22
3.1 Source of Employment	24
3.1.1 Direct Impact	24
3.1.2 Indirect Impact	25
3.1.3 Induced Impact	26
3.2 Value Added as a Percentage of GDP	27
3.3 Other Quantitative and Qualitative Impact	28
IV. Major Problems for Productivity and Performance of the Port of Assab	30
4.1 Shortage of Know How and Skilled Labour	30
4.2 Lack of Financial Resources	34
4.3 Planning and General Management Related Problems	41
4.3.1 Deficiency in Management Information System	41
4.3.2 Inefficiency of Supervision, Motivation, and operational planning	47
4.3.2.1 Inefficiency of Supervision	47
4.3.2.2 Lack of Motivation	48
4.3.2.3 Inadequacy of operational planning	49

V.	Cost Benefit Analysis of alternative Solutions	53
	5.1 Training	53
	5.2 Changes in Management Information System	56
	5.3 Changes in Maintenance Management	58
	5.4 An Investment Plan	60
	5.5 Operations Plans	60
	5.6 Port Reforms	61
VI.	Conclusion and Recommendations	63
	Bibliography	69

List of Tables

Table1	Comparison of Population and Land between Eritrea, Ethiopia and Sudan	7
Table2	The Trend of GNP in Terms of Nakfa and Equivalent US\$	8
Table3	Number of Berths, Their Length and Depth	13
Table4	Port Equipment	15
Table5	Cargo Traffic through the Port of Assab	15
Table6	Ratio of Containerised Cargo to Total Dry Cargo	17
Table7	Berth Occupancy Ratios for the Port of Assab	18
Table8	Average Turn Round Time of Ships in the Port of Assab	20
Table9	Productivity of the Port of Assab	21
Table10	Direct Employment Impact of the Port of Assab	25
Table11	Revenue and Expense Statement (1997)	35
Table12	Port of Assab Port Equipment Service Years (1997)	38
Table13	Port Equipment Availability and Performance Follow up (1998)	39
Table14	Port of Assab Summarised Gang Idle Time for Dry cargo Vessels 1992-1996	40
Table15	Proposed Training Schedule for Employees of the Port of Assab	65
Table16	Eritrea: Ports Rehabilitation Project for 1998	66

List of Figures

Figure 1	Eritrean Administrative Zones	6
Figure 2	Port of Assab Organisation Chart	12
Figure 3	Plan of the Port of Assab	14
Figure 4	The Potential and Actual Hinterland of the Port of Assab	23
Figure 5	Port of Assab Age Distribution of Employees (1998)	32
Figure 6	Port of Assab Education Status of Employees (1998)	33
Figure 7	Port of Assab Revenue and Expenses Trend	36
Figure 8	Phase 1: Proposed Computer Network within the Port of Assab	67
Figure 9	Phase 2: Proposed Computer Network for the Port of Assab with Port Clients and Authorities	67

List of Abbreviations

BOT	Build Operate Transfer
CAMC	Computer Assisted Maintenance Control
CTJ	Coastal Tanker Jetty
DMT	Department of Maritime Transport
ECT	European Combined (delta) Terminal
EDI	Electronic Data Interchange
EMIS	Engineering Management Information System
EPRP	Eritrea Ports Rehabilitation Project
ERISTAS	Eritrean Shipping and Transit Agency Services
ETSS	Eritrea Transport Sector Study
GDP	Gross Domestic Product
GNP	Gross National Product
IMF	International Monetary Fund
IPP1	Improving Port Performance course No. 1
IPP2	Improving Port Performance course No. 2
IPP3	Improving Port Performance course No. 3
IPP4	Improving Port Performance course No. 4
IPP5	Improving Port Performance course No. 5
LAN	Local Area Network
LOA	Length Over All
MEBO	Management/Employees Buy-Out
MIS	Management Information System
MPH	Maximum Possible Hours
PIC	Port Information Centre
PMA	Ports and Maritime Authority
RJ	Refinery Jetty
Ro/Ro	Roll on/ Roll of
SATCOM	Satellite Communication
SJ	shell Jetty
SMIS	Supplies Management Information System
UNCTAD	United Nation Conference on Trade and Development
WAN	Wide Area Network
WMU	World Maritime University

I. Introduction

As David Motram, former professor at WMU has stated ‘every thing is changing’. However, it is not just a matter of change, also the rates of change are even faster than ever. Ports in the world in general, and the Eritrean Port of Assab in particular, have undergone tremendous changes. Organisations like the Port of Assab face two kinds of change: internal and external. Internal changes result from changes in internal resources. According to Motram, these internal resources include people, things, money, procedures and time. The external factors, on the other hand, consist of political, economic, social and technical aspects. (Motram D, 1998,)

Certainly, management has little or no control of the external factors, but it has direct control of the internal resources. Due this fact, when selecting the topic of the dissertation, a decision has been made to analyse the internal (institutional) problems of productivity and performance of the Port of Assab. Taking certain measures by management of the organisation can solve the internal problems relatively easily. However, the external factors can hardly be changed or influenced by management. For example, the loss of traffic that the Port of Assab has been suffering recently is due solely to a political decision made by the main user of the port - Ethiopia.

The main objective of this dissertation is to find out the obstacles for the Port of Assab for not achieving higher productivity and performance. It does deal with all the internal and external causes of inefficiency but only the major institutional problems will be dealt with.

The general reasons for limiting the subject to the analysis of major problems of efficiency are twofold. The first concerns the availability and ease of access to data and information. The second, and probably the most important reason, is that it is easier to study the internal problems and come up with recommendations to solve them.

The specific objectives of the chapters in this dissertation are the following:

1. To provide general information about and a description of the country and the Port of Assab.
2. To analyse the problems of productivity and performance of the port.
3. To analyse the contribution of the port to the national economy.
4. To make a cost benefit analysis of alternative proposals.
5. To give proposals and recommendations for tackling the prevailing problems of lower productivity and performance of the port.

The paper is divided into four main chapters. Chapter two describes the general aspects of the Port of Assab. It is followed by some explanation of the role of the port and significance of the paper in chapter three. The analysis of major problems of productivity and performance of the Port of Assab, which is the substance of this study, are presented in chapter four. Chapter five discusses the costs and benefits of alternative proposals. Finally, the conclusion and recommendations are presented as a concluding part.

The research methodology is mainly based on secondary data, except that one questionnaire was sent to the Port Administration of Assab. That questionnaire seeks information on issues such as:

- Main causes of equipment break down,
- Inefficiency of tallying,

- Maintenance policy, and
- Ship related delay causes.

All questions have effectively been answered and were helpful.

In an attempt to collect relevant information for the study, the Eritrean Maritime Administration, the Port's Administration, the Bank of Eritrea and the Ministry of Finance of the State of Eritrea have been contacted. A literature review has been made including: University of Asmara, WMU library and lecture notes, government reports, research papers, Internet and other electronic sources such as Fair Play, ports statistics and information, and field trip observations and hand-outs.

The main limitations of the study are lack of sufficient data especially in the cost-benefit analysis part, time, and money for the purpose of telephone communication because there is no other alternatives such as E-mail and Internet.

As explained in chapter three, it is hoped that the dissertation will contribute to achieve higher productivity and performance in the Port of Assab and thereby to the nation as a whole. Implementing the recommendations outlined at the end of this dissertation could lead to the attainment and increment of the port's contribution.

II. General Aspects of Eritrea and the Port of Assab

This chapter will begin by giving a brief description of the economic, historical, demographic and geographical profile of the country as a whole to give the reader a broader picture of the country.

2.1 A Brief History of Eritrea

(Abstract from <http://www.netafrica.org/eritrea/history.html>, 3/13/99)

During the 1st to the 9th century, Eritrea was part of the Aksumite kingdom, a trading state that emerged about the first century AD.

After the rise of Islam in the seventh century, the Aksumite kingdom became internationally isolated as the Arabs gradually gained control of maritime trade in the Red Sea.

From the 8th to the 13th century, Eritrea was part of the seven Beja kingdoms and then from the 13th to the 16th century was part of the Bellou kingdom.

Over the centuries, other kingdoms and empires also established outposts or exercised control over various parts of present-day Eritrea. These include the Ptolemaic Egyptians (3rd C. BC), the Sennar kingdom (16th-19th C.), the Abyssinian kingdom (14th-18th C., 19th C.), the Adal Sultanate (15th-16th C.), the Aussa sultanate (16th-19th C.), Egypt under Muhammad Ali (18th C.), and the Ottoman Turks (16th-19th C.).

All of the area now known as Eritrea was gradually united under Italian rule. The king of Italy issued a decree creating Eritrea on January 1, 1890. Italy established an administrative structure and a transport and communications network in Eritrea. Italian settlers set up plantations and industries.

During World War II, the British defeated the Italians and established a protectorate over Eritrea. Eritrea became an important centre for British and American operations in the region during the war.

The 1950 United Nations resolution federating Eritrea with Ethiopia went into effect. The resolution ignored Eritreans' desire for independence but guaranteed them some democratic rights and autonomy.

The armed struggle for independence began after years of peaceful protest against Ethiopian violations of Eritrean democratic rights and autonomy produced no improvement in a deteriorating situation.

Using armed force, Ethiopia's emperor, Haile Sellassie, unilaterally dissolved the Eritrean parliament and annexed the country.

After 30 years of armed struggle the Eritrean peoples gained their independence, on 24 May 1991. In April 1993, in an internationally monitored referendum, 98.5% of the registered voters voted, and of these, 99.8% voted for independence.

2.2 Location, Land, Population and Climate

Eritrea is located on the eastern part of Africa usually known as the Horn of Africa. It is neighboured to the Red Sea on the East, the Sudan on the North and on the Northwest, Ethiopia on the South and to Djibouti on the Southeast.

Eritrea Administrative Zones



Figure 1. Source: <http://www.primenet.com/~ephrem/>

In terms of land and population Eritrea is by far the smallest compared to Ethiopia and the Sudan. Although the population of Eritrea is estimated to be 3.8 million, only an estimated 2.8 million people live in the country. The remaining people live in Diaspora as they were forced to leave their homes because of the thirty-year war for independence. The comparison of the three countries is shown Table 1.

Data	Eritrea	Ethiopia	Sudan
Area	124,300	1,224,000	2,505,810
Inhabitants	3.8 Million	58 Million	33 Million
Population per Sq. km	30	47	13

Table 1: Comparison of Population and Land between Eritrea, Ethiopian and Sudan. (1998)

Source: ETSS Consultant and <http://www.odci.gov/cia/publications/factbook/>

Eritrea's terrain varies dramatically between highlands above 2,133 m (7,000 ft) and the surrounding lowlands, which descend to sea level on the Red Sea coast and the arid Sudan border. Eritrea is a mountainous country; its highest point, 2,591 m (8,500 ft), is located south of Asmara, the capital. Temperatures in the highlands range from 10 degrees C (50 degrees F) to 29 degrees C (84 degrees F) and regularly reach 38 degrees C (100 degrees F) in the lowlands. Less than 508 mm (20 in) of rain falls annually in the lowlands, while the highlands may receive 762-1,016 mm (30-40 in). Eritrea is located in the easternmost part of the Sahel and experiences periodic drought. Erosion and deforestation are serious problems. (<http://eritrea.org/EIB/control/EImain.html>, 31/07/99)

2.3 Economy

Although Eritrea is one of the least developed countries, since liberation there has been great success on the performances of the economy. Gross domestic product (GDP) growth during 1992-1997 averaged 7.0 percent, while inflation was kept at an average of 6.0 percent per year. The overall government fiscal deficit, including grants, was less than 5.0 percent of GDP at the end of 1997, and the country's gross foreign reserves increased from less than one-month of imports in 1992 to over seven months of imports at the end of 1997. (<http://eritrea.org/EIB/control/EImain.html>, 31/07/99)

Data	1993	1994	1995	1996	1997
GNP (in Million Nakfa, Eritrean Currency)	3108	4407	4650	5128	5975
GNP (in million US\$ equivalents)	431.7	612.1	645.8	712.2	829.9

Table 2: The Trend of GNP in terms of Nakfa and Equivalent US\$

Source: IMF staff estimates based on information provided by the Eritrean Authorities.

Some of the major factors that lead to the achievement of these successes include:

- Right policy: Eritrea's economic policy is anchored upon the establishment of a dynamic private sector-led, out-ward looking economy. The commitment is to make the private sector the leading actor in the economic life of the country.
- Industrious people. The rehabilitation of the railway between Massawa and Asmara by relying solely on local expertise and resources is a good sign of the industriousness of the Eritrean people.
- Uncorrupted government. The fact that corruption is not a problem in Eritrea is witnessed by many independent agencies. The World Bank's good relation with the government is one example of this case.

Agriculture is the backbone of the Eritrean economy especially as far as employment is concerned. It accounts for about 80% of the total employment. (General Information on Eritrean Port. P. 2). According to an article in the local newspaper - Eritrea Profile- industry and distribution services are the leading sources of growth to GDP. (Eritrea Profile, Abraham Kidane, November 1997)

Regarding transportation, domestic cargo transport of Eritrea has been largely dependent on land transport. Inland waterways are non-existent. The railroad, which had initially been built during the Italian rule, extending over 320 km from Massawa to Bisha, with a planned extension to Tessenay was completely destroyed as a consequence of the devastating thirty-year war. Massawa and Assab serve the maritime trade of the country and of the neighbouring countries, Ethiopia and the

Sudan. Eritrea to date has two international airports at Assab and Asmara, while the construction of a modern international airport is underway at Massawa.

2.4 Geographical Location

Located strategically at the southern part of the Red Sea, the Port of Assab is one of the two major ports of Eritrea. The distance from Asmara, the capital, is about 1,185 km. Since the road is not in good condition, at present there is no scheduled or frequent land transportation between the two points. On the other hand, the distance from Addis Ababa, the Ethiopian capital, is 860 km and the road is in relatively good condition. Although the port is a little bit far away from the capital and some of its hinterlands, it is very close to one of the busiest international sea-lanes along the Red Sea coast. Therefore, compared to the Port of Djibouti, this gives it a great competitive advantage not only for using the port to transit cargoes to the central and southern part of Ethiopia, but also for transshipment cargoes that pass through the two entrances of the Red Sea.

2.5 Historical Background

Little is known about the Port of Assab before the Italian colony came to Eritrea in 1869. As a matter of fact:

The history of Assab Port is basically the history of the beginning of Italian colonialism in Eritrea. In 1869 Italy purchased the Bay of Assab through a shipping company and gained its first foothold in Eritrea. Assab was formally declared an Italian colony in 1882. (Government of Eritrea Ports and Maritime Authority, 1993,Asmara.)

During their rule, Italian colonisers constructed two berths and used the port as a transit hub to supply and transport coal for large ships. In contrast during Great

Britain's protectorate administration the Port of Assab witnessed no progress. Several of its facilities were taken and sold to neighbouring countries by the British.

As the main drive of Ethiopia to colonise Eritrea has been the possession of the coastline, and mainly the ports of Eritrea, it started to direct substantial investments to develop the ports. Due to geopolitical interests the investments in the Port of Assab were so big that in 1962 the Port of Assab became a modern town and port.

From that time up to the liberation of the country (1991), investments were limited to port equipment only. Eritrea being a young nation and starting from scratch after the bloody thirty-year-war with Ethiopia, the longest in Africa, there is a relative shortage of funds to finance heavy investment in new facilities and equipment.

However, the government of Eritrea, in line with the process of rebuilding the country, is making great efforts to improve the efficiency and performance of the two ports. To this end, several measures have been taken. The measures taken so far include up grading the qualification of its employees, recruiting qualified personnel and training employees domestically and abroad (in many countries such as Sweden, Germany, and Russia). In addition, the government of Eritrea has already outlined the short-term and long-term plans. The short-term plans are the purchase of port equipment, construction of berth 13/14-in to a container terminal, concrete work for container stacking and human resource development. Developing the port into a modern transshipment port by encouraging the private sector to participate actively in the infrastructure development through joint ventures or different forms of concession is the long-term plan. (General Information on Eritrean Ports, 1998. P 20)

2.6 Port Administration

The administration and organisation of the ports of Eritrea, Assab and Massawa, has been different before and after independence, except for the fact that they are

government owned and service ports. Before independence, the Ports and Maritime Authority (PMA) of Ethiopia was in charge of all maritime related affairs including port services, agency services, and shipyards. However, the shipping line, although publicly owned, was independent of PMA.

Since the liberation of the country, several changes in structure, authority and responsibility have taken place in the maritime administration in general and in the port administration in particular. From May 1991 up to early 1993, it was under the direction of the Department of Ports and Marine Transport Authority, and then it changed to Eritrean Ports Authority. Since 1995, the Department of Maritime Transport (DMT), as the main body of government in the maritime administration, is working under the general guidance and supervision of the Ministry of Transport and Communications. Accordingly, the ports were given more autonomy.

The new organisation structure proposed by the management of the Port of Assab in 1997 is quite similar to the existing one (see attached figure 2) and to that of Massawa. The only differences with the existing one being that the procurement and property management division is put under the technical division and a marketing division is to be added to the new one. According to the new organisation chart the port will be supervised by a Board and the daily operations will be carried out by a general manager. The general manager (GM) has control over staff functions for legal questions, internal audit, planning, and port security. (ETSS, 1996, P-C/205).

Port of Assab Organisation Chart

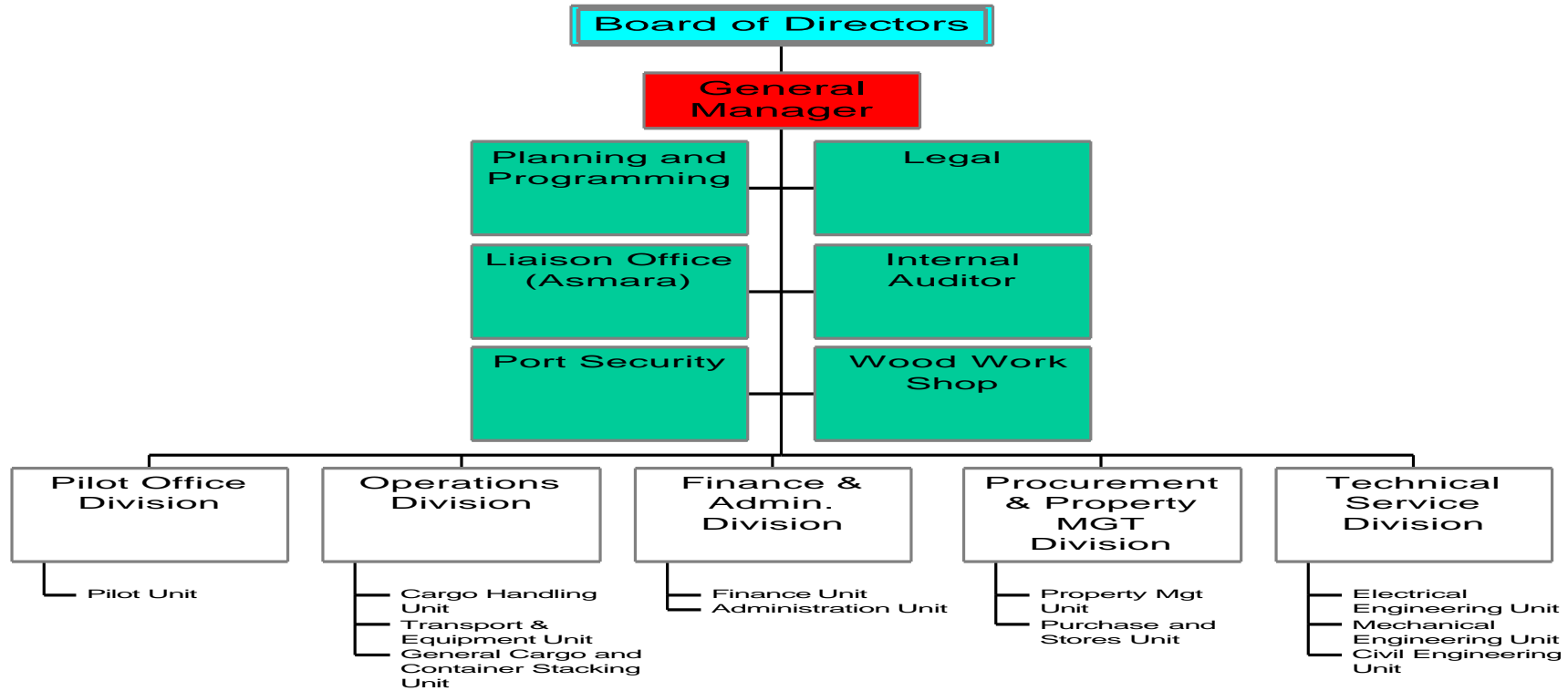


Figure 2. Source: Port of Assab

At present the port has a monopoly on all cargo handling, stevedoring and storage activities. In other words, all the port services, even tug and pilotage services, are under the control of the port administration. This means that the Port of Assab can be categorised as a service port.

2.7 Infrastructure and Superstructure

Currently, the Port of Assab has two jetties at the commercial harbour, namely, the North Jetty and the South Jetty. The North Jetty with a length of 495 m consists of berth 1, berth 2 and berth 3. The South Jetty is 530 m long and comprises berth 4, berth 5, berth 6, and berth 7. All these berths are general-purpose berths. There are also two other special berths for Roll-on/ Roll-off ships at the tips of the two jetties, namely berth 1A and Berth 7A.

Berth	Length (M)	Depth (M)
1	210	10.97
2	150	10.97
3	135	10.06
4 (formerly N0. 8)	80	5.48
5 (formerly N0. 9)	140	8.20
6 (formerly N0. 10)	160	8.84
7 (formerly N0. 11)	150	10.06
7A (formerly N0. 11a)	115	7.5

Table 3: Number of berths, their length and depth

Source: General Information on Eritrean Ports

In addition, there are three oil berths at the oil terminal and one salt loading terminal. Unfortunately, the salt loading terminal and berth 1A are not presently in use. The oil berths are known as Coastal Tanker Jetty (CTJ), Refinery Jetty (RJ), and Shell Jetty (SJ). The latter two terminals are totally operated by different organisations and they are not referred to in this paper.

Plan of the Port of Assab

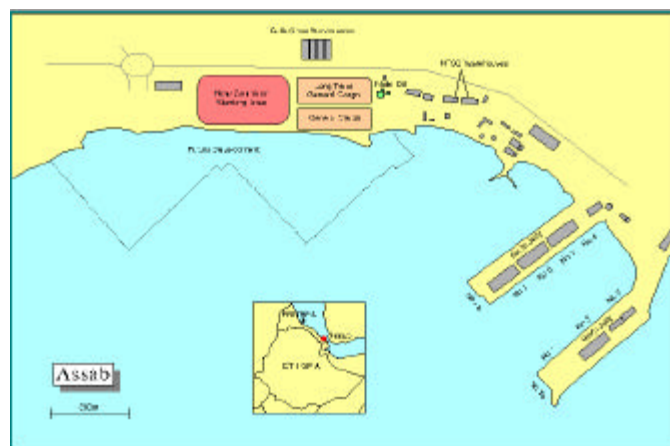


Figure 3. Source: Fair Play

Maximum and minimum draughts of the berths at the commercial harbour are 10.9m and 5.5m, respectively. Maximum Length Over All (LOA) of a ship that can be handled at the commercial harbour is 200m, but there is no limitation with regard to beam. It is deemed important that all the berths are well protected from seasonal waves by a breakwater built in front of the commercial harbour. As the tides are negligible there is no lock. The port has two approach channels although the north entrance is the one most frequently used.

As far as port equipment is concerned, the Port has eighteen shore cranes of 6-20 tons capacity, five mobile cranes (one with a 150 ton capacity), two tugboats, four pilot boats, three container lift trucks, and more than one hundred forklifts and tractors. Besides, it has bulk cargo handling equipment such as bagging machines and vac-u-vators. Table 4 shows the number and quantity of port equipment.

Equipment	Capacity	Quantity
Tug Boat	1400-1600 HP	3
Pilot Boat		3
Shore Crane	6-20 ton	18
Mobile Crane	6-150 ton	7
Forklifts	3-10 ton	72
Container Lift Truck	10-35 ton	4
Tug Master		4
Tractors		34
Bagging Machines		8

Table 4: Port Equipment

Source: General Information on Eritrean Ports

The port has a total storage area of about 509,498-sq. m, which can hold approximately 370,000 tons of dry cargo at a time.

The port has 754 staff employees plus over 2000 registered skilled workers, according to the figures of 1997.

YEAR	'000 Metric Ton			
	UNLOADED	LOADED	TOTAL	DRY CARGO %
1992	2,075	353	2,428	49
1993	1,919	372	2,291	46
1994	2,310	505	2,815	46
1995	2,443	484	2,927	48
1996	2,421	562	2,923	54
1997	1,836	476	2,312	44

Table 5: Cargo Traffic through the Port of Assab

Source: General Information on Eritrean Ports

2.8 Productivity and Performance Indicators of the Port of Assab

It is very difficult, if not impossible, to measure effectively the operational efficiency of a port using a single measurement. Instead, one has to use a series of different measures, which are known as port performance indicators. According to UNCTAD, there are four commonly used groups of performance indicators for cargo handling, namely:

1. Indicators of Output
2. Indicators of Service
3. Indicators of Utilisation
4. Indicators of Productivity (UNCTAD, IPP1, 1982. P 6)

The following paragraphs present these four groups of performance indicators with regard to the Port of Assab.

2.8.1 Indicators of Output

Generally, there are three essential types of output indicators for ports: berth throughput, ship output, and gang output. The berth throughput measures the total tonnage of cargo handled at a berth in a stated period – usually a year.

The port of Assab handled about 1.4 million tons of dry cargo, about 1.6 tons of oil and 676 vessels in 1996. The dry cargo traffic comprises break-bulk cargo, containers, bulk cargo, and vehicles. In recent years, containerisation has been increasing rapidly in the Port of Assab. It has grown from just 5% of the total dry cargo in 1992 to 30% in 1997.

YEAR	TOTAL FULL CONTAINERS HANDLED (M/tons)	TOTAL DRY CARGO HANDLED (M/tons)	%
1992	52,855	1,176,116	4
1993	94,896	1,045,984	9
1994	135,037	1,279,979	11
1995	182,425	1,399,665	13
1996	292,603	1,331,080	22
1997	298,736	1,005,952	30

Table 6: Ratio of Containerised Cargo to Total Dry Cargo

Source: Port of Assab, Stasistical Bulletin

The second measure of output is the ship output. It measures the rate at which cargo is handled to and from a vessel at a berth. There are several ways to measure this indicator, but the common ones are tonnes per ship working hours, tonnes per ship hours at berth, and tonnes per ship hours in port. To calculate these indicators, one has to divide the ship's total tonnage by the ship's worked hours, ship's hours at berth, and ship's hours in a port, respectively. The average ship output of break bulk cargo per ship worked hours at the Port of Assab is about 32 t per hour. The average output per ship hours at berth is 23 t per hour, and the average output per ship hours in the port is 18 t per hour. The average number of gangs per ship per shift is 2.2.

The last indicator of output is the gang output. This is the average tonnage of cargo handled by one gang per hour. The gang output can be calculated in several ways:

$$\text{Gang output per ship per shift} = \frac{\text{Total tonnes handled by gang in a shift}}{\text{Shift hours}}$$

$$\text{Or Gang output per ship} = \frac{\text{Total tonnes handled in a ship}}{\text{Total gang hours worked in the ship}}$$

The average gang output of general cargo for the Port of Assab based on the data of 1997 is about 18 tonnes. This does not include containerised cargo and vehicles because the handling rates for these types of cargoes are so high due to their nature that it will overstate the gang output.

2.8.2 Indicators of Utilisation

As the name implies indicators of utilisation measure the extent facilities and resources are used. UNCTAD suggests two major indicators of berth utilisation; namely, berth occupancy and berth working time. Berth occupancy may be calculated by:

$$= \frac{\text{Hours (days) berth is occupied}}{\text{Total Possible hours (days) in a Period}} \times 100$$

As shown in table 7, the average figure of berth occupancy for the Port of Assab fluctuated between 45.3 and 62.9 in the years 1992 to 1997. The figures are by far below the maximum occupancy ratios provided by UNCTAD. (B.L Francou, Performance Indicators, 1999, P 26.). The main reason for this problem is the application of very high possible hours by simply assuming the port is open 24 hours 365 days a year.

Year	1992	1993	1994	1995	1996	1997
Berth Occupancy Ratios	60.6	53.6	62.9	58.0	54.8	45.3
Number of Ship calls (only Dry Cargo)	262	314	384	429	491	473
Waiting Time	39%	14%	33%	22%	25%	17%

Table 7: Berth Occupancy Ratios for the Port of Assab

Source: The Port of Assab

The second major utilisation indicator is berth-working time. This is defined as the period of time that a ship is at berth and labour is scheduled to work. In other words, ship's time at berth minus non-operational time gives berth-working time. One has to deduct idle time to arrive at the operational time of a ship.

There are no reliable statistics on berth working time in the port of Assab. The already existing data suggest a very high berth working time, which is more than 90% of berth time. The main reasons for this limitation could be the method of recording data. First, non-operational time is recorded with respect to labour rather than to each ship. Secondly, since there is no official meal break, it is assumed that the whole shift time is an operational time unless work is interrupted by bad weather conditions. Even shift changeover delays are not recorded. Therefore, it is difficult, if not unrealistic, to give a sound conclusion how the berth has been utilised based on the available data.

2.8.3 Indicators of Service

Nowadays, the customer is placing more and more emphasis on the quality of service provided than tariff or other elements of costs. This is largely because the level and quality of service provided affects costs and thus profits of the customer directly or indirectly. Therefore, it is essential a port knows and evaluates its quality of service.

There are many indicators that can be used to measure the quality of service a port provides for its users (shippers, importers, and ship owners). However, the most commonly used indicator, and the only one that will be considered in this case, is ship turn round time: the total time spent by a particular vessel in a port.

The ship turn round time can vary depending on many factors: ships' particulars such as size, and type, and speed of service being provided to ship operators. The larger the vessel, the longer the ship-turn round time tends to be. Similarly, a general cargo vessel with many small consignments and different packaging requires a longer

services time and thus longer turn round time compared to a Ro/Ro vessel with only one type of cargo, mainly vehicles.

On the other hand, it is obvious that the faster the service provided to the ship operator, the shorter the ship turn round time will be. Therefore, it is more logical to present the average turn round time of each type of ship.

Table 8 depicts the average turn round time for each type of ship type based on the statistical data of 1997.

Ship Type	Bagged	Lash	Bulk	Container	General cargo	Ro/Ro
Average Turn Round Time (hours)	173	11	380	34	98	89

Table 8: Average Turn round time of ships in the Port of Assab

Source: Port of Assab

2.8.4 Indicators of Productivity

The final category of indicators concerns the indicators of productivity. They show the efficiency of berth operation. The cost per tonne of cargo handled is a useful measure of efficiency in cargo handling operations. In order to arrive at the cost per tonne value, the costs incurred for cargo handled must be available.

There are many ways of categorising port costs, but in general they can be categorised in to fixed and variable costs. As their name implies the variable costs vary with respect to variation in output, but the fixed component does not vary with respect to output. The fixed costs are also referred to as overhead costs.

Using 1997 data of 157 vessels, the cost per tonne or the productivity for the port of Assab has been roughly found as provided in table 9.

Cargo Type	Productivity
Bagged	1,62
Bulk	2,29
Container	23,92
General Cargo	3,47
Ro/Ro	9,46

Table 9: Productivity of the Port of Assab

Source: Port of Assab

III. The Role of the Port of Assab to the National Economy

Generally, the transport system of goods by sea consists of three essential components. The first refers to the movement of goods by land from farm or factory gates. Secondly, there is the merchant fleet, which consists of the marine vehicles that move the goods from the loading and discharging ports. Finally, there is the port acting as the crucial interface between the land and the sea. This is the primary role of ports in the world.

However, depending on their size and circumstances, ports have much greater roles to play, either to the national economy only, or to both the national and regional economies. Among the other main contributions of ports are employment creation, income generation (value added), and trade promotion. This chapter explains the role of the Port of Assab briefly.

The main objective, however, is to emphasise that the role of the port can be enhanced if its problems of productivity and performance are solved. It is hoped that by identifying the main problems of productivity and performance of the port and providing recommendations to solve them, this dissertation could contribute to materialise the port's role and/or increase it.

Depending on the hinterland they serve, ports can generally be categorised as local, regional, or national. Since the Port of Assab used to serve predominantly (more than 90%) transit cargo from and to Ethiopia, it can be categorised as a regional port (see figure 4 for hinterland map of the port). However, at the present time due to the unfortunate border conflict between the two countries, Ethiopia and Eritrea, the

former has diverted its seaborne trade to the neighbouring Port of Djibouti. Consequently, the impact of the port after the conflict has diminished simply because domestic traffic is very limited. Whether Ethiopia is going to use the Port of Assab in the near future or not is difficult to foresee. Nevertheless, it is worth mentioning at this point that for convenience purposes the analysis of the impact of the port is based on the situation and facts that existed before the conflict. In addition, all statistics reflect the situation since independence.

The Potential and Actual Hinterland of the Port of Assab

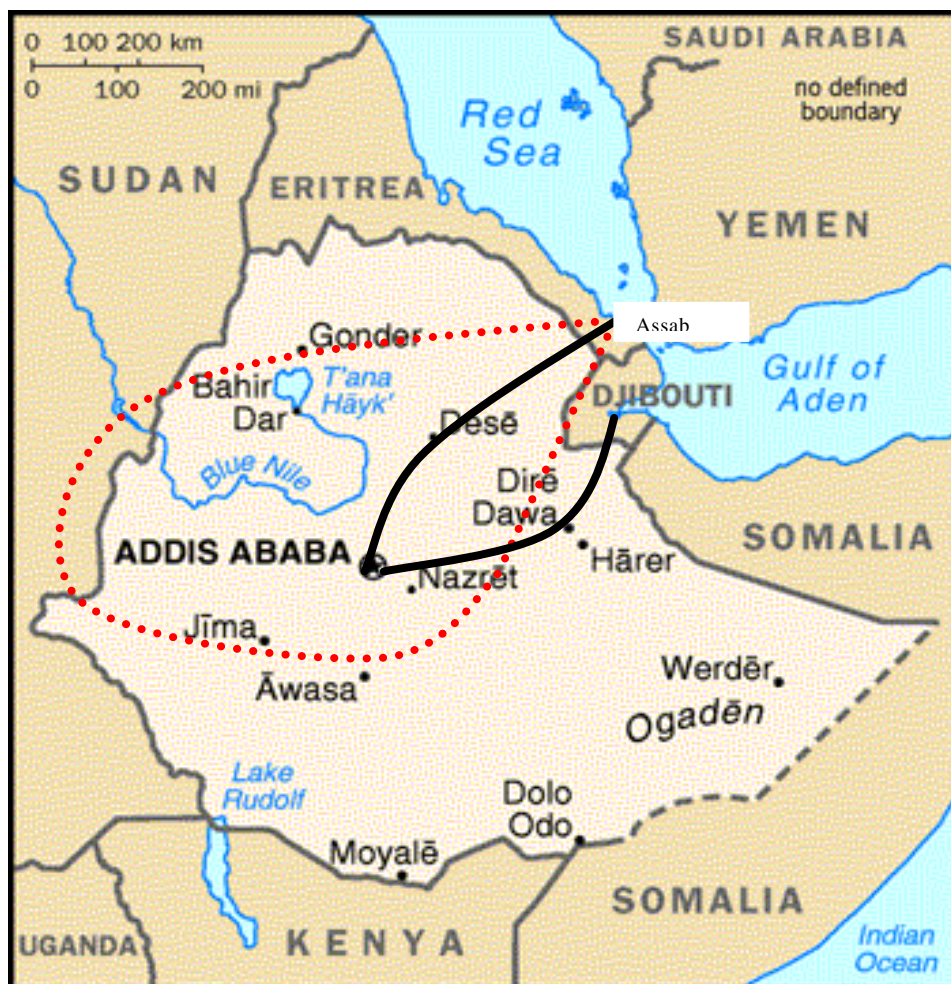


Figure 4. Source: <http://www.comesa.int/>

Keys: — The roads linking Addis Ababa with the Ports of Djibouti and Assab
 Potential and Actual Hinterland

This chapter has three main parts. The first part deals with the direct, indirect and induced employment impacts. In the second part, an attempt is made to find out the value-added impact of the port to the Gross Domestic Product (GDP). In this part the difficulties faced to get that information are also explained. Finally, other quantitative and qualitative impacts, not only to the national economy, but also to neighbouring Ethiopia as the main user of the port, will be discussed.

3.1 Source of Employment

3.1.1 Direct Impact

In the past, owing to the absence or very low competition among ports around the world and public ownership of them, the main objective of ports used to be the creation of employment. Nowadays the situation has changed. Competition has become more and more fierce and private companies have started to run and own ports. This has necessitated a very close control of costs. One way of controlling costs is to utilise the right combination of the factors of production, which in most cases has been to use more capital and less labour. In any case, ports remain to be great sources of employment.

Similarly, the Port of Assab has been a great source of employment, both to Eritreans and Ethiopians alike, thanks to the labour intensive method of providing services and the labour demanding nature of break bulk cargo. The employment levels in industries that are directly related to the port could be presented as follows:

Port Administration Employees (includes all cargo handling, pilotage, tugging, mooring/ unmooring, port security, infrastructure maintenance and administrative staff) All contract, casual, and permanent employees.	3100
Shipping Agencies (Only Eritrean Shipping Transit and Agency Service), (Maritime and Transit Service of Ethiopia, and Ethiopian Shipping Line not included)	200
Ship chandlers and other ship - related services (personal estimate)	40
Forwarding Agents	>100
Control: Customs, Health and Immigration	>50
Refinery (approximately)	800
Total	>4290

Table 10: Direct Employment Impact of the Port of Assab

Source: Port of Assab and Author's observation.

3.1.2 Indirect Impact

The indirect impacts', according to the port impact lecture notes, 'are the effects of the firms or organisations that have decided to settle themselves around the port, or inside the port area, and even a little farther from the port, because they need it for their activities; the port has been the determinant factor for their location. (Francou, B 1999. P. 9.)

The only firms or organisations that can be presented here as examples are the Fishery and the Salt industries. These are considered as an indirect impact of the port because they obviously decided to settle around the port for the reason that they needed some port services in carrying out their activities. Specifically, while the Assab Salt Factory makes use of pilot services for exporting salt by ships, the fishery industry will utilise the cold storage of the port as soon as it starts exporting fish. Although there is no accurate data, these firms certainly absorb a considerable amount of employment. There are more than 300 workers in the Assab Salt Factory working on a daily or permanent basis. Roughly, about 50 people are working under the Ministry of Fisheries in the Assab branch. Besides, a new fishing infrastructure built to promote fish export was in the implementation stage in 1997. The mere

construction of this project created considerable employment in the city. Therefore, it is evident that the port is creating a substantial level of indirect employment.

3.1.3 Induced Impact

Finding the accurate amount of induced impact of ports seems a common problem in almost all ports in the world. It requires extensive investigation and thus considerable resources. Case studies conducted in Le Havre, Rotterdam and other ports to find out their impact are the prime examples in this case. A simple approach is adopted to provide a rough estimate of induced impact of the Port of Assab, which is based on certain facts, as follows:

- There are no major industrial or trade activities in the port city of Assab apart from the port and related activities. In other words, the city almost entirely depends on the port, fishery, refinery, and the salt factory.
- The population of the city of Assab has fallen dramatically to almost 50% of its pre-conflict figure, according to some people's opinion. Most of those who left the port are Ethiopians who became jobless due to the substantial decline in traffic.

Based on these facts, one can infer that for every one job created in industries which are directly or indirectly linked to the port, at least three additional jobs were created in the form of induced impact. The population of the port city of Assab was around 60,000 of which about 5,000 people were directly or indirectly employed in the port and related activities. If the families who depend on them, the income they spend on food, clothing, and other necessities for themselves and their families are taken into account, the induced impact on employment will be even higher.

3.2 Value Added as a Percentage of GDP

Indeed, it is very difficult to give an exact picture of the impact the of Port of Assab on the economy in value added terms for one basic reason - the difficulty of obtaining data. As it is very well known, Eritrea has emerged from a devastating thirty-year war. Consequently, all the economic sectors of the country have been gravely affected by the war and everything had to start from zero. Due to this fact, the method used to calculate the Value Added impact of the Port of Assab is quite unconventional.

The figures collected from different sources are combined together to arrive at closer to reality value added impact of the port. The Ministry of Finance provided the GDP of the country. The income of the port is obtained from the annual report prepared by the port administration. According to the 1997 figures the contribution of the Port of Assab in value added terms to GDP equals 2.3%. The value added takes into account only the income generated from port activities: cargo handling, wharfage, receipt/delivery operation, equipment hire, registration and licence, and shipping service (pilotage, mooring/unmooring,). Thus, the other related firms and organisation are omitted due to the difficulty in getting data.

To sum up, the employment impact of the port of Assab locally is substantial. In fact, since the port is a regional one, it has an impact on neighbouring Ethiopia as well. Thanks to the duplication of shipping and forwarding agency activities, the same or may be even higher number of people are employed in Ethiopia to perform the same tasks. However, the latter impact is not mentioned in the foregoing section primarily because there is little, or no, difference when Ethiopia diverted its seaborne trade from the Port of Assab to the Port of Djibouti.

3.3 Other Quantitative and Qualitative Impacts

The generation of hard currency to the national economy from port dues is another contribution of the port. Eritrea, like all other developing countries, greatly needs hard currency, although not all revenue or port dues were collected in terms of hard currency. Pursuant to the agreements reached between the two countries' governments, vessels flying the Ethiopian flag were permitted to pay their port dues in Birr, the Ethiopian currency. Thus, despite the great need for hard currency, the source was limited only to port dues from ships of a foreign flag other than Ethiopian. This is good for the latter because it is relieved of considerable hard currency spending on port services. It also implies that the Port has played a great role to promote Ethiopian seaborne trade.

Not only from the exemption of hard currency did the Ethiopian economy and seaborne trade benefit, but also from the reduced port tariffs and increased efficiency of port services (as compared to the past when Ethiopia had direct possession of the port). In addition, Ethiopia used to have freedom to use the port for its seaborne trade. All imports and export transit cargoes were free of any customs duty. Ethiopian customs authorities were allowed to check their cargoes for customs purposes inside the port although the border is more than 70 km far away from the port. This had some contributions to increase the in-transit-time of transit cargo and hinder cargo-handling operations. Despite these difficulties, it is worth mentioning here that the cargo traffic that passed through the port of Assab has increased considerably from 1992-1996 by 20% per annum. This is because the port of Assab has been more efficient than the neighbouring Port of Djibouti, especially as far as bulk and conventional general cargo is concerned. Although statistical data can not be presented to support this argument, ship owners always witness that the turn-round time in the Port of Assab is shorter than that of Djibouti.

The equitable distribution of economic activities and wealth achieved could be considered as an example of qualitative benefit that the port of Assab contributes to the country. In the author's opinion, growth in this part of the country would be much lower than the present had the port not existed. In other words, the port is contributing to the balanced growth strategy of the regions within the country.

Furthermore, it would be interesting to mention that the Port of Assab administration planted all the trees in the city of Assab. This is another important contribution to the environment and also gives the port good reputation. Thanks to the efforts that have been made by the port administration, the Port of Assab is also known as 'The Green Harbour.'

IV. Major Problems of Productivity and performance of the Port of Assab

Many factors contribute to a port's poor performance and productivity. Broadly, they can be grouped into two: institutional and external factors. The institutional factors are those that originate from within the organisation itself. These problems are relatively easy to solve by better management of internal resources. As the name implies, the external problems are those that are caused by external actors in the port with the exception of the Port Authority. In these are included: customs office, trucking companies, freight forwarders, shipping agents, immigration authority, shippers and ship owners. Poor port performance and productivity arising from inefficiencies of these actors is difficult to be solved by the port unless they are ready to implement the recommendations forwarded by the port authority, or they take initiative by themselves.

This is one main reason for this paper to deal with the institutional causes of poor port performance and productivity. Even all the institutional factors are not analysed exhaustively because of insufficient time and other resources, particularly unavailability of relevant data. So, the analysis of the difficulties for the productivity and performance of the Port of Assab in this chapter is limited to those, which are considered as the major problems.

4.1 Shortage of Know-how and skilled labour

In general, in order to provide services or to produce products, three basic ingredients - labour, capital and land - are needed. In economics these are called production factors. Of these three factors, labour is the most important. There can

never be any growth or development without the contribution of labour. People create machines (capital), but machines do not create people. Of course, using more automation can reduce the level of people involved in providing services or products but still skilled labour is needed to operate and manage these machines.

Not just to labour intensive ports, such as the Port of Assab, but also to the most automated and capital intensive ones is skilled labour important. For example, the most automated terminal in the world today, (the ECT - European Combined delta Terminal - in the port of Rotterdam), is not completely unmanned. There are engineers who program the automatic machines. Undoubtedly, automation can result in great savings in the level of labour involved in production and not a complete absence. Also, the kind of labour may be different in the sense that the company uses few, highly paid, and very highly skilled people instead of many, less skilled or unskilled, and low paid labour.

Given the rapid growth in technology in all industries in general, and in shipping in particular, the need for skills and know-how has increased tremendously. Ports need skilled people to operate and manage equipment that is fast increasing in sophistication, and to a certain extent, increasing in cost. For example, ports need skilled and well-trained people to operate modern, very expensive gantry cranes. Nowadays, most port equipment requires special skills and know-how that can only be acquired by giving training and/or recruiting competent people. As discussed in IPP3:

Many of the worst features of port can be ascribed not to lack of equipment or of financial resources but to poor performance of labour force and management. (UNCTAD, IPP3, 1990. P 141)

Since skilled labour is increasingly becoming important for the survival and growth of today's ports, it might be necessary to look at the level of skill and know-how in

the port of Assab. This is approached in two ways. First, by analysing the statistical data available and second by applying the author's observation.

It seems logical to start with the investigation of age composition. In the year ending December 1998, the average age of the total permanent employees of the Port of Assab was 36 years. As can be seen from figure 5, 18% of the total employees are older than 46. Female employees constitute only 9% of the total employees About 44 percent of the employees are below 32 years old. The range for all employees (including the contractual workers) at that time was 20 to 65. According to the Eritrean provisional labour law the retirement age is 55. Thus, those who are at retirement age work on a contractual basis.

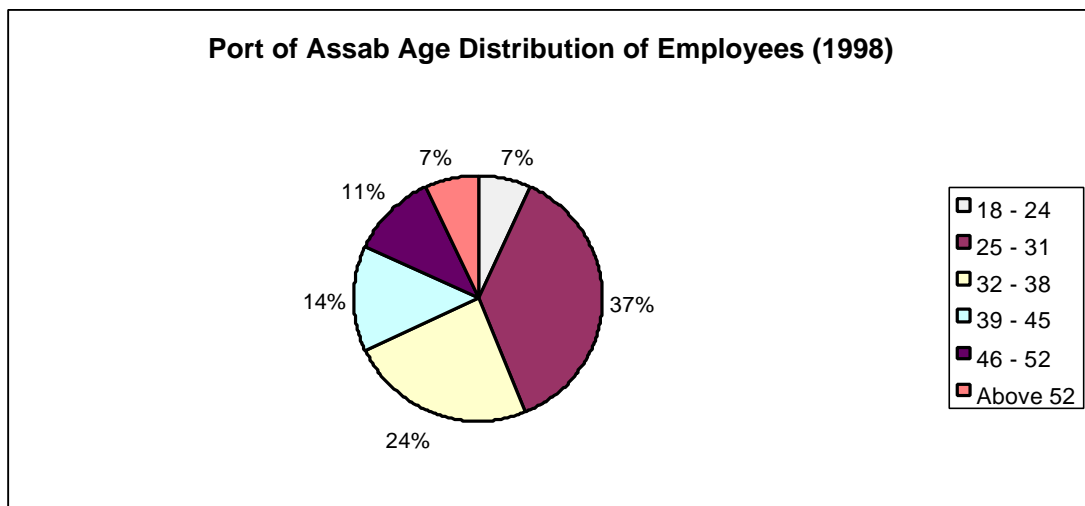


Figure 5. Source: The Port of Assab

The next point to be made is the assessment of skills and know-how. The port almost entirely serves foreign vessels and cargo. The international nature of the activity and the ever-increasing competition with neighbouring ports demand sound entrepreneurship detailed knowledge of the port industry and maritime regulations. This being the key factor to survive and continue in the prevailing competition, the labour force both at management and non-management level lacks the required basic and specialist skills. The educational status of existing employees indicates that out

of the total staff 0.5 % are illiterate, 7.5% can only read and write, while about 40% are below 12th grade. Just 2.5% of the staff have vocational/technical education while the diploma and degree graduates constitute only 4.5%. The port had recruited over 50 technically skilled people in the years before 1995, but most of them resigned after acquiring enough experience due to dissatisfaction of salary. So, on the one hand the port loses experienced workers, and on the other hand, it is forced to keep many lesser skilled workers with a relatively low morale.

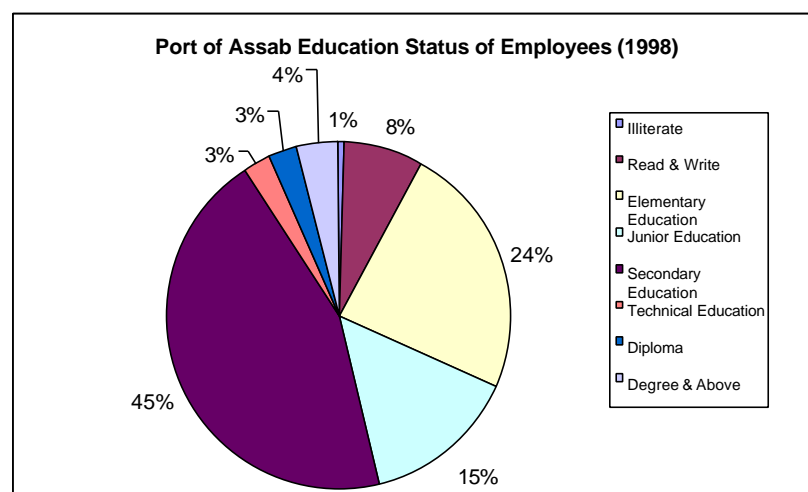


Figure 6. Source: The Port of Assab

As far as training is concerned, although it has been given to port employees, it was not sufficient and continuous for several reasons. The major reason is shortage of trainers not only in the Port Administration but also in that region of the country-known as zone 'Dehubawi Key Bahri'. Almost all graduates come from the central highlands and resettle in this region. Despite the fact that Eritrea possesses more than 1200 km of seacoast, most of the Eritrean population is concentrated in the highlands, a little bit far away from the southern coastlines. Consequently, most of the people's knowledge about the sea is limited and they consider working in the maritime field as the riskiest kind of employment. The implication of this is that there is a supply constraint.

When assessing the skill and know-how, it is not just the level of education and training that matters but also profession, and the relevance of education and training. There is a critical and acute shortage in marine engineering and nautical fields in the Maritime Administration in general and in the port administration in particular. There are very few seafarers in the country, but they prefer to go to sea because they can earn much more money from sailing than from working in the ports.

Another reason that caused the shortage of skill and which specifically refers to the lack of trained people is a historical fact. For example, several people have been trained at World Maritime University (WMU) before independence, but none of these were Eritrean. Although currently five Eritreans are studying at WMU, besides being the first batch since independence, none of them has had any nautical or marine engineering background.

4.2 Lack of Financial Resources

Generally, people agree that the bottom line of any organisation is to make a profit. The main question is how to get this profit? It is beyond the scope of this paper to go into deep analysis of the financial situation of the port. Nevertheless, the general financial position and the areas where shortage of money is reflected will be highlighted.

In the year of 1997 the port received revenues of 163,218,000 Birr, Ethiopian currency, which is equivalent to US\$ 22,669,000 (exchange rate is 1 US\$ = 7.2 Birr). Details are shown in table 11. The main source of income was cargo-handling charges, which, together with storage charges, accounts for 72 percent of the total.

Costs in that year were only 54,274,000 Birr. This figure is equivalent to 38% of revenues. One of the reasons for lower costs in relation to revenues is attributed to very low provision of depreciation costs, plus a low level of reinvestment.

Depreciation takes the historical cost of assets instead of market value or replacement values. Consequently, the highest cost incurred was on "wages and salaries" which accounted for 53 % of the total. The second largest costs, materials and supplies, accounted for 20 % of the total costs.

ACCOUNT TITLE	AMOUNT IN BIRR
TOTAL REVENUE:	163,218,000
TOTAL EXPENSES:	54,274,000
PROFIT BEFORE INTEREST AND TAX	<i>108,944,000</i>

Table 11 Revenue and Expense Statement 1997

Source: Port of Assab

Looking at the profit, the port made 108,944,000 Birr profit before interest and tax, equivalent to 67 % of total revenues. The port appears to be profitable and financially self-sufficient, but here many points have to be taken into account.

Firstly, at present the port is not burdened with loans, and therefore has no interest payments.

Secondly, the Port of Assab, as well as the Port of Massawa, do not pay income tax, but their profits are passed on to the Ministry of Finance and their foreign exchange is transferred to the Central Bank. The port does not have its own foreign exchange account, but it is allowed to use as much hard currency as it needs from the national treasury for importing spare parts and other necessary inputs.

Thirdly, the depreciation method is not appropriate. It neither takes the replacement value nor the economic life of the equipment into consideration. The straight-line method of depreciation is the one that is used to depreciate assets. Although this is determined by the law that is passed by the Ministry of Finance of the State of Eritrea, attempts could be made to convince the Ministry to apply dynamic and appropriate depreciation methods to reflect the real financial statements of the port.

Finally, tariffs are stated in dollars, and are also paid in dollars with the exception of tariffs charged to Eritrean and Ethiopian shipping lines, which are allowed to pay in Birr. However, there were increases in profits due to the fact that charges for some of these services increased in terms of Birr (because they were kept relatively constant in terms of dollars) when the tariffs were last revised in 1995.

Recent trends reveal that revenues increased by 41% p.a. between 1992-1997 in terms of Birr. The main reason was increases in revenues from cargo handling, storage, shipping, and equipment hire. The revenues from these services increased mainly because the volume of cargo went up, but partly, as explained above, charges for some of these services increased in terms of Birr.

On the other hand, costs have increased by slightly less than the revenues in the same period. Wage costs increased as the wage bill for casual workers increased along with the cargo levels, which went up by 20% per annum (see page 25-chapter III).

The combination of rising revenues and slightly less increase in costs has resulted in increasing profits by the same percentage points as revenues, see figure 7.

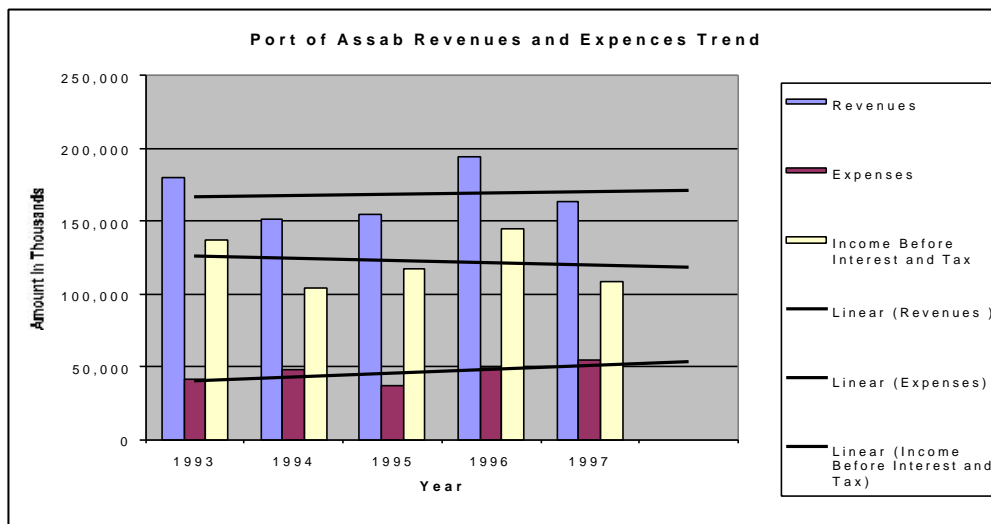


Figure 7. Source: Port of Assab

The shortage of money can be looked at from two viewpoints. The first one is the organisation's inability to send as many people as desired for training abroad. It just can not afford it.

The second viewpoint is the difficulty to replace the old and outdated equipment. Empirical studies indicate that many of the (equipment) management difficulties experienced in the ports of developing countries arise from a shortage of funds, particularly of foreign exchange for the purchase of new equipment and vital supplies, and from rigid government constraints on overseas purchases. Unlike in some ports where the major cause of their inability to finance such purchases themselves is due to the governments' prevention to review and, where appropriate, raise their tariffs to provide sufficient revenues, the Ports of Eritrea enjoy little control on tariffs. They are free to change their tariffs as long as it is commercially justifiable.

The problem of port equipment and facilities in the Eritrean Ports has been thoroughly studied by the Eritrean Port Rehabilitation Project Unit (EPRP) with the close collaboration of the World Bank. The studies have recommended the purchase of some equipment for both ports and rehabilitation of the Port of Massawa, the second major port of Eritrea. Some of the problems of equipment in the Port of Assab are explained briefly below in order to give a picture.

It can be seen from the service years of equipment in table 12 that 19% of the equipment has served below 5 years, 22% 5-10 years, 13% 10-15 years and 46% above 15 years. Due to this reason the cargo handling activities are suffering from the wear and tear of equipment. It should be noted here that the service years are counted until the year of 1997 only.

Fifty-seven agricultural tractors serve shore-handling operations. Twenty-eight were acquired in 1993, while eleven of them are in service for over 15 years. The speed of the tractors is extremely low especially when compared with modern alternative

equipment. This illustrates besides their old age, that they are obsolete and inappropriate for port activities, thus possibly reducing output while increasing operating costs.

The maximum heavy lift capacity is limited to about 50 tons. Even if there is one mobile crane with an original capacity of 150 tons, mainly serving ship to shore handling, it is downrated to 50 tons due to long service years. This particular equipment was acquired in 1976. The rest of the mobile cranes are capable of working on shore activity only and none of them has less than ten years of service. This leaves the port dependent on one mobile crane for the handling of containers and heavy lifts for ship to shore activities.

The wear and tear on port equipment is the most serious as far as forklift trucks is concerned. Almost 67% of the seventy-two forklifts have had more than 15 years of service while only 4.2% of them were acquired five years ago.

Service Years	Below 5 years		5-10 years		10-15 years		Above 15 years		Total Number
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Forklifts (3-15t)	3	4.2	4	5.6	17	23.6	48	66.7	72
Tractors	28	49.1	18	31.6		0.0	11	19.3	57
Tugmasters	0	0.0	4	100.0		0.0		0.0	4
Mobile cranes (6-150t)	0	0.0		0.0	4	57.1	3	42.9	7
Container Lift Trucks (25-75t)	0	0.0	3	75.0	1	25.0		0.0	4
Shore cranes (6-20t)	0	0.0		0.0		0.0	18	100.0	18
Tugboats	0	0.0	1	50.0		0.0	1	50.0	2
Pilot boats	0	0.0	1	25.0	1	25.0	2	50.0	4
Bagging Machines	4	33.3	8	66.7		0.0		0.0	12
Total	35	19.4	39	21.7	23	12.8	83	46.1	180
	19.4		21.7		12.8		46.1		100

Table 12: Port of Assab Port Equipment Service Years Annual Report 1997

Source: The Port of Assab

Finally, the shore cranes are hardly the cause of low productivity despite the fact that they are older than 15 years. They are, by technical standard and practical usage in the Port of Assab, capable of serving longer than the other port equipment. In general, they can serve up to 25 years or more; of course, preventive maintenance and major overhauls are required.

TYPE OF EQUIPMENT	CAPACITY	Down Time		AVAILABILITY		UTILISATION	
		HRS	% FROM MPH	HRS	% FROM MPH	HRS	% FROM AVAILABILITY
MOBILE CRANE	15 Ton	1,056.00	12.1	7,704.00	87.9	860.8	11.2
	150 Ton	472.00	5.4	8,288.00	94.6	1109.2	13.4
	25 Ton	1,304.00	14.9	7,456.00	85.1	1531.6	20.5
	45 Ton	4,448.00	50.8	4,312.00	49.2	191.6	4.4
CONTAINER LIFT TRUCK	25 Ton	2072	23.7	6688	76.3	261	3.9
	35 Ton	10312	39.2	15968	60.8	3,081	19.3
FORKLIFTS	10 Ton	7624	43.5	9896	56.5	2,356	23.8
	3 Ton	24378	34.8	45702	65.2	7,420	16.2
	4 Ton	57906	33.1	117294	66.9	19,158	16.3
	6 Ton	38752	63.2	22568	36.8	4,312	19.1
TRACTOR	60 HP	91466	37.3	153814	62.7	48,751	31.7
	65 HP	154192	80.0	38528	20.0	8,027	20.8
	76 HP	38816	88.6	4984	11.4	1,412	28.3
SHORE CRANE	20 Ton	3235	9.6	30345	90.4	6,155	20.3
	6.3 Ton	8424	7.2	109106	92.8	19,379	17.8
TUG MASTER	40 Ton	7279.7	27.7	19000.3	72.3	5,165	27.2

NB: MPH= Maximum Possible Hours - For Shore Crane is 23 Hours Per Day

Table 13: Port Equipment Availability and Performance Follow up Annual Report of 1998

Source: The Port of Assab

The other point that should be investigated on the problem of port equipment is the status of equipment. As can be seen from table 13, the 25t and 6t mobile cranes, the 4t and 6t forklift trucks, and the 65hp and 76hp tractors have been inaccessible for quite a considerable time. These are most in demand because of the nature of the traffic. They are flexible operationally. The mobile cranes are used for full containers and for conventional cargo. The forklifts are employed for lifting empty containers, and palletised and other conventional cargo.

The performance of equipment is another issue to be dealt with. Again, referring to table 13, it is evident that shore cranes have the highest availability next to the 150t mobile crane, but their utilisation is too low. The reason for low utilisation is mainly due to low demand and low traffic in that year.

Normally, the older the equipment the lower the performance and the higher the operation cost. Due to the hot and humid climate of the Port of Assab, the wear and tear of equipment is accelerated which in turn results in high break down and, of course, higher maintenance cost. The breakdown of shore and quay handling equipment caused the highest idle time at berth in 1996 (see table 14). It has been steadily increasing throughout the years between 1992-1997. The causes of breakdown are age of equipment and continuous deployment of equipment during peak demand. That means preventive maintenance and routine overhauls are bound to be postponed, which further deteriorates the piece of equipment.

Year	SHIP MOVEMENT	SHIP PREPARATION	GOODS	LABOUR	SHIP PORT EQUIPMENT BREAK DOWN	SHORE TRANSPORT	METEOROLOGY	CUSTOM, HEALTH, SHIP AGENT, IMMIGRATION	MISCL.	TOTAL
Code of idle time cause*	01, 08 37	02,03,04,06, 07,09,10	11,15	12, 13, 22, 23, 24, 31, 33, 34	05,14,21,25, 26	16,17, 18	27	19,20,32	28,29,30, 35, 36, 38, 99	
1992	173.5	102.5	267.5	845.5	493.5	192.25	183.5	4.5	100	2362.75
1993	196.5	100	198.5	724.75	600.5	410	39.75	2.75	105.75	2378.5
1994	255	5.75	30	854.25	298.75	462.75	51.25	-	137	2094.75
1995	328.75	17.25	48.75	822	714.5	188.5	59.75	4.75	248.75	2433
1996	341.25	235.25	181.75	1172.5	1239.25	154.75	247	19	517.5	4108.25

Table 14 Port of Assab Summarised Gang Idle Time for Dry cargo Vessels (hours/year) 1991-1996.

Source: Port of Assab

* The codes are the same as in UNCTAD Hand Book on Uniform Port Statistics, 198x

This clearly indicates that the condition of equipment is getting worse. The maintenance policy of the Port of Assab is mainly preventive maintenance, but, of course, equipment is repaired when a breakdown occurs. The hot and humid climate of the place necessitates preventive maintenance to be one option of a maintenance

policy, but corrective maintenance should be done as well. This leads to a high maintenance cost of the equipment.

To sum up, analysing the cost of equipment is not the main objective of this research. The objective is rather to show that although the lack of necessary equipment is affecting the productivity and performance of the port, the real cause is lack of finance to take measures. More specifically, there is a lack of financial resources to purchase new equipment.

4.3 Planning and General Management Related Problems

4.3.1 Deficiency in Management Information System

It is a general consensus that information is power. So, one without information is powerless. Information is necessary for doing planning. It is also essential for the success of an organisation in today's highly competitive ports.

The significance of information for all types of planning in general, and for equipment planning in particular, is well understood. The effectiveness and efficiency of planning greatly depends on the availability and use of relevant, accurate and comprehensive information. There are very good examples in the IPP3 handbook concerning port equipment policy, management and maintenance. One is on equipment planning:

Equipment planning is virtually impossible with out traffic forecast, operational indicators, assets register data, maintenance records and cost information. Procurement is the other examples. In procurement, technical specification has to be based on analysis of past and current data on operating performance and maintenance history, as well as on suppliers and their past performance-not to mention the process of life cycle costing, which is utterly reliant on comprehensive information. Effective maintenance management requires a wide range of record types for all

aspects of planning and costing. Supplies management can only be performed efficiently and organised appropriately if it is based on a good record system for stock control and procurement. In operations the vital business of cost control revolves around operation records. In other sections of the port, personnel records, salaries and bonuses, as well as staff appraisal, training and manpower development all depend on information. (UNCTAD, IPP3, 1990. P 166)

An accurate inventory of equipment is essential for operational and investment planning. In this respect the Port of Assab has some deficiencies. First of all, there is some inconsistency on the information concerning the equipment inventory. For example, the number of fork lift trucks available in "General Information on Eritrean Ports, 1998" is higher than that in the Assab port Annual Report, 1997, in spite of the fact that no equipment was added through purchase or otherwise. Secondly, the way of recording machine hours is not quite reliable because it is based on the 'Requisition Form' rather than on the readings of an hour-machine.

Not only accuracy, relevance, and comprehensiveness of information but also its systematic collection, compilation, analysis and presentation are important. In other words, the existence of a sound management information system (MIS) for effective and efficient port planning including operation planning is vital.

The essential elements of MIS include:

- A system: a formalised sequence of activities and records, available to all who need it when they need it, and in a convenient, easily managed and maintained form;
- A database: which contains all the required information, accurately recorded and updated, analysed and presented in a usable and easily comprehended form;

- A management tool: an indispensable instrument in the decision-making process.

As part of a sound MIS, data should only be collected for a purpose, not simply because they might be useful. When the purpose has been defined, the form and quantity of data can be decided and the system for its collection, summary and storage organised.

M. Dounts, in the Manual on Port Management, Part Two (1976), distinguishes two ways of data collection: in-house and external. He further subdivides the in-house data collection system into three basic ways; namely, continuous recording, sampling, and one-off collection. In continuous recording, data are collected as events take place and are stored for later use or summarised in regular reports. With sampling, data are collected intermittently or for a certain proportion of all events. With one-off collection, data required for a specific purpose are collected in purpose designed exercise. These methods are not necessarily simple alternatives.

The Port of Assab mainly applies continuous recording, but some times data are collected on a one-off base for specific purposes, such as tariff revision. This, of course, has cost implications. Nevertheless, since data are being prepared in operations, finance and administration, and technical divisions and sent on to the planning and statistics unit in order to be retained for planning purposes, consistency of data collection is controlled and the availability ensured when the data are required.

The second way of data collection is the systematic collection of external data from outside organisations such as new projects and the press. This way of data collection is not sufficiently exploited by the Port of Assab. This might not affect the productivity and performance of the port directly but it can affect it indirectly. For example, information about new methods of handling cargo may be available in

certain international press. If the port does not follow such information, it will have a disadvantage as compared to competitors who manage to get such data.

Great efforts have been made to control and measure the administrative and operational costs of the Port of Assab. Before independence the operating and running costs of most of the equipment was hardly controlled. However, that is not sufficient to ensure the efficiency of the port. More efforts should be exercised to analyse costs. Management should be provided with ready-made information on costs to make decisions. For example, information about the economic life of equipment is essential to decide the replacement of that particular equipment. The full control and analysis of the port costs in general, and equipment costs in particular, can not be realised due, amongst other things, to the deficiency in MIS.

One of the main reasons that enabled the port of Aarhus, Denmark, to be the most productive port in Europe, is that it employs a sound MIS not only within the port's different sections but also with relation to all port users and relevant authorities. The port users and relevant authorities include transport buyers, local liner agents, transport providers, forwarders and trucking (companies), terminal operators, port authorities and others. The system is called Port Information System (PIC).

The quality of MIS in the Port of Assab, like some developing countries' ports, is not adequate and satisfactorily efficient. To start with, there is inconsistency of information supplied by different departments of the same item. For example, the operations' division report about equipment inventory does not agree with that of the engineering division. This is because the latter evaluates any piece of equipment from a technical point of view, while the former evaluates the piece of equipment from the safety of cargo, safety of operators, productivity and efficiency viewpoint. For example, the operators do not like to use old and frequently breaking down equipment. On the other hand, the engineers consider any piece of equipment as

available for use as soon as it is maintained irrespective of its history. So, when they are asked what stock of equipment the port owns, they report differently.

The point is that although the real problem is unavailability of the required equipment that affects the productivity and efficiency of the port, the lack of consistent and accurate data is also an obstacle to the management to take the right action at the right time.

Another impact of poor MIS is delays in processing spare parts. Damaging delays occur in the issuing of spares from stock, and even more severe delays in procuring non-stock items. This reinforces the need for close-and early- collaboration over this phase of every engineering task, and the firm inter-linking of the Engineering Management Information System (EMIS) and Supplies Management Information System (SMIS).

The importance of supplies to maintenance must not be underestimated. The procurement and the stores of spare parts are an integral part of maintenance. Any weakness in those areas has a direct impact on the performance of maintenance. As observed in the Port of Assab, most of the high downtime of equipment in the maintenance shop is associated with weaknesses in procurement and supplies. Among the weaknesses in supplies management of the port are included:

- Insufficient stocks.
- Incorrect stocks, because of mistakes in ordering the wrong parts or in placing insufficient orders.
- Deficiencies in supplies personnel.
- Poor internal communication. Few incidents of failure to maintain the necessary co-operative relationship between supplies and maintenance staff have occurred.

There are deficiencies in system inter-linking as well. Frequently, for example, the engineering department has no direct access to stores inventory, and so has no knowledge of the current stock position or ready information on spare parts designations and code numbers. In such a situation, either an unnecessary telephone call has to be made, during which the stores staffs have to look up their own records; or one or more visits to the stores have to be made. Besides, there is considerable delay before the spares 'Requisition Form' can even be filled in.

The MIS in the Port of Assab is still a traditional one that consists of an array of specially designed forms, on papers and card, bound and loose-leaf registers, and card indexes of varying degrees of elaboration. There are hundreds of printed forms, each designed for one specific activity within the sequence of documentation procedures. The resulting assemblage of dissimilar forms does nothing to encourage accurate and consistent recording and analysis of equipment data.

The main problems with such a conventional (paper) MIS are that it is bulky and paper accumulates enormously and that it is time-consuming to operate effectively, particularly its analytical component.

Obviously, the first problem is the sheer bulk of the resulting paper work. The files of collected job cards and schedules, Asset History Cards, Requisition Forms, etc. accumulate in vast quantities, and storage in readily accessible form becomes very difficult. Records occupy rows of shelves in workshops and administrative offices- usually subject to dust.

The second problem is that bulky files are difficult to access for analysis; indeed they discourage managers from attempting to analyse the data on a regular basis. Nevertheless, should there be a need to analyse the paper-based data, dedicated engineers should thoroughly and carefully extract comparative data from the workshop and other records, producing monthly summaries, graphs of trends in

usage and reliability of their equipment, and even data comparing machine types and manufactures. Consequently, this takes up large amounts of their valuable time - time better spent on improving equipment management than on paper work with pencil and calculator.

Another major problem concerning the traditional paper bound MIS concerns duplication of data entries. It is inevitable that the same data such as ship particulars are entered by all parties involved in port activities, in a lot of 'Forms' and 'Cards' for specific purposes. One department could do this only once and distributed to others, had there been an electronic system of inter-link like of computer network system, or specifically electronic data interchange system.

4.3.2 Inefficiency of Supervision, Motivation, and operational planning

4.3.2.1 Inefficiency of Supervision

Next to equipment breakdown, labour was the second biggest cause of idle time in the ship to shore operation in 1996. In general, labour associated causes of idle time include early finish, late start, strikes and so on. It is observed that most of the labour idle time in the Port of Assab is attributed to early finish, and late start. At least three things could be the reasons here. The first reason could be lack of supervision. That is either the supervisors are not doing their job well or they could not influence the dockworkers to start and quit their jobs on time. The second reason is obviously the low morale of some of the dockworkers. Usually, low self-motivation is the result of a bad culture of people, bad working conditions, or low remuneration.

The third reason has to do with planning. It is very possible to be able to finish cargo operations in fewer numbers of shifts by working out careful planning and by exercising sound co-ordination in the implementation of the plans. However, since the planning in the Port of Assab is not done perfectly, cargo-handling operations take more shifts than necessary.

Shortcomings in supervision are also observed in certain areas. The performance of tallying is officially evaluated as just average. It was believed that the main reasons for low performance of tally clerks were insufficient supervision and poor motivation. To solve these problems the wage of tally clerks on shipboard was substantially increased. This did not bring the expected changes. Importers and exporters still complain about the tallying many times and called for private tallying instead of tally unit under the port administration, as they felt that it would better if tallying was done by an independent body instead of the port itself.

4.3.2.2 Lack of Motivation

It is quite clear that it is not easy to motivate people. In fact, as Alain Chauval argues (1999), it is not possible to motivate people at all, but it is easy to demotivate them. What one can do, he further argues, is to create an environment (atmosphere) that can motivate people.

With respect to the supply of skilled labour, Assab is located in a relatively unsuitable position. People, especially the skilled ones, are reluctant to migrate from the highlands, where there is more skilled labour than in other regions, to the port for several reasons. The first reason is the climatic hazards. The climate is hot and humid. This is a detriment to productivity mainly due to fatigue. The worst problem is that the resignation of skilled and executive workers was high in 1997. Even those who gained experience and skill out of the port activities resigned after they have acquired enough skills and experience. This leaves the port with more unskilled labour. Coupled to climatic hazards is the risk of serious contagious diseases such as malaria. These are but external factors that prevent people from increasing their productivity.

Moreover, it is believed that the free provision of medical care in the port clinic and in the hospital is not a good motivation. It has, on the contrary, become a cause for

many people to be absent from work by going frequently to see the doctor even for very minor sicknesses. Moreover, it creates a free rider-in the sense that people do not even take the dosages that are prescribed by the doctor.

Finally, there are occasional labour relation problems when workers go on slow down strikes. Fortunately, no other kinds of strikes have ever taken place. Nonetheless, there have been some incidents when some workers complain about the lack of qualities of leadership of their supervisors.

4.3.2.3 Inadequacy of Operations Planning

Operations plans are so important to achieve optimum allocation of resources and co-ordination of activities.

No matter how well traffic and operations managers undertake their day-to-day control and supervisions, it is impossible to achieve the cargo throughput of which the berth is capable unless operations are planned effectively, to produce a smooth, cost effective, and balanced flow of cargo through the port. (UCTAD, Monograph No. 4, 1985, P. 1).

Plans can be divided into three based on time scale: Short-term, Medium-term, and Long-term. Short-term plans are made for days, weeks, and months ahead.

Short-term planning efforts involve the current allocation of the port's facilities, equipment and manpower to meet the needs of the vessels and cargo in the port. The planning is in response to the short-term needs of the port users. The information used includes requests from ships' agents and the status reports relative to the port berths, equipment and storage areas. Typical outputs are the daily assignments of labour and equipment, the daily or weekly berth assignments, and the weekly or monthly maintenance

schedule. The goal of this planning is to ensure efficient cargo handling operations, rapid vessel turn round, and reasonable levels of utilisation of equipment and facilities. (Ma Shuo, 1999. P. 2)

Medium-term plans are made for one to three years ahead. Long-term plans are made for at least three years and they can go up to twenty years ahead. In Eritrea, the time scales for short-term, medium-term, and long-term plans are 1-2 years, 2-5 years, and over 5 years, respectively.

B. J. Thomas distinguishes between three principal groups of activities in port operations planning. The first one, which takes place before the vessel arrives, is called pre-arrival planning. It includes such tasks as berth allocation, planning the right labour and equipment and estimating working times. The second activity is known as work scheduling and takes place when the vessel is alongside the berth and covers all the preparations for the next shift. The final task, in operations planning, is the performance review, which is undertaken when the vessel has completed the discharging and loading of its cargo and has left the port. The main objective of this is to closely evaluate the performance of the cargo handling operations.

The two latter planning tasks are carried out relatively well in the port of Assab. However, the first one, the pre-arrival planning, is not done. The institutional reasons for not doing this planning are not known for sure, but it is most probable that one reason could be due to the shortage of specialist knowledge. The other reason could be shortage of equipment; meaning the shortages of some highly demanded pieces of equipment such as container lift trucks does not allow reserving these pieces of equipment for a particular ship.

In this case the external factors used to be the major reasons that made the pre-arrival planning very difficult. They include:

- Communication and Transportation Problems. In the years between 1991-1995, There was a serious air transportation problem. There were only two scheduled flights between Asmara, the capital of Eritrea, or Addis Ababa, Ethiopian capital, on the one end and the port on the other. Besides, it was not unusual for flights to be cancelled. This was a major source of delay in the transfer of documents about ship and cargo by air. Similarly, since for historical reason there was no direct telephone link between Assab and Asmara, considerable delays, inconvenience and more costs were inevitable. To minimise costs VHF radio communications were often used. However, the Eritrean Shipping and Transit Agency Services (ERISTAS) had to use SATCOM for speedy communications.
- Inaccuracies in information obtained about cargo. This was the reason, as reported by the operations divisions, for the incorrect deployment of resources, mainly labour.
- The nature of cargo itself. It is obvious that break bulk cargo that comes in small consignments takes more time to handle than unitised and homogenous cargo. The cargo traffic that is moved through the Port of Assab is mainly break-bulk cargo (more than 45% excluding containerised cargo).

This research focuses on how the deficiencies in short-term operations plans affect the efficiency and productivity of the port. In this context, it is deemed important to explain what information is needed to carry out the short-term planning and what items, or who is involved, in short-term plans.

In order to be able to plan effectively one needs sufficient, relevant and up-to-date information. Ship data is just the primary information needed. Ship data consists, in the first place, of the technical details of the ship which as a rule are already known. Also, they provide information for the various cargoes. For import cargo this means the ships manifest, stowage plan, and expected time for the ships despatch. For outgoing ships an overall ships plan, loading/unloading data, the ports of call and a

cargo list for the various destinations are needed. (UNCTAD. Manual on Port Management, Part III. 1976. P. 13-14).

Before a ship arrives at the port, it is necessary to work out and prepare all the information for the quayside operations. This means listing export consignments already at the port, their weight, port of discharge, dangerous cargo. In addition, and particularly for storage planning purpose, the present location of cargoes in the port and consignments not yet available or to be added, with anticipated time of arrival and information on whether they should be discharged in to a shed first or directly into ship, are required. An important quayside detail is the storage capacity of the sheds. This means the amount of space needed which is either already there or must be cleared, depending on the type of goods expected and their respective properties. This amount of space varies with the degree of mechanisation of the port.

In the case of the Port of Assab, the decisions on the various berths to be used the next day is reached by about 10:00 a.m. of the previous day. The necessary number of gangs and the operation methods are determined according to the services to be provided by shipside gangs and quayside gangs of the respective sheds. The operations manager on board a ship and the operations manager on the quay make these decisions.

V. Cost Benefit Analysis of Alternative Solutions

The previous chapter dealt with the major causes of low productivity and performance of the Port of Assab. This chapter proposes some solutions, together with their cost-benefit analyse. However, for convenience, and mainly because of time constraints, the cost-benefit analysis is to be detailed. It is not done for all solutions either.

5.1 Training

In spite of the increased need of skills and know-how for survival and continuation of the organisation in the competitive environment, there is an acute and critical shortage in certain essential fields. Providing thorough training to upgrade the skill and know-how of existing workers can solve this problem and most of the other major problems of the port.

In general, as Allan (1987) explains, there are three costs associated with training:

1. Establishment Cost: are costs of training organisation within the company and typically comprises such elements as salaries, insurance, pension contribution and all other benefits given by the company to members of that unit. This cost could be very low for the Port of Assab because of two basic reasons. The first reason refers to the pensions and insurance. In Eritrea a law governing insurance, pensions contributions and other labour related laws is still under study. So, the company is paying these contributions. Secondly, the level of salary in the country in general, is low. Therefore, taking into account the salaries of the

training manager and one typist, this cost could approximately amount up to US\$4300 per annum.

2. **Marginal expenditure:** by this is meant the additional money which has to be spent, in addition to establishment costs, in order to carry out any one training activity. Atypical example of this is outside lecturers' fees and expenses. These are demanded by university staff, consultants, etc. hired to make a presentation to an internally organised company course. Finding accurate figures of this type of cost is difficult at this stage because it depends mainly on the number of courses that will be given by outside lecturers' per annum. Sometimes it can be free of fees because it is possible to find volunteers and aid from special agencies, like UNCTAD. However, it is unrealistic to assume that it would be totally without expenses. Thus, if any course is to be given in a particular year, it might demand up to US\$10,000 outlays in the form of marginal cost.
3. **Interference Costs:** when one gives time and effort to training, and thus ceases to be occupied in one main tasks, which are other than training, there is an interference with the output with which one is primarily concerned. This interference with normal work obviously has an associated cost. This is more or less similar to the opportunity cost of being in training. In the Port of Assab this component of training cost could be minimised tremendously by carrying out efficient planning and co-ordination between the training centre and other departments of the port; for example, by giving training during the low traffic season (usually in the first quarter of the year).

As far as the benefits of training are concerned, there are a lot of variables to consider before going into detail. First of all, the evaluation of the benefits of training cannot be undertaken by restricting the study purely to those things within the limits of the functional responsibility of the training manager. Instead, it should extend throughout the chain as far as is deemed necessary.

Secondly, training has short-term and long-term benefits. It is difficult to tell with certainty the exact future benefits. That is to say there is the problem of estimating precisely the benefits accrued to training when justifying its future benefits.

Attributability is another problem associated with estimation of the benefits of training. Specifically, when training is followed by an improvement in performance it is easy to attribute the improvement to the training itself and to the technological substance of the training. For improvement in performance that occurs after training, it is difficult to tell exactly what the contribution of training was, and what the contribution of other factors were.

Despite all the above difficulties in evaluating the benefits of training, there are several obvious benefits. It is believed that these benefits can only be fully evaluated, by comparing the 'after training' performance (human, mechanical or financial) with the 'before training' performance.

It has been proved that in the year 1997, damage to equipment and cargo dropped considerably as the result of short-term training given to operators of different equipment by the mechanical engineering division.

Generally, the benefits of training can be listed as follows:

1. Reduction in human error accidents
2. Avoidance of sabotage
3. Readiness and competence of people to take responsibility
4. Reduction in mechanical and procedure problems
5. Ability of managers to understand better current approaches to commercial, organisational and management problems
6. Decline in industrial disputes or in labour wastage
7. Addition to the quality of industrial life.

8. Transfer of technology: Specialist skills that could not be given internally could be acquired by sending people abroad.

In short, for a port this implies a better quality of service, reliability, and efficiency. This good reputation could also attract more customers to use the port.

The benefits from training could also be analysed from a reduction in different cost elements enjoyed by importers and exporters. These people can get the following benefits as a result of improved productivity.

- Reduced stevedoring costs
- Higher service quality and lower ship turn-round times
- Reduced inventory costs
- Shortened transit time
- Cut demurrage claims by truck operators
- Reduced freight rate, provided that the market forces either remain constant or decline with the reduction in port costs.

On the other hand, training gives benefits to trainees in many ways. For example, the benefits to employees could be promotion to higher posts or higher salary. These benefits are the after training benefits. Nevertheless, it should be remembered that training by itself induces motivation. So, even during training there is usually high morale on the side of the employees who get the opportunity of training.

5.2. Changes in Management Information System

It is evident that the effectiveness and efficiency of every port planning, maintenance and operational activity depends on the availability of relevant, accurate and comprehensive information. An appropriate MIS helps to achieve these objectives.

The port could continue to use the conventional paper based on MIS to take advantage of lower labour costs in relation to capital. However, if the port intends to achieve quality, and most importantly a long-term cost effective MIS, it should look for a computerised system. The port needs to employ a computerised MIS such as Electronic Data Interchange (EDI) and Local Area Network (LAN) and Wide Area Network (WAN) system. More specifically, the policy changes in MIS should include:

- Modern techniques of general management in the sense that there should be good principles of delegation, management style and discipline;
- Rigorous cost accounting;
- Simplified procedures; and
- Modern communication and information technology.

The benefits of a computerised system to the conventional paper based MIS can be presented in summary form as follows:

- availability of information at the right time, in the right manner, for the right people, which implies the availability of reliable and effective data collection, data processing as well as effective and efficient information;
- reduction in the cost of operations by avoiding errors, by optimal allocation of berth, yards, equipment and labour force to tasks quickly, and
- reduction in the administrative and telecommunication costs.

There are, of course, certain costs associated with computerised MIS. Generally speaking these costs include:

- At the initial stage, installing modern technology is certainly going to cost a substantial amount of money, but later on, just like any other capital investment, this is going to diminish.
- Other costs associated with computerised MIS are the maintenance of the system, the risk of bugs, and redundancy.

This, similar to structural adjustment programmes, is likely to lead, at least initially, to a reduction in the workforce. This is particularly true in over-manned, state-owned ports, like the Port of Assab. However, as a result of increased productivity, security of employment for port workers could be improved.

5.3. Changes in Maintenance Management

It appears that the port needs to introduce some changes in its maintenance management. First of all, the port needs to review its approach to maintenance and to consider the various options and formulate an appropriate maintenance policy. Equipment should not be maintained simply for the sake of maintenance. Cost-benefit analysis of a piece of equipment should be conducted and compared against buying a new one to ensure the rationale of maintaining existing equipment. If any piece of equipment reaches its economic life, it should definitely be phased out.

Computer Assisted Maintenance Control (CAMC) is used in most efficient ports to control the costs and maintenance history of equipment. The Port of Assab should also try to apply such a good tool to ensure the efficiency and effectiveness of maintaining any piece of equipment.

The writer does not see substantial cost to be incurred due to mere changes in maintenance policy. A limited amount of money might be expected for installing CAMC and training or recruiting qualified staff.

In contrast, the benefits could be really great. For instance, the result could be a saving in maintenance costs by avoiding unnecessary maintenance. If this overhead cost saving by the maintenance department is passed on to the port user through reduced cargo handling costs or otherwise, it could become a source of other benefits to the port such as the capture of new traffic or better reputation to the port.

The second change to suggest in maintenance management mainly aims at improving the availability of equipment. Revising the organisation of shifts and staff working times in the workshop could lead to the achievement of this goal. The introduction of flexible working hours, at least on the part of the staff, will greatly improve productivity. However, when implementing flexible working times in the workshop, one must carefully examine the peak demands for maintenance as they occur during the day, and then adopt working hours accordingly.

As long as the maintenance staff do not display any reluctance in implementing these flexible working hours, there will not be any cost attributable to this change. Even if staff do, the costs will be limited. To the contrary, tremendous benefits could be obtained as a result of implementing flexible maintenance working hours. Operators' satisfaction, reduction in overtime costs, and avoidance of unnecessary investment in equipment to maintain the minimum required availability level are but a few of the benefits.

Finally, outsourcing might be a possibility in the future. Currently, however, outsourcing the maintenance of equipment does not seem possible for the simple reason that there are no competent local engineering companies near the port. In addition, there are no local agents for manufacturers of several types of the equipment that the port owns. The port is the only one that owns and uses heavy equipment in that region of the country.

5.4 An Investment Plan

To make sure that the port does have the inventory of equipment and the facilities necessary for the actual traffic, the development of an investment plan will be needed for new equipment or the replacement of existing equipment and new facilities. An investment plan is part of the port's corporate plans. So, it is a compulsory that every port must do this; it is not an option.

Of course, to make such a plan very detailed information regarding traffic forecasts and equipment output will have to be gathered, but this does not imply that making an investment plan requires significant special costs. As regards the benefits of preparing an investment plan, they are the same as other plans. Thus, it seems there is no need to analyse in detail the costs and benefits of preparing an investment plan.

In fact the Port of Assab does have an investment plan which is prepared for both the ports of Eritrea by the Department of Maritime Transport. The investment plan spans for fifteen years from 1995-2010. It needs updating because many events and variables have already changed. This investment plan should be adhered to and updated regularly and the inaccuracies of forecasting should not be used as an excuse. It needs regular updating and if possible the simulation method of planning should applied to suit inevitable changes in ship and cargo traffic and those that influence them.

5.5 Operational Plans

Now that the external factors, such as communications and air transport, which had been the reasons for not carrying out the pre-arrival plans, have already been solved. The shortage of skilled labour should also be solved either by giving training or

recruiting qualified people. Thus, the complete set of operations plans has to be worked out in order to achieve the efficiency of cargo handling in the port.

All the three operational plans discussed in the preceding chapter should be worked out. This is really a plus for the quality of the port services. The ship owner will be so happy if he/she is able to know when operations in the port are going to start and end. Better utilisation of resources, better co-ordination of different tasks and the smoother flow of cargo handling are among other benefits.

Performing the plans is not likely to cost much. What is needed is to employ skilled people, either by recruiting new, qualified people or by giving training to the existing staff. The other requirement is the timely arrival of information concerning the vessel and cargo characteristics. The information should arrive well in advance before the ship enters the port. This is not a problem if the new technologies are applied to improve the MIS of the port as explained above.

5.6 Port Reform

Sometimes changes in the management of internal resources or organisational changes alone do not bring about the desired improvements in port efficiency. In such a situation, the organisation, or the port authority for that matter, has no choice but to consider the other options of port reform.

In general, options of port reform include:

- Improvement of the port administration
- Liberalisation (introduction of competition)
- Commercialisation
 - Contracting out of certain (non-core of the business) activities
 - Leasing

- Corporatisation (privatisation without change of ownership)
- Privatisation
 - Public offer
 - Private placements
 - Management/employees buy-out (MEBO)
 - Build-operate-transfer (BOT)
 - Sale of Assets
 - Joint Ventures

In the port industry a commonly used method to apply port reform is through the contracting out (leasing) of public services to the private sector. (De Vos Fe, 1995. PP. 26-30)

When one is considering applying any of the above port reforms, there are two basic remarks that must be considered:

1. Efficiency will not automatically increase
2. To limit the commercial risks to the maximum extent and probably obtain more benefit, the port management should consider only leasing the infrastructure, because:
 - The port management reduces its investments and therefore the financial risks
 - The operating company will be more loyal to the port since it is requested to make large investments in superstructure. (De Vos Fe, 1995. PP. 26-30)

VI Conclusion and Recommendation

Starting by introducing the country's general background and port's background, this dissertation then went on to present the significance of the port to the national economy and also the significance of this study. As explained by analysing the major causes of low productivity and performance and giving some recommendations, the port's role can be realised or it can play even greater roles in the national economy.

Based on the analysis made in chapter four, it is found that the major causes of lower productivity and performance of the Port of Assab as compared to international standards were the following:

- Acute and critical shortage of skilled labour and know-how, particularly in the nautical and engineering fields;
- Shortage of financial resources to purchase new equipment and send people for training abroad or to recruit expatriates to fill the gap where skills and know-how are lacking;
- Deficiency in Management Information System (MIS); and
- Deficiency in supervision, motivation and planning.

To solve these problems alternative solutions are suggested in chapter five. In addition, attempts are made to analyse the costs and benefits of the alternative proposals.

It should be noted that since all the analyses are based on the facts that prevailed before the border conflict, the recommendation is also based on that scenario. This is

because of the belief that the current situation is a temporary emergency and the port will likely continue its normal services as a natural gateway to Ethiopia.

The recommendations, it is admitted, could be implemented if, and only if, the situation comes back on track to its normal situation. Otherwise, the current situation is quite different and needs different approaches to analyse and come up with effective new solutions. At the present, the greatest problem of the port, that is the loss of traffic, is not institutional but something that is caused by external factors. This is a very serious problem to the port.

Once the major problems are identified and analysed, it is necessary to make certain recommendations. Accordingly, the following recommendations are suggested.

1. A well-trained work force is essential for efficient port operations. The objective of training should be to provide port workers with the skills necessary for the safe and efficient performance of their work, to facilitate the movement of workers across the organisation's ladder. To this end, the writer suggests the following training schedule to be given in the short and medium terms. This, by enhancing the skills and know-how of the port workers, does solve most of the major problems of the port. Therefore, the organisation should put people first in its strategies and take steps towards the achievement of this goal, not only by providing training but also by organising continuous human development programmes.

It seems unrealistic to the writer to believe that the findings of this study are sufficient to determine the exact number of trainees. It undoubtedly needs more vigorous scrutiny and consultation with senior staff of the Port Authority. The following suggestions are particularly aimed at solving the problems investigated by this study. The suggestions do not include the general training needs to all port employees.

Familiarisation with computer operating and computer network system should be provided to all staff with exception of those who are not going to be part of the network system suggested as a solution to the MIS problem.

Priority level	Trainees Group/ Members	Trainees	Type of Training	No. of trainees	Short Term	Medium Term
First	Top Management	General Manager and Division heads	Training, Workshop, Seminar, visits and Conferences	6	Port Management, Port Economics and Finance, IPP3, IPP4, IPP5	Port Management, Port Economics, and Finance, IPP3, IPP4, IPP5
Second	Operations Division	Intermediate managerial, and senior managerial manpower	Training, and Seminar	15	IPP1, IPP2, and IPP3, logistics, Principle of Management and Accounting, Safety and IMDG code. In Service Training	IPP1, IPP2, and IPP3, logistics, Management and accounting, Safety and IMDG code. In Service Training
		Supervisors, clerical, and junior managerial manpower	Training, and Seminar	60	IPP1, IPP2, IPP3, Safety and IMDG code, Warehousing Management and Principle of Management	IPP1, IPP2, IPP3, Safety and IMDG code, Warehousing Management and Principle of Management
		Drivers of different Equipment	Training, and Seminar	60	Training on the new types of equipment to that are to be procured with accordance to the Eritrean Ports Rehabilitation Project	Training on the new types of equipment to be procured with accordance to the Eritrean Ports Rehabilitation Project
		Dockworkers	On the job Training	360	Integrated Gang System, and training on Safety cargo Handling	Integrated Gang System, and training on Safety cargo Handling
Third	Mechanical Engineering Unit	Technicians	Practical Training	36	How to maintain the new types of equipment to be procured with accordance that are to the Eritrean Ports Rehabilitation Project	How to maintain the new types of equipment to be procured with accordance to the Eritrean Ports Rehabilitation Project
		Workshop Foremen and Maintenance Planners	Education and Training	6	IPP3, and Principles of Management and Accounting	IPP3, and Principles of Management and Accounting
Fourth	Procurement and Property Management Unit	Intermediate managerial, and senior managerial manpower	Training and Seminars	6	logistics, Principle of Management and Accounting	logistics, Principle of Management and Accounting

Table 15. Proposed Training Schedule for Employees of the Port of Assab

Keys:

Education is a training that should be given by institutions or universities level

2. The port should introduce some change to improve its performances in the maintenance department. Changes in its maintenance policy should be introduced such as scraping equipment when it has reached its economic life.
3. The MIS of the port should be improved by applying an EDI or a computer networks systems so that information can be transferred or received automatically. Within two phases the port could be inter-linked internally within different division of the port and externally with respect to port actors such as ships' agents and freight forwarders, like that of Aarhus.

Million US\$

Category	Component Description	Local	Foreign	Total	% Foreign	% Total Base Cost
1 Equipment		-	10,6	11,05	96	70
	a. Reach Stackers, 40t (4)	-	1,80	1,80	100	
	b. Reach Stackers, 15t (2)	-	0,50	0,50	100	
	c. Ship-to-Shore tower crane (2)	-	6,00	6,00	100	
	d. Mobile crane, 50t	-	0,40	0,40	100	
	e. Tugmaters (6)	-	0,90	0,90	100	
	f. Trailers (18)	.	0,45	0,45	100	
	g. Forklift truck, 15t	-	0,20	0,20	100	
	h. Forklift truck, 4t (9)	-	0,35	0,35	100	
	i. Fire fighting truck	-	0,45	0,45	100	
2 Marine Craft		-	3,45	3,45	100	22
	a. Multipurpose tugboat	-	3,35	3,35	100	
	b. Retaliation pilot boats	-	0,10	0,10	100	
3 Environment		-	0,80	0,80	100	5
	a. Equipment and facilities for improving operating practices and maritime safety.	-	0,80	0,80	100	
4. Consultancy		-	0,20	0,20	100	1
	a. Short term consultants (4mm)	-	0,10	0,10	100	
	b. Technical assistance (4mm)	-	0,10	0,10	100	
6. Training		-	0,30	0,30	100	2
	a. training	-	0,30	0,30	100	
Sub-Total Assab		-	15,35	15,80	97	100

Table 16 Eritrea: Ports Rehabilitation Project for 1998

Keys:

mm: Man Months

Source: Port of Assab

4. Having an investment plan, which is updated regularly according to circumstances in cargo traffic and factors that affect it, is a necessary condition. Implementing that plan is a sufficient condition. Thus, immediate investment in equipment is required either by borrowing from different external creditors such as the World Bank and African Development Banks, or by direct public or private investment. The recommendations made by the Eritrea Port Rehabilitation Project Committee to procurement several pieces of equipment should implemented as soon as traffic resumes if port's productivity is to be improved (table 16). However, the recommendation made by the same unit on construction a container terminal should be reconsidered.

Phase 1: Proposed Computer Network within the Port of Assab

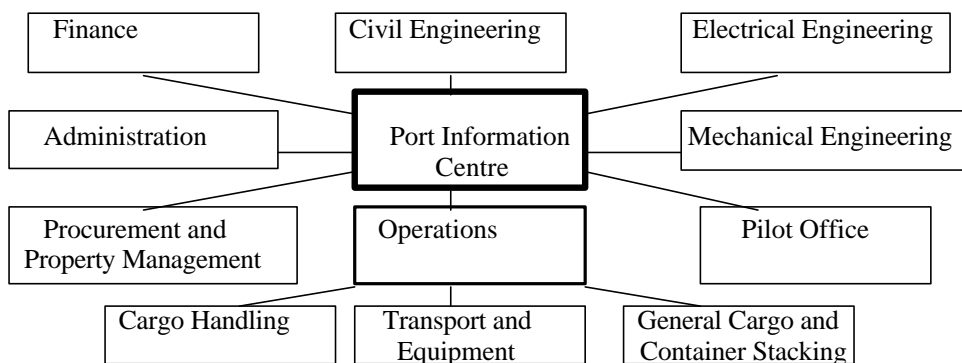


Figure 8.

Phase 2: Proposed Computer Network for the Port of Assab with Port Clients and Authorities

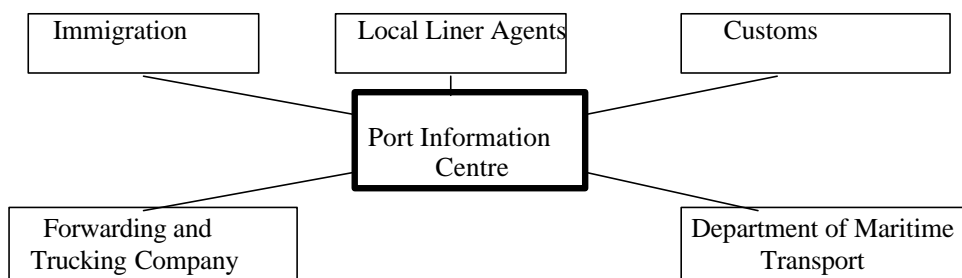


Figure 9.

5. Finally, one might notice that the above solutions are a sort of package proposals that are meant to improve the productivity and performance of the port as long as

the port remains as a service port. However, many ports in the world are moving from a 'service port' type to a 'tool' or 'landlord' types due to several factors such as globalisation. Thus, it seems the right time that the Port of Assab takes some steps in this direction; for example, it should consider privatising the stevedoring activities as well as tallying activities.

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