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# Improving port performance and productivity in Massawa port in Eritrea

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**WORLD MARITIME UNIVERSITY**

Malmö, Sweden

**IMPROVING PORT PERFORMANCE AND  
PRODUCTIVITY IN MASSAWA PORT  
IN ERITREA.**

By

**TECLE ABRAHAM ABAI  
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 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**

**This work is sincerely dedicated to all Eritreans who are  
defending Eritrean freedom from Ethiopian aggression,**

**And**

**To My father Abraham, to my mother Abrehet and  
to my aunt Bein**

## **ACKNOWLEDGEMENTS**

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## ABSTRACT

Title of Dissertation: **Improving Port Performance and Productivity in Massawa Port in Eritrea**

**Degree:** MSc

This dissertation discusses ways of improving port performance and productivity at Massawa Port in Eritrea. Its purpose is to evaluate the organisational and managerial aspects, which affect port efficiency and effectiveness. It is the author's view that improved port performance and productivity is the key in achieving greater customer satisfaction and enhanced competitiveness.

The baseline of the study is the analysis of the existing situation of the port in terms of performance and productivity. It identifies and examines the problems and constraints operationally and structurally.

The major problems of the port are deficiencies and inadequacies of port equipment, inefficiency of operational planning, inadequacy of the management information system, lack of an Electronic Data Interchange (EDI) system, low level of skills, and inadequate training. The causes of these problems are inefficient human resource development, lack of timely investment, inadequate equipment policy, and inefficient port and customs regulation.

Consequently, the port productivity and performance is low, availability and utilisation of equipment is inefficient, berth occupancy is high, and customer satisfaction is low.

This study suggests some possible solutions to the above problems, namely to create good management; to upgrade Planning and Programming unit to Management Information System (MIS) level; to set up an EDI facilities; to formulate effective Maintenance Policy for equipment; to develop (strengthen fully) marketing section, and to set programmes for human resource development.

**Key words:** **Communications, Eritrea, Human Resources Development, Massawa Port, performance indicators, and productivity**

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## ABBREVIATIONS

BC	Before Christ
CDG	Carl Duisberg Gesellschaft
EDI	Electronics Data Interchange
EMIS	Engineer Management Information Systems
GDP	Gross Domestic Product
GRT	Gross Registered Tonnage
HRD	Human Resource Development
IPP1	Improvement Port Performance Management of general cargo operations
IPP2	container terminal strategy
IPP3	Improving port performance: port equipment: policy, management and maintenance: a seminar for policy maker
IPP4	Strategic port policy
Km	Kilometre
km <sup>2</sup>	square kilometres
LCL	Less than Full Container Load
LDCs	Less Developed Countries
MDP	Manpower Development Plan
MIS	Management Information System
mm	millimetre
MT	Metric Ton
MTP	Management Training Program
OMIS	Operations Management Information System
PPU	Planning and Programming Unit
Ro/Ro	Roll On Roll Off
TEU	Twenty Feet Equivalent Units
TSS	Technical Service Section
UNCTAD	United Nations Conference of Trade and Development
US	United States of America
US\$	United States of America Dollar
WMU	World Maritime University

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1. Back ground of the Port**

Massawa Port is one of the two main national ports. It is located on the eastern part of the country on the northern bank of Massawa Islands at the geographical co-ordinates of  $15^{\circ} 37'N$  and  $39^{\circ} 19'E$ . Massawa Port is 115 kilometres away from the capital city, Asmara.

Massawa Port plays a great role for the development of the economy. Besides, the port has better comparative advantages than the other neighbouring ports in terms of geographical location, relatively better hinterland transport connections, and reasonable tariff. The port has a large hinterland as a transit services to Ethiopia (though due to political reasons terminated) and east Sudan.

**Figure 1: Map of Africa**

**Figure 2: Map of Eritrea**

## **1.2. Background of the study**

The author is impressed by the high port performance and productivity of the European ports while touring them, particularly the port of Rotterdam (the Netherlands), Le Havre (France), and port of Hamburg (Germany). These ports are commercial/ business oriented organisations. Their core objective is to satisfy customers as their staying alive are depending on the customers' satisfaction. In addition, they develop the business culture, which focuses on customer needs by developing the dimension quality , that is full access, credibility, reliability, security, competence, communication, courtesy, and responsiveness. Moreover, they are continuously investing in equipment, facilities and other types of technology to cope with the market customers' demand. All these measures are inclined towards increased efficiency and quality of the ports. Most ports in developed countries believe that the satisfied customers will remain loyal without deviating to other competitors. Therefore, the author is motivated to study the performance and productivity of Massawa Port based on experience from other ports in the world.

## **1.3. Scope of the study**

The study comprises six chapters. Chapter One discusses the background of the port, background of the study, scope of the study, methodology, objectives of the study and limitation of the study.

Chapter Two discusses the country's profile and port description, which comprises its organisational structure, objectives, facilities, port operations and other main activities.

Chapter Three explains the necessity of the improvement of port's performance and productivity. This chapter mainly focuses on factors that motivate (initiate) the port to take measures to improve the port performance and productivity. These are the growth

of the national economy, increase the demand of the port service, the continuous change of the ship's structure, and the willingness to use the opportunity of the comparative advantages of the port.

Chapter Four deals with the identification and analysis of the problems based on the different international standardised indicators. These are indicators of output, indicators of services, indicators of utilisation, indicators of quality service, and indicators of productivity.

Chapter Five focuses on the main general problems which are summarised from the in depth analysis of Chapter Four and suggestions of the possible solutions. This chapter discusses particularly the major problems, which include shortage of skilled manpower, Inadequacy of MIS, unavailability of EDI facilities, and their consequences.

Chapter Six comprises of conclusions and recommendations. In this chapter, the conclusion presents the summary of all major problems and their possible solutions in a very precise way, and the recommendations comprises only two important main solutions which are very helpful for short, medium, and long term problems. These are the training of manpower and setting the modern MIS and EDI facilities.

#### **1.4. Methodology**

The author has used the following methodology: gathering, organising, analysing, diagnosing, and summarising the information; and giving possible solution based upon the result. Besides, a survey of the Aden Port Authority (Yemen) was done based on the information which was collected through questionnaire by E-mail. All the data are organised and compiled through the help of the Excell programme according to the different formula of performance and productivity indicators. The information includes

- Primary sources of data from the DMT
- Second source of data from permanent and guest lecturers, field trip presentations and discussions, books, UNCTAD brochures, magazines, periodicals and information through Internet.

### **1.5. Objective of the study**

- To evaluate the port performance and productivity based on the internationally standardised indicators;
- To identify and examine the main problems and constraints of the port to the efficiency and effectiveness of the port from analysing the indicators;
- To identify the main causes of the problems and constraints;
- To derive the conclusions and recommendations based on the above objectives.

### **1.6. Limitation**

The author faced the problems of obtaining data and information. For instance:

- a. The information regarding Port performance and productivity of the neighbouring countries such as, Sudan and Djibouti.
- b. This dissertation did not cover the financial analysis except comparing the tariffs with neighbouring countries' ports. As the cost accounting centre has not yet been developed, there is no detailed cost and revenue item information from the port. In other words, the port is used to keeping the general accounting system, that is total revenue, expense and profits. Thus, it does not indicate which section or part of the work is profitable or not.
- c. The European ports visited by the author like Port of Rotterdam, Le Havre, Malta and Hamburg were not willing to give information of their performance. As a result, it was not possible to use them for comparison.

## **CHAPTER 2**

### **COUNTRY PROFILE AND PORT DESCRIPTION**

#### **2.1. Country profile (Eritrea)**

##### **a. Land**

Eritrea is located on the horn of Africa. It is bordered by Ethiopia to the south, Sudan to the west and north west, Djibouti to the Southeast, and the Red Sea to the east. It has a land area of 124,320 square kilometres (km<sup>2</sup>) and a population of about 3.5 million. It has about 1,200 kilometre (km) of Red Sea coastline with 350 islands and is rich in natural resources including minerals and fish.

Administratively, Eritrea is divided into six administrative zones, and has two main ports: Assab and Massawa. Geographically, Eritrea is divided into three major regions: Central highland, Western lowlands, and Eastern coastal plains which their average rainfall is in between 200 millimetres (mm) to 500mm.

##### **b. People**

The total number of the population is approximately 3.5 million. It is estimated to grow by 3% per annum. It is sparsely populated, that is 30 persons per square kilometre. There are nine ethnic groups who have their own languages. Almost 80% of the people depend on farming and fishing in the rural areas.

### **c. History**

Eritrea was ruled from 3<sup>rd</sup> Before Christ (BC) - 19<sup>th</sup> century by different kingdoms and empires, but like any other African countries, it was founded as a country during the Italian colony in 1890. During the Italian colony, from 1890-1941, Eritrea became one of the African industrialised countries.

In 1941, during the Second World War, Great Britain defeated the Italian colony. Accordingly, Eritrea came under the trusteeship of Great Britain from 1941-1952, and served as an important centre for the allied countries, especially American and British, for operating in the region during the war.

In the 1950's a lot of African countries got their independence as soon as their colonialists left their country, but Eritrea did not. In 1952 the United Nations passed an unexpected resolution that placed Eritrea under the federation of Ethiopia though the Ethiopian socio-economic and politics (feudalism) was not compatible with the Eritrean. The reason is the United Nation was not able to overcome the interest (give the sea gate to their allied Ethiopia) of the two superpower countries: Great Britain and United States of America.

The Ethiopians began to dishonour the federal act that bounded Eritrea with Ethiopia. The economy of the country fell down to the ground and armed struggle started in 1961. A year later (1962), the king of Ethiopia unilaterally dissolved (abandoned) the Eritrean parliament, annexed, and proclaimed Eritrea as the fourteenth province of Ethiopia.

After 30 years of a bloody war against Ethiopia and its then alliances: United Union of Soviet Socialist Republics (USSR), Cuba, Libya, and South Yemen, Eritrea was liberated in 1991 once and forever and confirmed its independence in

May, 1993 by making formal referendum in which 99.8% voted for independence. At present, the country is in the process of rebuilding the ruined economy with an average of 7% annual growth rate. (Eritrean Embassy in US, 1999, p.1).

#### **d. Economy**

Eritrea, as a new country, started to develop its economy after independence, because while it was under different colonisation, there was a huge economic devastation and no significant investment was done. This was due to the pretext of 'political instability' As a result, the Ethiopian colony displaced the big industries from Eritrea to Ethiopia and allowed all big investments to be limited in the central region of Ethiopia. Consequently, the date when Eritrea was liberated, the Eritrean economy in general was at the very worst condition. In addition to this, its skilled manpower, technology, finances and institutions was downed at very low level condition; the same to infrastructure and superstructure too.

At present, the main economic backbones of Eritrea are agriculture, industry and services. Agriculture is the most basic economic sector that contributes 50% of the Gross Domestic Product (GDP). There is also about 90,000 square kilometres of potential fishing ground with an estimated annual production of 65,000 - 70,000 tons of fish at the Eritrean jurisdiction on the Red Sea coastline. (Country Commercial Guide- ERITREA, 1997, p.1). Moreover, the country has substantial deposits of mineral resources including oil, natural gas, gold, copper, iron, lignite, limestone, and geothermal. In addition, its geographic location on the Red Sea coast, unique topographic features and historical relics make up a great asset for the development of an attractive tourism industry that enables to earn foreign exchange. However, due to the extensive expenditure on the rehabilitation and reconstruction, the country's expenditure is greater than its earning revenue. As a result, its annual

trade deficit reached United States of America Dollar (US\$) 418 million in 1996 [United States of America (US) Embassy in Eritrea, 1998, p. 1].

According to 1998/1999 World Development Report, the Eritrean economy has shown significant growth. Its per capita income has reached US\$260, more than double that of Ethiopia (US\$110) and approaching that of Sudan (US\$280). During independence, Eritrea's per capita income was only US\$100, perhaps the lowest in the world. In the same way, the quality of life of the population is improving, bringing up the average life expectancy from 50 to 55 years. The main emphasis of the Eritrean development policy is on the improvement of the quality of human capital through investment in health and education. However, though the Eritrean per capita income almost doubled since independence, it is still by far a lower income country, that is US\$350 (Tesfamariam, 1998, p.1).

Eritrea's inflation is under continuous improvement. According to IMF team of economic and financial specialists, Eritrea's economic inflation rate which had risen alarmingly to double digits (10-12%) at the end of 1996, has fallen steeply to the range of 2-4% during the early part of 1997 (US Embassy in Asmara, 1997, p.1).

## **2.2. Port Description and organisational structure of the Port**

### **2.2.1. Port Description**

#### **a. History**

Massawa Port has a nearly one hundred years history with a splendid development period. It was constructed between 1885 and 1941. Four decades ago, Massawa Port was a competitive commercial port that played an important role in commercial trading, economic development and communication along the Red Sea especially during the Italian colony period. However, under the British Protectorate and

during the Ethiopian regime the port had not shown any progression. Contrarily, the port lost most of its best port facilities and structures. For instance, when the British Administration left the country in 1952 it dismantled and sold off the port's equipment and facilities. Consequently, the port suffered serious economic blow. The same happened under Ethiopian colony too, especially during the Derg's era, when no improvements were made. Its services were limited to military purposes, and finally 90% of its facilities were destroyed. But after independence, the Eritrean government soon gave priorities for its reconstruction and rehabilitation.

**b. Facilities**

The port has the following facilities. These are mainly berths, storage and equipment facilities (see Appendix 1).

**c. Movement of Goods, Ships, Containers, and Passengers**

*i. Movement of goods and ships*

Massawa Port handled above one million metric tons of dry cargo and 205 thousands of bulk liquid cargo in 1998. The major imported dry commodities handled at the port are grain, fertilisers, chemicals, construction materials, transport equipment and spare parts, and the major export dry commodities are hides and skins, oil seeds, and salt (see Table 1).

The cargo is delivered in two ways: direct route and indirect route. The portion of direct cargo delivery was 71% of the total cargo discharged at the port (see Table 2). The shortage of storage area obliged the port to motivate the customers to take off their cargo through direct delivery though this route affects the productivity. The dwelling time of cargo is 20 days for general cargo and 30 days for container.

*ii. Movement of Ships*

The number of ships handled at the port was 463 of which 361 were dry cargo vessels. Both number and size (Gross Registered Tonnage) of the ships has shown increment by 7% and 4% respectively (see Table 1).

**TABLE 1. ANNUAL SHIP TRAFFIC AND THROUGHPUT**

Description	1995	1996	1997	1998	Average Growth
ships handled					
Dry cargo	278	311	308	361	17%
Tankers	59	74	64	24	-18%
Passengers	78	60	50	78	-21%
Total	<b>415</b>	<b>445</b>	<b>422</b>	<b>463</b>	<b>7%</b>
Total Gross Registered Tonnage	1,229,912	1,805,477	1,777,478	2,012,699	48%
Cargo handled					
Dry cargo	540,000	611,000	724,000	1,035,000	43%
Fuel	163,000	203,000	241,000	205,000	32%
Total	<b>703,000</b>	<b>814,000</b>	<b>965,000</b>	<b>1,240,000</b>	<b>41%</b>
Containerisation	5,500	9,200	10,100	13,200	93%
Cargo delivered	514,000	581,000	645,000	931,000	37%
Passengers	12,000	11,000	10,000	25,000	17%

*Source: Massawa Port Report of 1998*

**TABLE 2. PORTION OF MAJOR TYPE OF CARGO AND PASSENGERS**

Description	Portion
Export cargo	6% of the total cargo
Dry cargo	79% of the total cargo
Fuel cargo	21% of the total cargo
Direct delivery	71% of the total cargo
Passengers in	75% of the total passengers

*Source: Massawa Port Report of 1998*

**ii. Movement of containers**

The flow of the containers to and from the port is either by conventional or feeder service vessels. The feeder service is offered from and to Aden and port of Djibouti. The portion of cargo that was transported by container was 9% of the total dry cargo. Most of the containers handled are a standardised containers: 20’ and 40’ containers. The productivity of the container handling is on average 9 containers move per hour. The movement of containers can be seen in Figure 3.

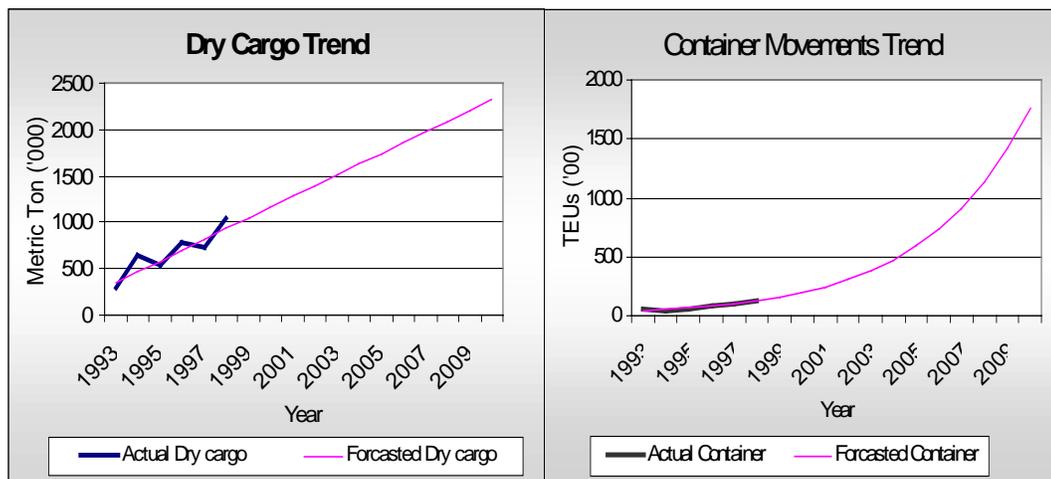
**TABLE 3. DRY CARGO AND CONTAINER TRAFFIC TREND**

Description	Actual Traffic						Estimated Traffic
	1993	1994	1995	1996	1997	1998	
Dry cargo	291	635	540	611	724	1035	1,045
Container	50	47	55	92	101	132	158

Keys:
* Dry Cargo in '000 MT
* Container in '00 TEUS

Description	Forecasted Traffic										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Dry cargo	1,161	1,277	1,393	1,509	1,625	1,741	1,857	1,973	2,089	2,205	2,321
Container	197	245	305	380	473	589	733	912	1,136	1,414	1,760

**Figure 3- Dry Cargo and Container Traffic Trend**



Source: Massawa Port Report of 1998

### *iii. Passenger Traffic*

Massawa Port, in addition to its main cargo handling operations, offers Passenger vessels handling services. Many of the RO/RO vessels carry passengers. Most of the passenger traffic is done between Saudi Arabia and Eritrea. In 1998 over 25,000 passengers were hosted through the port.

#### **2.2.2. Organisational Structure of the Massawa Port Management**

Massawa Port has an autonomous administration, which is free from direct government interference. According to the organisational chart, the port is supervised by the board of director, but the daily operation of the port is carried out by the general manager. The main objective of the government of allowing the port to have an autonomous administration is to pave the way of transferring the authority or ownership, step by step, from the state or public sector to the private sector. This autonomous administration gives an opportunity for the port to have a free market mentality and arial services, which at present are the basic factors for competition and commercialisation. Yet no part of the port has been privatised though it is being planned. In other words, the port is an operator port.

The port administration has five sections, namely, operation, pilot (provisional section), technical services, finance and administration, and marketing sections. The heads of the divisions are in charge of the general manager of the port and bear the responsibilities for their divisions' tasks. The general manager also has direct control over staff functions: legal, internal audit, planning and programming, and port security (Appendix 2).

## **CHAPTER 3**

### **THE NECESSITY OF PRODUCTIVITY AND PERFORMANCE IMPROVEMENT AT THE PORT**

#### **3.1. The Growth of the Demand**

Massawa Port plays the greatest role in the development of the economy. It is the blood stream and economic backbone of the country. It is the only port that serves as a hub for all economic sectors of the country especially for import and export goods. In addition to this, it offers transit services for the northern part of Ethiopia. It is also a potential gate way for south-eastern Sudan. The demand of the port is growing from year to year on an average 10 percent. This demand will raise its growth in the next ten years according to the study of the Department of Maritime Transport (DMT, 1995, p. 5). The demand of the port depends on the growth of the country's economy. In short, it can be said that Eritrea has a good opportunity and hope-full vision for the next decades, because the government took a lot of measures to remedy and revive the economy which was devastated by war. For instance, the issuing and planning of correct macro economic policy is one of the best measures taken by the government. This policy comprises the introducing of a modern agriculture system, development of capital and knowledge, export-oriented industries and services, tourism, fisheries, mining and mineral resources including off shore oil.

The other policy of the government is to foster the goal of the economic development through private sector investment rather than foreign aid. Moreover, the government makes the investment policy more attractive and initiative for investors by giving the following benefits:

- Duties and taxes levied on imports only 2 percent and sale tax is 3%
- Exports are exempted from duties and sales tax
- Overcoming tariff and tariff barriers through trade liberalisation and standardisation of customs regulations
- Opening of all areas of investment except of retail and wholesale
- Protection of investment from nationalisation, confiscation, seizure, or expropriation
- Permits net profits and dividends out of Eritrea in foreign currency to the foreign investors

Furthermore, the following situation of the country also attracts investors:

- Very low crime and corruption;
- High stability and economic prosperity
- The countries location at the crossroads to Europe and the Far East and its strategic coastline

All these factors will have remarkable contribution to the growth of the economy. The average growth of the economy is 9 percent per annum. As most of this growth is mainly import and export goods, it will influence the demand of the port tremendously (Gebremichael ., 1998, p.2)

### **3.2. The role of Port on the National Economy**

Massawa Port has a great role in contribution to the development of the national economy. The impact of the port to the national economy can be explained as follows:

#### ***a) Direct impact***

- Massawa Port handled more than 1 million tons of cargo of which 90% is national cargo. It is mainly a captive user port. It earned around US\$ 12 million from all port services including the cargo and ship handling services; value added services, and transits services per year. This revenue comprises 2% of the country GDP. Besides it offers an opportunity of above 1000 employment (permanent 442, Dockers 225, and casual 350) whose their average monthly salary was US\$90 (DMT, 1998, p.3).
- The port handles on average 600 vessels including passenger vessels and tankers. The port has got revenues not only from the cargo handling service but also from the ship handling service. The proximity to foreign markets and waterways particularly to the crossroads of Europe and the Far East is attractive to ship owners. Besides, its strategic coastline also gives great advantage to the customers.
- Seventy percent of Eritrean commercial and industrial cargo (import and export cargo) is shipped through the Massawa Port. Some of the most important economic goods handled through the port are construction materials, spare parts and vehicles, skin and hides textile and leather products, and oil products (Melake, 1998, p.25).

Therefore, the improvement of port services will have a great role to influence ship owners to make direct calls at the port. This can give high opportunity for

reducing the price of trade commodities due to direct calls at the port. Besides, big ships can carry more and voluminous cargo and this also offers an opportunity of economies of scale for the commercial cargoes or trades.

***b) Indirect Impact***

Cement factory, salt factory, oil depots, fisheries, tourist industries, fuel oil explorers' company, ship repair yard, Communication systems and network companies and truck service companies are the economic sectors which mainly benefit from the existing port. Their survival depends on the port existence. These sectors have greatly contributed to the development of the national economy. Further, they create approximately over 700 jobs.

***c) The Induced Impact***

- The port gives a reduction in cargo handling operations, equipment hire, and storage services' tariff for the main economic sectors of the country, especially agricultural or industrial exported products. This incentive though directly helps to develop the sectors, but indirectly it assists the development of the country's economy. In general, Eritrean Port tariff is very flexible and gives an opportunity of economies of scale benefit for the customers who use the port most frequently and/or large quantities. Consequently, this awards great contribution to the economy of the country, because indirectly, it offers an advantage of the reduction of price in commodities.
- The efficiency and effectiveness of the port also has a great impact on logistics. As the definition indicates, 'logistics is an optimisation process of the location, movement and storage of resources from the point of origin, through various economic activities, to the final consumer' (Ma, 1999, p.2). The port is part of the process, movement and storage for the logistic system. Therefore, improving port productivity and performance is the fundamental philosophy for efficient

and effective logistic systems. The more efficient the port, the quicker and safer the delivery of the cargo will be. This creates a good ground for the just-in-time system. Furthermore, it gives an opportunity of future reduction of tariffs, because the more effective the port the higher the productivity will be and the lower the cost of the port will be. This gives a price reduction to the customers, and stability to the state economies.

- The other importance of the port is earning and saving foreign currency. For instance, all transit services are charged in foreign currency and aids the country to earn foreign currency. Furthermore, all service fees for the local trade other than stevedoring is earned by local currency. This shows that having its own port is a great advantage for a country in saving foreign currency.
- Over 2,500 jobs are created because of the existence of the port excluding the direct and indirect job opportunities. In general, almost 67% of the 30,000 Massawa city inhabitants live on the port activities (Gebremichael, 1998, p.1).
- The sea is the most efficient connection route between the south east and the other zones of the country through Massawa Port. This is because the road route is unreliable. Consequently, all social and economic activities with the zone are through this sea route. Therefore, the port has a great contribution to the development of the local economy.
- Massawa Port is an international port that has links with five continents. This shows that the port has a great contribution to the development of trade and transportation throughout the world via the sea. Like other countries in the world, the largest proportions of the commercial and industrial activities of countries, directly or indirectly, have relation with the shipment of goods through the port.

To summarise, the efficient port increases cargo handling productivity and storage operation. Besides, it improves the quality of services, that is offered by the port such as: distribution and added value for customers. All these factors contribute to great reduction on cost. Moreover, it offers incentives for fishing, commerce and trade, tourism, and agricultural economic sectors. These all motivate to do reform and improvement in the port management systems so as the port can play the biggest role in the country's economy.

### **3.3. Keeping the comparative advantage of the port**

Massawa Port is situated in the area of fierce competition with neighbouring ports, namely, port of Djibouti, port of Aden, and port of Sudan. The competition is in handling the ships, because it is the shipowners who have a right to choose the efficient port that gives him best value. However, the port has comparative advantages over the neighbouring ports on the following peculiar advantages to the ship owners and consignees:

- ***Geographical location:*** Massawa Port is a natural port located at the strategic area on the main maritime routes of the Red Sea, enclosed by a 'peninsula' and islands with low tides and a natural breakwater. Ship-owners are keen to call at Massawa Port because this natural gift gives more reliable safety for the ships. The distance from the main route is also another factor for attracting customers. The distance of Massawa Port is 50 miles from the main route, whereas the others are more than the mentioned distances. For instance, Djibouti is around 350 miles from the main route (Port Information, 1997, p.3)
- ***Hinterland transport connection:*** There is a relatively good transport connection between local hinterlands and the port through trucks. There are more than 10,000 local trucks. The railway has also been under construction. There is also good hinterland connection with Northern Ethiopia and Eastern Sudan.

Furthermore, for the future there will also be confident anticipation of good hinterland connection with the south and South-east of Sudan.

- **Reasonable tariff:** Port service tariffs are one of the factors of competition among the neighbouring ports. On average Eritrean ports provide efficient services at competitive rates (tariffs). Besides, tariffs are revised continuously according to the current situation. It is also a relatively flexible rate and gives an advantageous of economies of scale. For instance, the following table No. 4 shows how the Eritrean port tariffs are fare compared with neighbour ports.

**TABLE 4. COMPARISON OF PORT TARIFF**

Tariff head		Eritrea	Djibouti	Kenya
Stevedoring	20'	71	115	120
	40'	123	143	144
Shore-handling	20'	67	197	150
	40'	117	395	180

*Source: Eritrean Network Information Centre: <http://eritrea.org/EIB/control/main.html>*

- **Socio-economic stability:** The port is free from unrest, strikes (boycotts), safety problems, unstable service standards and charges. These are very important for keeping the good reputation of the port. Ship-owners naturally prefer a good socio-economic stability to other factors.

### **3.4. Continuous change of ship structures**

The continuous change of ship structures, like any other ports, affects the port operations at Massawa Port. There is evolutionary change in the port. Decades ago the port handled only general cargo, but at present as the age of the ships calling at the port are old, the port handles various types of ships especially containers, bulk carriers and passenger vessels. Therefore, ships as well as the port carry and

transport more cargoes in volume, mostly unitised cargo. Thus, the number of conventional container vessels and feeder service vessels increases tremendously from time to time. Yet, the port has not fully kept up with the development of ship technology, especially with the handling of containers. Therefore, the port has to look for the means that assists in increasing and improving its productivity and performance so as to be competitive with neighbouring ports.

In summary, the port has direct and indirect impact on the national economy. Therefore, since efficiency is one of the important key factors for the success to compete with other ports, and is the only way to reduce the costs of the external trade, it is often relevant to analyse in detail the present port performance.

## **CHAPTER 4**

### **PORT PERFORMANCE INDICATORS**

Port performance indicators are the signs that assist in measuring performance of the port, identifying the problems, and looking for possible solutions. According to the UNCTAD publication 'Port performance indicators tell us how much cargo is handled, at what rate, and at what efficiency' (Roach, 1982, Unit 2, p.1). The importance of the port performance is to compare the actual performance of the port with the port's target. Besides, it assists to examine (view) the port trend in relation to its performance level. These indicators give best results especially if the study comprises overall set of measures together, such as quality of service given to ships, cargo and inland transport. Therefore, the author will evaluate the performance of Massawa Port based on the international port standards that assists in knowing the level of its efficiency. The indicators are mainly divided into five major groups: indicators of output, indicators of service, indicators of utilisation, indicators of the quality services, and indicators of productivity.

#### ***4.1. Indicators of output***

Output, unlike other industries, refers to the quantity of cargo handled by the port throughout the year by using different mechanisms. The author will consider the indicators output in three major parts. These are berth output, ship output and gang output.

**TABLE. 5. BERTH OUTPUT AND SHIP OUTPUT OF MASSAWA PORT**

Descriptions	1995	1996	1997	1998	Growth	Yemen	Djibouti	European ports standard metric tons
<b>Berth output</b>	511,223	777,964	712,290	1,020,644	62%		NA	NA
<b>Ship output</b>								
– Total tons handled/total hours worked	23	23	28	36	24%	36	NA	80
– Total tons handled/total hours at berth	18	17	20	26	15%	26	NA	NA
– Total tons handled/total hours in port	14	14	15	19	13%	19	NA	NA

*Source: Massawa Port Report of 1998, Port operations Management Lecture by Captain Horck 1999 and Aden Port Authority (Yemen) through Email.*

#### ***4.1.1. Berth output***

Berth output is the total quantity of cargo handled at a berth throughout the year. This indicator is very useful for the port planner, because it assists in evaluating the performance of each berth and determining port capacity. According to table 5, the annual berth output of Massawa Port reached over one million metric tons and its growth rate is 62% per year.

Though table 6 shows that the port worked less than its capacity. However, the port might work over its capacity, because the flow of the cargo fluctuated not only seasonally but also during the daily operational time. The above situation will be the worst from the year of 1999, because the cargo flow will exceed its maximum capacity of the cargo handling. As it is known, over-capacity is one of the main causes for the diminishing of port productivity. This denotes for the port to be aware of the matter and to take a quick action. However, it does not mean that the port has been without berth congestion problems. The above estimation assumed that all six berths are in good condition, whereas in reality only 5 berths are in good conditions.

The above statements show that the berths have had congestion problems especially during the peak seasons.

**TABLE 6. MAXIMUM CAPACITY OF CARGO HANDLING BEFORE AND AFTER THE COMPLETION OF THE NEW PROJECT OF BERTH REHABILITATION**

Description	in metric ton (MT)				
	Bulk cargo (in MT)	Bagged cargo (in MT)	Break Bulk (in MT)	Total (in MT)	Container (in TEUs)
<b>Before Completion (YEAR 2000)</b>	329,000	423,000	400,000	1,152,000	<b>15,500</b>
<b>After Completion (YEAR 2000)</b>	417,000	539,000	507,000	1,463,000	<b>32,000</b>
<b>Actual cargo handled (1998)</b>	281,000	399,000	60000	1,040,000	<b>13,200</b>

*Source: Massawa Port Report of 1998*

Though the above is the general circumstance, only the berth output indicator can not be an efficient measurement of performance. This is because of the following reasons: First, all berths are general purpose berths and handle all types of cargoes (wheat, iron and steel, and container) with different type of packages (bulk dry, drums, bags, rolls, bales, container etc.). Second, various types and ages of vessels are handled at the berths, such as conventional, bagged cargo carriers, bulk carriers, general cargo carriers, and Roll On Roll Off (Ro/Ro). Most of the ships handled are not only old but also small in sizes, such as: 95% of the ships' Gross Registered Tonnage (GRT) is less than 13500 or 68% are less than 9500 GRT. Third, the berths are multi-terminal (general cargo) berths and have draft limitation or restriction for ships to use any berths. For instance, except berth 3, 4, and 6 the other berths can not handle a ship of more than 8 meter or more than 4000 GRT. Berth number 1 has been under utilised due to low level draught. Fourth, almost 70% of the cargo handled are delivered through direct routes which are a less productive system. Fifth, all berths are not fully equipped with appropriate equipment. For instance, there are

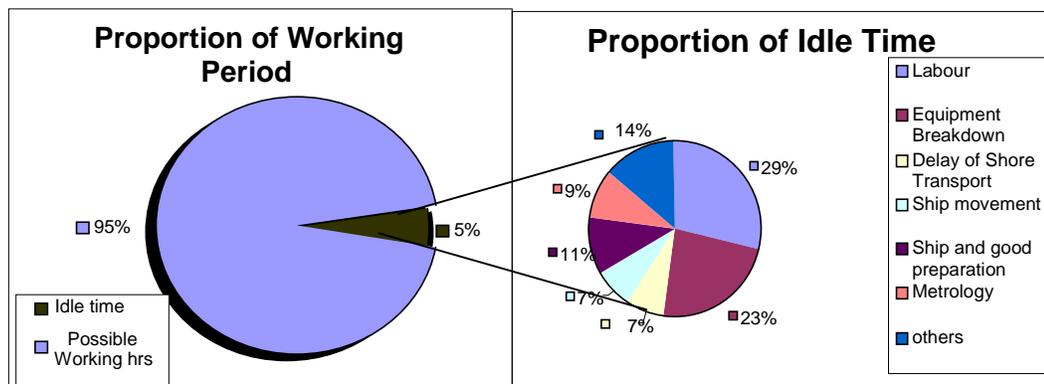
only five shore-cranes for six berths. The above mentioned reasons have great impression on the variance of berth output and causes discomfort for flexibility.

In summary, though the berth output alone is less efficient to use as an indicator due to the above factors, it assists in knowing the overall capacity of the port compared with the actual capacity of cargo handling of the port.

#### 4.1.2. Ship output

According to the UNCTAD publication definition, ‘ship output is the total cargo handled from and to the ship at a berth, which indicates of how good the operations are, in a stated period of time’ (Roach, 1982, unit 2, p. 11). The ship output of Massawa port is very low comparing with European ports standard and Yemen Port (see table 5). In Massawa Port the ship output is evaluated and calculated monthly, quarterly and yearly in three ways, namely: tons per ship working hours, tons per ship hour at berth, and tons per ship hour in port. This is a very important and helpful indicator to compare and diagnosis the problem as well as to find the solutions, because the indicator shows that the larger the difference among the results, the more

**Figure 4. Working period and Idle Time**

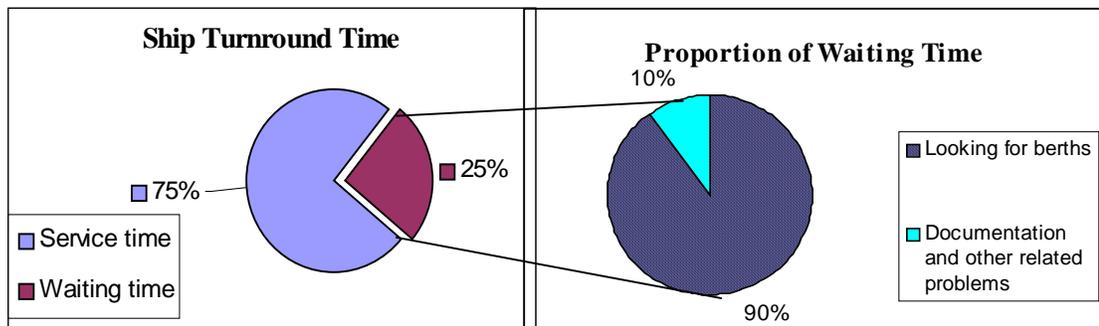


Source: Massawa Port Report of 1998

There is a variance between the tons per ship working hour and tons per ship hour at berth, and between tons per ship hour at berth and tons per ship hour in the port. On the earlier, the cause of the variance is the idle time. There may be many reasons for the cause of idle time, but the major causes are the items that are mentioned in Figure 4. Besides, the incompetence of supervisors also has the same effect both during the day and during night.

The latter difference, which is the variance between ship tons per hour at berth and ship tons per hour in the port, is called waiting time. It consists of the time from ship's arrival at the port premises until the tying of ship at berth, and from ship's leaving the berth until departed from the port premises. This paper will discuss in details about waiting time later in this chapter.

**Figure 5. Ship Turn-around Time and Proportion of Waiting Time**



*Source: Massawa Port Report of 199*

High berth occupancy is one of the main reasons for high waiting time. Its main reason is that the cargo flow to and from the port is varied seasonally though low productivity, continuous breakdowns of equipment, handling small and old age of ships and ineffectiveness of management have had their own contribution to reiterate

the problem. For instance, the berth occupancy in the 1<sup>st</sup> quarter is low, 2<sup>nd</sup> and 3<sup>rd</sup> quarter is high and the 4<sup>th</sup> quarter is very high and congested.

In summary, although the above factors affect the indicator, it is very important to make an analysis and diagnosis of the hypothesis, and make managerial decisions based on the information. Moreover, ship owners are interested in the information of ship output per-day, because it assists them firstly, to make plan for their route and secondly, in doing different scenarios and selecting the best opportunity that offers them the highest profit.

#### ***4.1.3. Gang output***

Gang output is the average of cargo handled per a gang hour. This gang output is frequently used as an indicator of productivity. In Massawa Port there are three ways of calculating gang output:

- **Tons per gang hour** (*the ratio of total tons handled by gang in a shift to shifting hours*)
- **Ship tons per gang hour** (*the ratio of total tons handled per calling of ship to total number of gang hours worked in a ship during its call*); and
- **Total tons within specified time per gang hour** (*the ratio of total tons handled within specific period to the number of gangs hours during the stated period usually a year*).

The first two formula of gang output are used for evaluating the daily or weekly performance of the port while the third formula is for yearly performance. The author will prefer to focus on the latter , that is total tons per gang hour per year, because it helps to analyse and evaluate the annual productivity of gang per hour.

According to Table 7, in Massawa Port there is variance between gang output rated and gang output effective, and the same for man-hour rated and man-hour effective too. The main reasons for these are due to the idle time, which was explained earlier. Besides, the gang outputs were varied with the type, capacity and efficiency of the equipment provided as well as with the number, size and skill of gangs deployed. Moreover, as mentioned before, lack of essential provisions for work and incompetent supervisors were also some of the other reasons. In addition, as mentioned, the age of the ship and size of hatch has also had its own negative effect.

**TABLE 7. GANG OUTPUT**

<b>Gang output</b>	<b>Gang output rated</b>	<b>Gang output effective</b>	<b>Average No. of gangs deployed per ship/shift</b>	<b>Man-hour rated</b>	<b>man-hour effective</b>	<b>Average No. of men in gang</b>
Bulk cargo(MT)	24.4	22.7	2.4	2.28	2.12	12
Bagged cargo(MT)	18.2	17.5	2.4	1.54	1.48	16
Break bulk cargo(MT)	12.5	11.8	1.5	1.09	1.03	8
Containerised cargo [Twenty Feet Equivalent units(TEU)]	10	9	1.2	3.44	3.13	6

*Source: Massawa Port Report of 1998*

Although this indicator tells the presence and the cause of the problem, the port has never used it.

The main shortcomings of the port regarding this indicator can be mentioned as follows:

- i. The management is unconscious of cost in running the port. It mobilises gangs as much as increases productivity without taking into consideration the cost effectiveness of the output.

- ii. Deploying workers and supervisors for more than one shift. The peak of traffic compels the labourers to work more than one shift per day. In reality, this is not a fruitful system of work because the work is naturally a tedious work. It is obvious that the workers work for the sake of earning money. As a result the gang output is not effective as was planned. In addition, the discipline of gang members has great influence for the ineffectiveness of the output. As the supervision and disciplinary measures are weak, some members of the gang are motivated to be lazy and depend on the outcome of the effective gang members. This reduces the gang output and forces the well behaved workers to do labour-hide strike.
- iii. The inefficiency and inadequacy of equipment which it will be explained later in this chapter
- iv. Some types of cargo, especially chemical cargo like cement, fertiliser and salt naturally have low productivity and are dangerous to the health. As a result, the Dock-workers are not motivated to work with this type of cargo, but prefer to save their energy while they are on duty.

In summary, the above indicator is very important to identify and know how the idle time affects the productivity of tons per gang hour of a ship. The higher the variance between gang output effective and gang output-rated, the higher the idle time will be and the less efficient the port will be. To the contrary, the less the variance between gang output effective and gang output-rated, the less the idle time will be and the more efficient the port will be. The objective of this indicator, as mentioned above, is to make the management aware and to take appropriate action to reduce the gap between the results. Besides, it is useful for planning and supervising the daily operation of the port, monitoring labour performance, and preparing port tariffs.

## **4.2. Indicators of services**

Indicators of services are the measurement of quality services that are provided by the port to the ship-owner. Most commonly, these indicators comprise ship turn-round time, grade of waiting time, and ship out-turns.

### **4.2.1. Ship turn-round time**

Ship turn-round time is one of the most common measurements of port performance in the world because the survival of ports totally depends upon the satisfaction of the ship owners (customers). The shortest ship turn-around time is the most advantageous for the ship owners because their profit is highly influenced by time staying at the port. The shorter staying time of the ship at the port the higher the profit will be.

In short, it can be summarised in the following verse, ‘ship turn round time gives an excellent indication of the speed of service being provided to ship operators, it is a very important element in Maritime Transport Costs’ (Roach, 1982, unit 2, p. 18). Ship turn-round time consists of two parts: ship service time at berth and waiting time.

#### **4.2.1.1. Waiting Time**

In Massawa Port, the waiting time comprises the time waiting for berth, manoeuvring, inspecting and clearing documents. This waiting time was on average 30 hours per ship though it varied in different seasons. Ninety percent of the waiting-time was spent looking berths while the remaining 10% were inspecting and clearing documents. (Figure 5). The waiting time ratio increased symmetrically with the increase of the berth occupancy ratio (see Table 10). The problem of congestion is more severe in small ports like Massawa Port where they have few and small size of berths. However, the port waiting time is not affected

by the topographic, geographic (estuary, tide, and weather), and operational factors (priorities of other ships, unavailability of pilots and tugs).

#### 4.2.1.2. Ship Service Time At Berth

**TABLE 8. SHIP TURN-AROUND TIME**

Service Indicators	Formula	Result in Hours				
		1996	1997	1998	Average	Growth/ year
Waiting time	Cumulated time for waiting/total No. of ships	19	22	30	24	35%
Service time	Cumulated service time /total No. of ships	98	95	91	95	-5%
Turn round time	Cumulated of waiting time and service time/ total No. of ships	117	117	121	118	2%
Grade of waiting	Cumulated waiting time/ Cumulated service time	17%	24%	25%	22%	44%
Fraction of time berthed ships worked	Total actually worked time for all ships/ total time service	77%	77%	82%	79%	3%
Fraction of time gang idle	Total idle gang time/total gross gang time	6%	5%	5%	5%	-17%

*Source: Massawa Port Report of 1998*

**TABLE 9. AVERAGE SHIP SERVICE TIME AND SHIP TURN-AROUND TIME**

Ships (%)	stayed at berth	Ship (%)	stayed at port
44%	<2 Days	34%	<2 Days
25%	3-4 Days	26%	3-4 Days
26%	5-13 Days	32%	5-13 Days
5%	>13 Days	8%	>13 Days

*Source: Massawa Port Report of 1998*

Service time is the time spent by the ship at berth , that is from time of berthing up to time of departure. In Massawa Port, according to Table 8, the service time has been decreased by 5% yearly, but waiting time has been increased by 35%. This shows that the cargo and ship traffic was increased throughout the year in all seasons and

hand in hand with this development, the berth occupancy also increased. This was basically due to the consequence of firstly, there has not been done significant investment for the poor infrastructure and superstructure due to shortage of funding. Secondly, the inefficient administrative formalities, high non-working periods, and informal slack of shifting time. Thirdly, loose supervision and controlling system; and lastly, lack of co-ordination of different sections and workers, such as tally clerks, storekeepers, supervisors, trucks, and cargo handling equipment. The above reasons caused very low effective working hours; especially late starting and early finishing were common in each shift especially during the night. Consequently, the ship turn-around time is affected. In general, the average days of a ship service time were more than three days and the details can be summarised in the following Table 8.

In summary: the ship turn-around time is the summation of waiting time and service time. In Massawa Port, it was increased on average by 2% yearly. There were many factors that influenced the turn-around time, but the major factor was the unavailability of berth particularly at a peak season when the berth occupancy rate reached 75-80%. The idle time, non-operating time, and non-scheduling of service had also its own contribution to the increase in ship turn-around time.

Moreover, the analysis of ship turn round time is also supported by the grade of waiting time ratio and idle time ratio. The details can be seen in Table 8.

#### **4.2.2. Grade of waiting time**

The other indicator, which the ship owners used for evaluating the quality of the port, is grade of waiting. It is the ratio of cumulated waiting time to cumulated service time. However, the average grade of waiting was 23%. This indicates that non-working time was high, that is 23% of the service time.

### **4.2.3. Ship out-turns**

Another quality of service measurement is ship out-turn. This measurement is done by comparing what is actually discharged from a ship with the condition or information expressed in the manifest about the cargo. This enables the port to know how much of the cargo is short landed, excess landed, damaged or deteriorated. In other words, it measures the efficiency and due care of the cargo handling operation of the port. In Massawa Port, this evaluation is done by 'out-turn report stuff'. This stuff is considered as neutral body and its report is as evidence for any claim by any concerned body. Even the port cargo handling service charge is based up on the out-turn report. However, the report of this stuff might not be fully pure information and trusty especially for the general cargo. This is because the out-turn report personnel, as a witness, are not involved directly during the cargo handling operation, but they check and compare, that is what the actually handled cargo and the actual conditions mentioned at the manifest together with the captain comments during the cargo handling operation, after the ship work completion. Therefore, as the report comprises personal views of the third party, it might not be a perfect report because the concerned party might give the distorted comments to escape from accountability.

In summary, though the ship turn-around time is very important for analysing the working time, non-working time and waiting time, the result is given on average. Hence, the port needs careful examination of the result because the port is seriously affected by seasonal fluctuations. Besides, according to Prof. Francou lecture notes, the comparison of the grade of waiting time gives good information of what is acceptable by ship owners. Ship owners accept the port as a quality port if the grade of waiting time is equal or less than 10% rate; beyond this rate, they consider the port as a low quality one' (Francou. 1999, p.7). Depending on the above statement, the port has had a deficiency in quality of the services, because the grade of waiting was more than 10%. Therefore, in order to improve the quality, the port has to be

competent and efficient in its management system because improving the management and supervision system plays a great role in increasing productivity and reducing idle time. This will give the opportunity of the reduction of the waiting time. Finally, the management has to give due consideration to sufficiency of storage area, efficiency of quay transfer operation, adequacy of labour, qualification of supervisors and competency of management, because they contribute greatly to the reduction of ship turn-around time.

### **4.3. Indicators of utilisation**

Indicators of utilisation are very important for indicating how the facilities and resources are utilised. In Massawa Port, the most common indicators of utilisation are berth utilisation, equipment utilisation and storage utilisation. The details can be explained as follows:

#### **4.3.1. Indicators of berth utilisation**

Berth utilisation is the possibilities of maximum usage of berth by using different means and best techniques. The efficient berth utilisation depends on good planning and co-ordination of resources and facilities. The more efficient the utilisation of resources and facilities, the more perfect the berth utilisation will be. Berth utilisation embraces berth occupancy and berth working time.

##### **a. Berth Occupancy**

Berth occupancy is *the ratio of berth occupied hours to the total berth hours* during a specific period. The result of this indicator shows the degree of utilisation, that is either above or below the average. Berth occupancy varies from season to season. This can be seen from the following Table 10 and 11.

**TABLE 10. SUMMARY OF BERTH OCCUPANCY RATIO OF 1998**

Description	1 <sup>st</sup> quarter	2 <sup>nd</sup> quarter	3 <sup>rd</sup> quarter	4 <sup>th</sup> quarter	annual	Range
Berth occupancy	70%,	60%,	62%	75%	67%	43% - 80%

*Source: Massawa Port Report of 1998*

In addition, the depth of the berth also has a great impact on the utilisation of the berth. For instance, though berth 3, 4, and 5 were relatively busier, berth number 6 was the busiest berth throughout the year and works more than average. According to historic data of the port, the berth occupancy ratio grows yearly up to 4% and will reach more than 75% in the current year (1999) and 82% by the year 2000. This shows that the port has already had a problem of congestion, as the standard berth occupancy is 60% especially at the highest peak season. As a result, ships are waiting for berth on average 5 days at the peak period. This is unfavourable for the ship owners and other customers in regarding time and cost.

This indicates that the port should be aware of the case and take correct measures in advance before its consequence will be the worst. This is either by increasing productivity and/or reducing non-operation time and idle time. If this can not solve the problem, building new berths or terminal, based upon the cost benefit analysis, are another alternative solutions. In this regard, the management has to confirm that the cost-benefit analysis is taking into account the under-utilisation and over-utilisation of the berth as both of them affects the revenues.

**TABLE 11 ANALYSIS OF BERTH OCCUPANCY RATIO OF 1998**

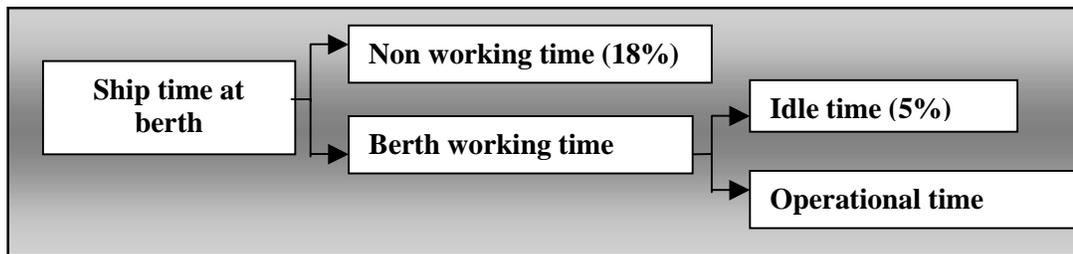
Degree of utilisation	Vacancy	Service time			
		Occupied and working	Occupied but not working	Occupied but not workable	Total
Highest	20%	59%	17%	4%	80%
Average	33%	54%	12%	1%	67%
Lowest	57%	33%	10%	-	43%
Average of service time		80%	18%	2%	100%

*Source: Massawa Port Report of 1998*

### b. Berth Working Time

Berth working time is the ratio of *the total ship time at a berth , that is scheduled to work to the total berth hours* often a year. This indicator like berth occupancy shows the intensity of the use of the berths. The difference is that working time excludes the non-scheduling of work (such as holidays, early finishing or waiting until the next working shift started) and non-operational time (such as shifting slack (06:00 to 07:00) and meal break). Both working time and berth occupancy comprises idle time. However, the ship service time of Massawa Port can be summarised as following (Figure 6).

**Figure 6. Ship Service Time**



*Source: Massawa Port Report of 1998*

#### ▪ Operational time

The working time of a berth that exempts from the idle time is called an operational time. In other words, operational time is the time , that is free from idle time, non-operational time and non-scheduling of work. The same with berth occupancy too, because the berth is not workable although it has been occupied. The loss due to this reason affects both the ship owner and the port. For ship owners the time staying at port is prolonged. If the idle time is reduced, the time stay of a ship at port and the cost would be reduced so their profits would be increased. On port side, as the berth has been working less effective, the berths' output was low and the port loses its reputation. Besides, all the equipment, gear,

labour and other resources were lying idle. Therefore, in order to alleviate the above problems, the port has to strengthen the management system or supervision to achieve high 'berth working time' and 'operational time' so as to have the most effective use of berth capacity and resources.

- ***Berth working time ratio***

Berth working time ratio is the rate of *total worked time* to *total service time*. This indicator tells the effective working hours in relation to service time of the port. For instance, in Massawa Port the berth working time ratio was 82%. This informed that shows the port was on average working for 20 hours including the idle time one hour per day.

#### **4.3.2 Equipment utilisation and availability of Massawa Port:**

##### **4.3.2.1 Availability of equipment**

Availability of equipment is the time (hours) when the equipment is ready for work or use. In other words, it is the time when the equipment is ready for work at the time it is needed. The formula of availability is the total possible hours minus down time. Availability of equipment depends upon the down time rate. The higher the down time rate, the lower the availability will be.

In summary, the sufficient availability of equipment is the best way for flexibility and high utilisation. Because, as it is known, the utilisation is mainly depending on using the right type of equipment, sufficient numbers of units and good organisation of its use. For instance, in Massawa Port, the low availability of shore handling equipment led to low levels of utilisation. Consequently, the productivity of ship handling operations and quay transfer operations was low, berths were under-utilised, more cargo congestion on the quay, sheds and yards. As a result, costs of the port and customers were increased.

#### **4.3.2.2 Down time**

Down time is the time when the equipment is broken-down/out of order and not accessible for cargo handling operations and other operations. This down time is known by Massawa Port as "equipment under maintenance hours". Massawa Port, unlike advanced ports in the world, does not make a schedule of preventive maintenance for equipment unless the continuous breakdown of the equipment has affected the port productivity extremely. The reason was no reserved equipment to cover the operational activities during the maintenance time of the equipment.

In general, the down time of all equipment was above 40% in 1998. This down time of equipment varies from one type of equipment to another even within the same type of equipment according to their age or quality of the equipment. For instance, the highest breakdown of equipment occurred in tractors and the lowest was in shore cranes , that is 63% and 25% of the possible working hours respectively.

The above statement shows that the down time ratio was very high. Thus, the customers have faced a problem of getting equipment access. There were a lot of causes for this high down time ratio, but the major causes could be mentioned as follows: incompetent maintenance, unskilled and inefficient equipment operators, lack of preventive maintenance, and shortage and delay of spare parts. Bad weather conditions and the old age of the equipment are also worsening the existing condition of equipment.

#### **4.3.2.3 Utilisation of equipment**

Equipment utilisation is the actual time worked by the equipment out of the total possible working hours during a specific time often a year. The possible working hours differ from port to port. For instance, in Massawa Port the possible working hours are the total time of the equipment that excludes the non-operating time,

shifting slack and preventive maintenance. The port works 23 hours a day, 7 days a week and 365 days a year. All holidays are considered as working time though it is in overtime work. Equipment utilisation is calculated in individual, group and aggregate. For instance, the aggregate result of equipment utilisation rate can be shown as follows (Table 12).

**TABLE 12. AVAILABILITY AND UTILISATION OF EQUIPMENT**

Description	No. of equipment	Performance	Utilisation	Running hrs/ available rate	Worked hrs/ running rate	Supply versus demand
Shore crane	5	75%	57%	77%	70%	77%
Mobile crane	6	43%	31%	71%	60%	65%
Container Lift Truck	3	47%	30%	64%	43%	87%
Forklifts	33	55%	43%	77%	70%	107%
Tractor	19	37%	32%	88%	86%	78%
Tugmaster	3	68%	65%	96%	96%	80%

**Source: Massawa Port Report of 1998**

The level of utilisation is affected (influenced) by growth of traffic, storage capacity, idle time, down time and seasonal peak traffic. Besides, the ineffectiveness of the management, especially supervision is one of the most important factors for decreasing the level of equipment utilisation.

The level of utilisation greatly influences the demand of the equipment. Both over utilisation and under utilisation affect the equipment demand condition. The utilisation indicator of equipment is a good signal for the future opportunity of the equipment conditions. For instance, the planning of purchase equipment depends on the level of utilisation. According to Thomas and Roach, 1982,

‘Utilisation value is an extremely important input to the planning of equipment purchase. A low level of utilisation for a particular class of equipment would indicate that the present stock of equipment is adequate-

even generous- and that no further investment is needed, despite any claims to the contrary by operators. On the other hand, a high average utilisation would support any request for additional machines'. (Thomas and Roach, 1982, 1989, p. 50).

Therefore, it can be concluded that in Massawa Port, except the shore-cranes and tugmasters, the stocks of other equipment have to be analysed before investing in additional equipment, because the utilisation of the equipment was on average 40%. Besides, non-deployment of equipment (non-allocating of equipment to work) due to hold on of equipment after finishing operation (un returning to the deployment centre) and improper recording of the working hours of the equipment, such as idle time mislead the utilisation time of some equipment. Therefore it needs careful examination before purchasing or investing in any type of equipment. Thus, the port has to find the means of improving the continuous breakdowns/downtime and maximise the allocation of equipment.

In short, the main reasons for the low utilisation in Massawa Port can be summarised as follows:

- There is no appropriate plan of equipment deployment
- The equipment is not returning to pool on time.
- There is no competent supervisors or controllers of the equipment
- There is no appropriate disciplinary measure against the negligence and irresponsible operators
- Lack of evaluating and reviewing equipment performance, which helps to take a quick corrective action, has not customised in the port though there is information of available.
- Shortage of skilled operators

- Continuous breakdown due to ineffective maintenance, lack of spare parts, incompetent mechanics, and obsolete equipment.
- No reserve of equipment and as a result the running of equipment is for round the clock , that is for 23 hours.

In summary, as the level of availability and competent management are the determinant factors for the utilisation of equipment, the port administration will have to give due consideration to the improvement of the above factors so as to pave way for the maximum utilisation of the equipment.

#### **4.3.2.4 . Demand and Supply comparison of Massawa Port**

According to table 12 in Massawa Port, demand is always greater than supply in almost all equipment. But if one makes analyses the actual condition of the equipment, on the one hand there was low level of availability and utilisation of equipment and on the other hand, demand of the equipment was higher than the supply. In other words, the port was not able to satisfy the customers' requirement of the equipment. This shows that there are mismanagement problems in the deploying system of the equipment. There may be many reasons for the disproportion of demand and supply, but the major reasons can be explained as follows:

- i. High repairing and maintenance ratio (down time);
- ii. High non allocating hours (that is. 21% of the availability hours); and idle time (26% of the running hours);
- iii. The undersigned out of the obsolescence equipment, which causes the continuous breakdown of equipment;
- iv. The high immobilisation time which occurred due to incompetent of supervisors and co-ordinators to the equipment and labourers.

v. Lack of appropriate planning in deploying of equipment

Moreover, the incompetence of the management had also its own consequence for the deficiency of the supply to fulfil the demand of the equipment, such as:

- ***Inappropriate Ship operation requisition of equipment:***

This requisition of equipment is done by the operation plan committee based on the information obtained from stevedores, ship agents (hatch plan and manifest), and quay section (delivering and storing requisition). During the deployment of equipment, priority is given to ship operations. The main problem is in filling a requisition form because it depends upon the work-value which was provided by the stevedoring personnel. The stevedores provided incorrect information either due to negligence or ignorance. Sometimes, the stevedores ordered more than what is needed deliberately for reservation because they distrust the condition of the equipment, such as a continuous breakdown of equipment. Consequently, the equipment was under utilised. This did not only affect to the other customer's requirement, but also to ship operations, because as the equipment was scarce in the port, the equipment could not be used (re-deployed) in other ship operations where equipment was inadequate. The error was repeatedly made due to lack of evaluation of the daily operation plan.

- ***Requisition of equipment for non ship operation:***

The use/deployment of equipment for non ship operation activities is done according to the rule 'first come first serve' based on their priorities of their requisition. However, there were two big problems regarding the deployment of the equipment.

First, though there was a shortage of equipment, there was deficiency in deploying the equipment. The responsible section did not make efficient plans to maximise

the utilisation of time. It did not realise what amount of time was required and when it would have to return. As a result, no plan was made or scheduled for other work until the equipment was returned from. Therefore, as there was no flexibility in deploying the equipment, the existing numbers of equipment were not sufficient to satisfy or supply the existing demand.

Second, almost all customers' requisition of equipment was congested only to the first two or three hours of each shift. The reason was the customers are not confident in getting the equipment after this time. Besides, customers did not want to take any risks of recruiting hourly workers, who inquired idle time payment.

The third reason is inflexibility of equipment operators. Most of the equipment operators are not multi-skilled. Therefore, in case accidentally some available equipment is needed or required for a job, it cannot utilise it unless the specialised operators are available.

Therefore, due to the above reasons though the utilisation and availability of the equipment was low, the supply of the equipment was not able to recover the demand.

- ***The leasing (hiring) system***

Equipment is hired or leased per ton or TEU. This rate system was very difficult for supervising the utilisation of equipment and lead to the inefficient utilisation of equipment. For instance, some customers requested equipment before finishing the documentation formalities. As a result, the equipment waites for the work to be ready. Therefore, it was very difficult to take beneficial corrective measures.

In summary, the supply of equipment does not only depend on the number of equipment but also on the utilisation and availability of the equipment. If the

availability and utilisation of the equipment is improved, the supply of the equipment will also increase. Therefore, the port management has to improve the availability and utilisation of the equipment through strengthening the management system of the operation, because improving the management system will contribute greatly to decreasing the down time and idle time in addition to purchasing additional equipment based on the cost benefit analysis.

### **4.3.3. The Performance Indicators for the Storage Operation**

#### **4.3.3.1. General Description of Storage Operation**

‘Port storage is a vital stage in the exchange of cargo between sea-borne and inland transport’ (Roach, 1982 1982, Unit 5. p.4.). A good controlling and management of storage operation plays a big role to maximise the availability of storage and saves the port from congestion. As it is known, congestion causes under-utilising of resources, declining of the productivity, prolonging of the ship turn round time, and increasing of cost per ton.

The advantages of storage are firstly, to make ready export cargo for loading on aboard ahead of time of the ship arrival. Secondly, to breakdown and segregate imported cargo especially for large numbers of small consignments in order to make ready for distribution to consignees; thirdly, to consolidate small packages and parcels of cargo , that is for both import and export cargoes; fourthly, to accommodate the imbalance between cargo carried by a ship and delivered by inland vehicles; fifthly, to secure the cargoes from being held up by weather and other delays; and lastly, to reduces the risk of ship/shore imbalance. (Roach, 1982, Unit 5. P.4.).

Massawa Port provides warehouses, open sheds and open storage of 204,100 square meters area and of 150,000 MT holding capacity. This storage is very important for facilitating the port operation though it is too small to fulfil customers' demand. In Massawa Port, all the storage areas are provided for transit purposes. There is no long-term storage. (Appendix 11).

The port has a container freight station and a container yard including the container consolidation area (stripping and un-stripping of containers). Moreover, it has a special area for dangerous cargo and refrigerated containers and facilities.

However, in Massawa Port, there are contradictory ideas regarding storage. On the one hand, the port has a shortage of storage area, but on the other hand, it gives full incentives and high motivation to customers to store their import and export cargoes. However, according to United Nations Conference of Trade and Development (UNCTAD) publication 'the realistic Free Storage Period is in between 3 and 5' (Roach, 1982, unit 5, p.59), but in Massawa Port, Free Storage Period is 20-35 days for import cargo, 40-60 days for export and 60 days for transshipment. Though the port knows the disadvantage of this grace period, the port could not reduce it, because it is one of the main competition factors with neighbouring ports, especially with port of Djibouti.

As the port is a general cargo port, the above benefits affect the port storage capacity, because the general cargo is voluminous cargo and requires big warehouses/open sheds. However, the port gives a direct delivery incentives in order to ease the congestion especially for the cargo of one consignee, which does not need segregation and administrative formalities problem. Consequently, 70% of the unloaded dry cargo is delivered through direct route. The port knows that the productivity of direct delivery is lower than the indirect delivery, but this system is

the only temporary alternative solution. The system is accepted by customers without hesitation because it relieves them from all the additional costs of indirect delivery, storage and loading trucks. On the contrary, the port also accepted all losses as a result of using the direct delivery system because the port is not able to provide adequate storage.

The main problem of the storage area is that the port is situated on an island. Its environmental periphery is surrounded by the residence building of the city. Thus, the probability of expansion is very little. It can only be done by demolishing the old buildings. This also has its side defects. It is not only costly to demolish but also difficult to convince the City Municipality about, because the City Municipality interest is different from the port, that is to reserve the old buildings as a notable relic or museum and develop a tourism centre.

Though, it is not easy to calculate the dwelling time manually with out the assistance of computers, the average dwelling time of the port is estimated 20 days for general cargo and 30 day for containers (DMT, 1998, p.6). However, the factors that affect the dwelling time can be summarised as follows:

- **Less than full container load (LCL)**

The main objective of LCL is to pack different consignees' cargo that does not fill the full container into one container. This has an advantage for the ship owners to handle and transport them easily. Its drawback is it affects the dwelling time, because LCL can not be used through a direct delivery system. The main reason is LCL is not comfortable to do all administrative and custom procedures unless all consignees are not attending.

- **The custom clearance delay**

The procedure of checking goods by the customs is long and bureaucratic. As a consequence of these, a lot of cargoes are obliged to use the indirect delivery system especially the general cargo. The main reasons for strict checking of all cargoes are some of the customers especially the tradesmen still continued to mischievous and deception the rule. The most common fraud (mistrust) which has been done by customers was importing cargo that was quite different from the lists in the manifest particularly cargoes which are imported from the Far East.

The other problem is yet the custom's office tasks have not computerised. The same to Port and Shipping including other related agents (tax collection office, bank, insurance and different agents) too have not yet been computerised. Consequently, the documentation procedure was done manually and took a long time to process. Besides, the location of these offices in different places and duplication of work due to non- co-ordination of their tasks caused delays to the documentation process.

- **Large number of small consignments**

Most of the general cargoes were owned by a large number of small consignees with large quantities of packages. Therefore, it was difficult to handle this type of cargo and to deliver it through the direct delivery system during the ship operation, especially the cargo which is less than one truck and placed in different holds/hatches.

- **Communication and information problem**

The information for export cargo is collected mainly from shippers, clearing and forwarding agents, and ship's agent. The information consists of quantity of cargo to be discharged/loaded, type and proportion of cargo to be stored, space need, length of time staying at store, and special requirement of storage by the customers.

The port's main problem was that it could not predict the demand of storage for the coming days, weeks or months, as the result of delaying the information. In principle, should reach to the port 3 days ahead of the ship arrivals at the port. But this information reaches to the port very late, that is almost near or at the time the ship arrival at the port. As a result, the plan was done in a hurried way at the last minute. The disadvantage of a hasty plan is that the plan is inefficient with a lot of errors. Thus, this requests additional cost and time for its correction. Besides, it causes a tremendous increase in idle time of the equipment, employees, and immobilisation time.

- **Lack of supervising storage operations**

One of the main tasks of the storage management is to supervise and control the storage operation according to plan or schedule. However, in Massawa Port, this activity was not done efficiently. The reason for of this might be many, but the main reasons were either the negligence or incompetence of supervisors on the one hand and the unaccountability of the storekeeper on the other hand. The supervisors did not strictly follow up to the storage keepers' as well as labourers' performance, and did not take disciplinary action for the fault doers. The consequence of this poor management led to poor utilisation of resources, high congestion in storage area and/or at port, slow ship operation, and unnecessary additional shifting of cargo due to poor organisation. Besides, it causes a delay of delivering cargo to inland transport, and exposition of cargo to damage, pilferage and loss. In short, though it could not estimate the loss in value, the above reasons definitely increases the cost of trade commodities, because capital assets, insurance premiums, surcharges and demurrages would be affected by the above factors.

In summary, the accurate storage plan, which is based on the current situation, is very important to minimise the time delay. On the contrary, the guesswork increases

the time delay in storage operations extremely because the decision might often be wrong. This wrong decision will request additional time and cost to be corrected such as shifting of cargo. This leads (proceed) to wastes of labour and equipment increased handling costs, and increase in cargo damage.

#### **4.3.3.2. Storage Utilisation**

Daily evaluation of the storage utilisation is very important for maximising storage capacity. In Massawa Port, daily in and out cargo from and to storage was reported by the storekeepers including estimated availability of storage space. The problem of storage utilisation is it depends upon the flexibility and awareness of the storekeepers and supervisors. The higher the flexibility, which mostly depends upon skill, the higher the storage utilisation will be.

In summary, 'Good storage management depends not just on sound planning procedures but also on close supervision' (Roach, 1982, unit 5, p.4). Unless you make sure that the storage regulations and policies are strictly applied, and that day-to-day operations are properly supervised, the consequence will be the worst and the risk will be high such as poor utilisation of space, poor accessibility to consignments, delays in identifying cargo, and storage congestion. Consequently, ship operations, cargo-handling operations and delivery/receives of cargo will be slowed down or stopped.

#### **4.4. The indicators of quality service**

The quality service indicator, like the physical service indicator, is very important to analyse the quality of services offered by the port. The ship owners at large are more interested and give priority to the indicators of quality service. In fact, only physical service indicators cannot give competent and efficient measurement of the port, but can combine with quality services. Some of the main indicators of quality of services

are waiting time, turn round time, handling productivity, storage grace period, and working hours in port.

The flexibility indicators and the reliability indicators are other measurements of quality service. The flexibility indicator consists of flexible working hours and punctuality. The reliability indicator also consists of work liability, security, and commercial climate. However, the author will consider only flexible working hours because the other parts have not yet been introduced and/or used.

Flexibility of working hours is the co-ordination of administrative and physical operations. According to Professor. Francou, 'the flexibility is the measurement for the capacity of the port services to adopt the requirements of the shippers and ship owners' (Francou, 1999, p.20). Accordingly, the flexible working hours of Massawa Port was on average 15 hours. This indicates that the port is open for 23 hours for cargo handling operations but its co-ordinated working hours with other service organisations such as and others was only 15 hours. However, the above average does not represent the actual situation, because with most of the organisations such as banks, shipping agent, insurance company, and freight forwarding agents its co-ordinated working hours is only for seven hours.

The litigation right is one of the factors for work reliability. In Massawa Port, the litigation ratio was very low, but this does not mean that there was not any damage, pilferage or loss of property. Nevertheless, up to now according to the ship owners' and consignees' comments, the Eritrean ports are relatively better regarding safety and security of the cargo. At present, the port decreed to take full responsibility against all risks for the cargo which is handled at the port in good order and condition. This can add to the quality services and reputation of the port.

In summary, the customers will stay at the port as far as they do not get better alternatives. Therefore, the port in order to keep its good reputation will have to take full responsibility for the cargo handling and will be accountable for all operations. This accountability helps to make the workers, supervisors and others concerned body aware of their duties. Moreover, the port has to give special consideration to the claim the litigious right by the customers in order to keep its good reputation and attract customers.

#### **4.5. Indicators of Productivity**

Productivity is the measurement of efficiency and cost effectiveness of berth operations. Unlike other indicators, it indicates how effectively labour, equipment, buildings and land are being used. The importance of this indicator is it measures efficiency in terms of cost per ton of cargo handled.

According to Massawa Port, the productivity is a gang output per hour and used as a base for calculating the port tariff. The average of the productivity is decided based on the historical data and experience (Table 13). The port tariff takes into consideration all the fixed costs, variable costs and overhead costs including the overtime work during the day, night, Sundays and holidays. Thus, it is a cost based rate. The average productivity is assumed the breakeven point where the cost and revenue of the port is equal plus a certain profit margin. The main objective of the port is to increase profit using the same resources, such as the men, gear and equipment by organising and supervising operations. According to the port tariffs formula, the higher the productivity above the average, the more profit to the port because the higher throughput, the lower the fixed costs will be because the lower the distribution share of the fixed cost to each unit of the cargo will be. The average productivity, which the port uses as the base level for its productivity, is shown in the following Table 13.

**TABLE 13. STANDARD AND ACTUAL PORT PRODUCTIVITY OF MASSAWA PORT (YEAR 1998)**

Description	Eritrea			Europe Standard	Yemen	Djibouti
	Minimum acceptable rate	Actual				
		Per hour	Growth 1998 Vs 1993			
Bulk cargo (MT/hr)	22	30	5%	40	27	16
Bagged cargo (MT/hr)	18	22	2%		27	NA
Break bulk cargo (MT/hr)	12	13	1%		8	12
Container (TEU/hr)	10	10	7%	25	20	16

**Source: Massawa Port Report of 1998**

The port makes continuous amendments as far as both throughput and productivity have shown growth in order to have fair prices and be more competitive. However, the port productivity is affected by the following factors:

- Improper stowage plan and loading factors
- Emaciated package
- Incompetent manpower
- Unskilled equipment operators
- Unsmooth flow of trucks
- Low speed of hook cycle and hook capacity

Therefore, the productivity will be improved if the management gives special consideration to the above factors particularly through an efficient management system and operational planning, good co-ordination, and competent supervision.

## CHAPTER 5

### PROBLEMS AND POSSIBLE SOLUTIONS

In the previous chapters (chapter 3 and 4), the author discussed the problems in detail based on the appropriate international standardised indicators. In this chapter, he will summarise the problems and look for possible and appropriate solutions.

The problems can be summarised in the following major parts.

- 5.1. Deficiencies and inadequacies of port equipment
- 5.2. Inadequate of operational planning
- 5.3. Inadequacy of the Management Information System
- 5.4. Lack of an EDI system
- 5.5. Low level of skills
- 5.6. Unaccountability of workers and Incompetent supervisors
- 5.7. Inadequate training
- 5.8. Shortage of finance for investment

#### ***5.1. Deficiencies and inadequacies of port equipment***

AS Dr.Thomas B.J. and Dr.Roach D.K. explained in 'Management of Port Maintenance': the main problem of inefficiency in Less Developed Countries (LDCs) is the poor quality of equipment maintenance. This causes the biggest obstacles to the achievement of acceptable levels of efficiency and increases the maintenance cost. This book further commented that though the acceptable level of

equipment availability is equal or more than 70% and the maintenance cost must not exceed above 10% of each capital cost of the equipment, in reality in those countries the situation is to the reverse (Thomas and. Roach, 1989, p.51). The same applies to Massawa Port, though one type of equipment differs from another; the average availability is almost 60%. The proportion of maintenance and repair cost to the capital cost of the equipment is not available, but its maintenance cost in general is 11% of the total budget of the port. However, it is obvious from the existing condition that the port operations have been affected negatively especially regarding flexibility and cost

Nevertheless, the repairing and maintenance of all cargo handling equipment, machines, and other facilities include other section facilities done by TSS (Technical Service Section). In this section there are inefficiencies in repairing and maintaining the equipment and machines. The main causes for the inefficiencies of the TSS can be described as follows:

#### ***5.1.1. Shortage of skilled labour***

In order to have a good maintenance, it is necessary to have a good policy and plan of repair and maintenance, which is totally dependent on the skills and intellectuality of the senior management. In Massawa Port, there is lack of skills and intellectuality of the senior management as well as other workers. For instance, lack of qualified and competent supervisors/equipment inspectors, who always depend on the trust of the workers, worsens the bad condition of the equipment. Consequently, a continuous and fast breakdown of the equipment is increasing.

Though the employee skills problem is in all sections and staff of the port, this problem is clearly and severely shown in the TSS. This is because the Port equipment is becoming very sophisticated and complex. As a result, it is very difficult to maintain the equipment with the present level of skills, especially as there is no engineer who can read and understood the manual to guide the technicians for the work. As it has already been mentioned, the main problem is unavailability of

skilled manpower. Most of the mechanics and electricians are largely unskilled and very few semi-skilled. (Table 14).

### ***5.1.2. Inefficient logistics***

The inefficient logistics system in the port causes delay of spare parts and other consumable materials and are not available at the time they are needed. The main causes of inefficiencies of the logistic system can be summarised as follows:

The distance between the supplier and the port is very high. As the port is a special industry, mostly it is difficult to find local spare parts and other consumable materials suppliers who fulfil the requirements of the port in the period of emergency or at the time they are needed. The only means that the port uses especially for the spare parts and electronic materials is to request the necessary materials from the foreign suppliers through 'letter of credit'. The main customers are Germany, Holland, England, and Japan. It is obvious that the distance and procedures affect the lead-time, most of the time one to three months even through the fastest aeroplane transport. Moreover, the infrequent ship services to and from the port have great problems for the cargo handling operations by paralysing the equipment, for example, waiting for spare parts. This condition is severe especially when there are accidental breakdowns, obsolete equipment, and unexpected spare parts are needed. In addition, the obsolescence of the equipment severs the logistics problem because their frequency of breakdown equipment is higher. Thus, they demand more spare parts and consumable materials including high labour costs. Furthermore, the problem of systematic follow up to the ordered goods; and inefficient system of communication either expensive method of communication (fax and/or telephone) and inefficient delivery mailing system (mailing through post office) affect the lead-time negatively.

### ***5.1.3. Poor preventive maintenance programme***

In Massawa Port, there is no formal preventive maintenance policy. The main task of the TSS is to do corrective maintenance, which is mainly for repairing equipment after failure. Moreover, the procedure of designing-out of obsolete equipment is not simplified one. Equipment is repaired in the port until no longer functional though economically unprofitable. This is because firstly, the port management has not developed such kind of planning culture. Secondly, the availability of equipment is low and there is no more reservation. Thus, the operation section is not willing to release the equipment for preventive maintenance for the sake of not interrupting the operation; and thirdly as the number of breakdowns is high, most of the time, the workshop gives full focus on the repairing, which is very costly and time consuming. Besides, maintaining the other equipment of the port, such as trucks, small cars and other facilities (air-conditioner, fan, and other electrical and mechanical items in the port's offices) is also another factor consuming maintenance time.

### ***5.1.4. Inadequate of cost accounting centre***

An adequate cost accounting centre is very important for analysing the economic life of the equipment. This analysis of the economic life of the equipment takes into account the discounting cash flow techniques, such as time preference, foregone interest, and risk and inflation. Moreover, the lifetime of the equipment depends upon the total cost, that is the annual operating cost less than the average annual total cost,. This idea is summarised by Thomas and Roach as follows: 'replacement could be timed when it is most economical, rather than when the asset is worn out' (Thomas and Roach, 1989, p.52).

In Massawa Port the cost accounting centre has not been organised well. As a result, the equipment has never been analysed through an individual cost benefit analysis (economic life of the equipment) though all information required is available. Thus, it is not known whether the equipment has covered its variable and fixed costs. This failure is not only misleading using unprofitable equipment but also blocked to make

a plan for replacement or disposal. For instance, in order to replace new equipment, predicted running and maintenance costs of each unit of equipment and those of replacement machine need to be compared. But, this principle, like in almost all developing countries, is not applicable in Eritrean ports. Equipment operates at whatever cost until it is no longer reparable. This is due to two reasons.

- The first reason is financial problems. Some of the equipment needs replacement so it is not productive, but due to shortage of finance it could not be replaced.
- The second reason is traditional administration. This is because the administration only focuses on the overall profit and not on a specific cost benefit analysis. Therefore, some of the equipment is running at a loss as the equipment are running by the support of a high repairing service.

#### ***5.1.5. Unawareness and disinterest of the operators in charge of the equipment***

Unawareness and disinterested of the operators in charge of the equipment accelerate the frequency of the breakdown of the equipment. For instance, the unawareness of the operators initiated either due to lack of competent supervisors, the labour policy of the country (life long job), poor personnel administration (inconsistency disciplinary measure) or ignorance of the operators. All the above give rises to negative motivation. As a result a lot of common mistakes made by the operators, such as forgetting checking the oil, tyre, and giving correct reports of the equipment failure.

In summary, the above five factors affected negatively the efficiency and adequacy of the equipment. Therefore, the following measures can devolve or at least minimise the problems.

\* **Solutions**

*i. Restructuring the transport and operational equipment unit under the control of TSS.*

As the operation section's main function is to handle cargo and ships fast, it gives priorities for the operation to the life and cost of repair and maintenance of the equipment. This causes inefficient utilisation of the equipment. Therefore, it is better that the administration of equipment should be under the TSS of the port than in operation, because as the TSS task is mainly to keep the health and life of the equipment. Thus, it can be the fully and unconditionally responsible for the condition and upkeep of the equipment. This type of work is more common in most ports of the world. It works as a commercial entity. Therefore, there is no problem of applying the same to the Massawa Port. This will be done by giving the section its own expenditure (spare parts, supplies purchase, labour salaries and overheads) and its own revenue from hiring the equipment though it is in paper reconciliation. This gives an opportunity to the TSS to have its own cost/revenue centre and set an appropriate financial and performance target. The control of equipment under the TSS has the following benefits:

- First, it encourages them to be cost conscious and have greater accountability and responsibility to fulfil to the utmost the requirements of the equipment in number and type of equipment in the operation section.
- Second, it is easy to make plans and schedules for a preventive maintenance programme for maximum efficiency taking into account the operation section needs.
- Third, better position to monitor maintenance costs and equipment costs, and take disciplinary action in the event of damage or fault done by the equipment operators.
- Fourth, the operation section will also be cost-conscious and will request genuinely only the equipment, which is needed for particular operations.

Besides, it gives relief to concentrate on the main activities of the section, that is daily requisition and deployment according to the operational planning.

- Fifth, the engineering section will work as a commercial sector and will provide the required equipment and offer full guarantee to the operation section either by buying or leasing from the others according to the strategic objectives of the port. This assists the TSS to be accountable and responsible for the equipment. Thus, TSS is forced to undertake post-shift inspection and this helps to detect and remedy small faults before they become magnified in use (Ircha, and Crook, 1999, paper 10)

However, both sections must have strong co-ordination and done relationship, because they have common points to be agreed upon for facilitating their performances, such as controlling equipment operators, good operational and engineering management information system, allocation procedures, maintenance schedules, and collaboration with Planning and Programming Unit (PPU) to assess the future changes in traffic and equipment requirements. (UNCTAD 1990, p.121-124).

*ii. The cost/revenue centre should be established at the technical service centre*

The sub cost/revenue centre must be established in all sections and one main centre under the finance and administration section of the port. This assists each section as well as the entire port to know their revenues, expenses and profits. For instance, the particular advantage of this centre to Technical Service Section (TSS) is to record all maintenance data, monitor the operating performance of equipment, study the economic life of the equipment and make out the profit of the section. The cost/revenue centre must be supported by a modern management information system such as Engineer Management Information Systems (EMIS) and Operations Management Information System (OMIS) because it is the simplest way to have

accurate data, updated, analysed and presented in usable and easily comprehended form.

Moreover, the cost centre assists to measure the performance of the each technician, such as the effective hours spend in maintaining the equipment either daily, weekly or annually. Thus, it is a good controlling mechanism for the management besides observation. Moreover, it makes it possible to calculate the total Maintenance Costs Per Running Hour and Operating Costs Per Machine Hour. This makes it easy for monitoring the performance of their section and to take the necessary remedial action to improve the efficiency of the maintenance services if the performance falls short of the set targets.

A computerisation system can ease the burden of ample work in all systems of the port. For instance, cost centres and supply management have very great inter-link in their tasks. Therefore, developing computerisation in these parts really gives the highest benefits not only in saving labour cost and the hardship of the work, but also reduces the sensitive error (such as type error) which causes a loss of million of dollars and unnecessary processing time. Moreover, it gives signals for the stocked materials and spare parts when they reach their minimum level of stock.

### *iii. Set effective Maintenance Policies*

Setting the effective preventive maintenance policy based on the strategic planning of maintenance is very important and significant because it upholds (maintains) the capacity through its economic of life. Therefore, the port has to introduce/initiate the preventive maintenance policy according to the strategic plan, which is based on the reconciliation with the workload and on the period of manufacturers' recommendations. (see appendix 4).

As strategic plan is very important to ease the workload. This is done by adjusting both the operational plan and maintenance plan (the preventive, accident breakdown repair and designing-out maintenance). These plans take into account priority rules

that are urgently needed for the operation; and the highest number and type of equipment ability to afford for the customer service during the peak periods.

***iv. Repairing the non-cargo handling equipment at the external contractors***

This is also another strategy for easing the overloaded work of technicians. This gives an opportunity to the technicians to focus on the cargo handling equipment that can not be maintained to the external contractors due to their speciality. Nevertheless, the non-cargo handling equipment has no problem to be maintained in any other outsiders' contractors.

***v. Reliable spare parts and consumable materials***

At present, modern communications have a great contribution to shorten the lead-time. Setting up EDI has a dual benefit for the port, it mainly facilitates the information to the port operation purpose. However, it can be better means of communication with the suppliers in order to have reliable spare parts and consumable materials because it is one of the modern relatively cheap means of communication. It assists to shortening the process and procedures. Therefore, the port has to install a preliminary EDI system, because 'If spares and materials are not immediately available when needed for preventive maintenance and for emergency repair work, then all the port's investment in workshops, facilities, tools and employees' skills counts for nothing'. (UNCTAD, 1990, p. 91).

Moreover, strategic planning of maintenance is also playing a very big role to fulfil the reliable spare parts and consumable materials. Besides, holding frequently needed inventory materials and spare parts to protect against uncertainties is also another solution.

***vi. Develop management and technical skills***

In the workshop, at least one engineer who has multidiscipline and is broadly qualified is urgently needed because the new equipment is not only complex but also they are very highly Electro-tech and computerised. Besides, training for the semi-

skilled workers is very important solution. Though the port is late to do this but still it is important to take action starting now for the future. The importance of skilled labour in this section is like any other section of the port to do planning and scheduling maintenance, and controlling maintenance workloads and workshop activities. This can only be done by skilled labourers especially senior technicians. Therefore, the port has to train/recruit skilled labourers will in addition one technical engineer has to be recruited.

*vii. Good condition of port roads, quay aprons and back up areas*

The condition of the roads, quay aprons and back up areas has to be smooth and good enough for the movement of the equipment. Besides, they have to be maintained well regularly. If this is not done, the productivity is affected negatively. Besides, it can cause damage to cargo and equipment.

## **5.2. Inadequacy of Operational Planning**

The short term planning, which is called operational planning by the port, is done by the Operational Planning Committee under the responsible port operation section. There are three types of operational planning: pre-berthing planning, work scheduling and the performance review, but in Massawa Port the most common operational planning is work scheduling. The other types of operational planning have not been used by the port. The main problems of operational planning are summarised as follows:

**a. Pre berthing planning problem**

As the name indicates, it is a pre-arrival planning of vessels. Though this plan in a whole package is the base for smooth and efficient cargo handling operations, Massawa Port gives due consideration only to berth allocation within the range of 24 hours, because naturally, the resource allocation is done for the ship, which is only tied at the berth or will berthed the next 24 hours. It does not emphasise on the resource allocation and estimating of operating time. There is no specific

reason other than lack of skilled labourers and traditionalism. However, the inadequacy of information (documentation) can also be another reason.

The cause of the inadequate information is the port as well as the port users not having introduced the EDI system. Even Electronic email access has not been started. All the information has been flowing through post mail. Consequently, it causes delays, inaccurate information, and higher cost.

The disadvantage of not using the pre-berthing planning by the Port is that it cannot allocate the resources efficiently and cannot think ahead how to minimise the Quay Transfer Distances. Besides, the port does not suppose or intend to approximate the berth occupancy hours of the vessels, the 'work content' and 'commanding hatch'. Moreover, it is not possible to do a pre berthing allocation of storage space, estimating calculating work value, estimating the operating time and ship staying time.

#### **b. Work scheduling (During berthing)**

Work scheduling is the shifting operational plan while the ship is tied at berth. The estimation of work schedule is depending on past experience, that is according to the productivity of each cargo. The work scheduling is affected by the cargo stowage, availability of facilities, efficiency of storage space, quay transfer operation and direct delivery system in order to have consistency in the operational activities and other resources.

The plan is done by the Daily Operational Planning Committee at 10:00 AM every 24 hours. The committee uses the work scheduling form to prepare the daily operational plan. The work schedule consists of the following titles: Stowage Position, Cargo, Work Value (tonnes/TEUs), Estimated Time of start and finish of work, and other special remarks including notes on the cargo handling, equipment and storage requirements, cargo consignments and delivery instructions, and all preparatory work. This form is prepared for each shift every

24 hours. It helps to achieve the highest possible ship output and the minimum of delays.

The method and the way of preparing the 'work scheduling' might be efficient, because the committee follows the procedures of operational planning. However, the problem can be summarised as follows:

- First, some of the information submitted to the committee is inaccurate. Consequently, the work scheduling would definitely be incorrect.
- Second, the incompetent and irresponsible of supervisors and foremen are also another reason for failure of achieving the target according to the work schedule. As is known, the planning needs strict follow up, control, and review at each shift/hour, because planning is sensitive to be affected negatively by weather conditions, non-arrival of transport, equipment failure, a sudden change in shippers' instructions, labour hide strikes and many other possible problems.
- Third, though the work scheduling is very important to estimate the minimum output during each shift, in practice it is not applicable. Nobody is concerned about whether the estimated plan has achieved its objective or not.

### **c. Performance review**

The performance review is the final stage of operational planning. This performance review has to be done after the completion of ship-work and ship-departure from the port. Roach in the book of 'Improvement Port Performance Management of general cargo operations' (IPP1) explained that the importance of the indicators is

- to monitor berths' performance;
- to investigate problems and weaknesses in planning and operating practices;
- to identify causes of poor performance; and
- to take the necessary action to remove them'. (Roach, 1989, unit 1, p.2).

The general performance review has been done in Massawa Port by planning and programming unit, but the problem is, the concerned management sections have never used the result of this review for correcting the deficiency of the operational problems. This is firstly, due to the traditionalism because nobody in the management knows that the PPU task is reviewing the port performance. As a result, neither the daily operational planning committee nor supervisors have used the data from the mentioned staff. Secondly, even the planning and programming, as an auxiliary or assistant of the management body, has never tried to be aware of the importance of its task and influenced the management to use the reviewed data and its comments. Consequently, the port performance review has never been used to correct the daily operational problems, but rather used to study the medium and long-term plan of the port. For instance, if the calculated Gang Output is below the Work Values, nobody asks the supervisors to give possible reasons for the low output and take appropriate action. Thus, it could never use this performance review as a tool of minimising the problems.

The other problem is the Work Value has never been updated with the current situation, such as the increment of productivity because of using capital intensive facilities. Consequently, it misleads the time of starting and completion of the work.

\* **Solution**

*i. Following the UNCATD manual in implementing the operational planning procedures*

The solution is to follow the UNCATD manual in implementing the operational planning procedures rather than traditional ways (try and error method) because effective operational planning has the following advantages.

- To control and supervise the port performance;

- To have the efficient and effective port performance;
- To do a proper allocation of resources, effective co-ordination of operational activities, and efficient management cargo handling operations at the berths (Roach, 1982, unit.7 p.1).

Pre-berthing planning creates a suitable opportunity for flexibility that assists in reducing the extreme demands of the resources and using the resources continually and efficiently. Therefore, the port has to take into account the advantage of the pre-berthing planning and avoid the traditional system of planning. This will be done by aware and mindful management personnel of the port and the port users.

Besides, as is known, planning and controlling are complementary elements. Planning can give the best result, if there is a good controlling system. In order to have a good controlling system and efficient and successful operational planning, competent supervision is necessary. Therefore, to have the competent managers and supervisors, the port has to train the personnel either in local institutions or at international universities such as World Maritime University and give other motivations which can strengthen their competence so as to achieve the target/standards and implement the work scheduled efficiently.

***ii. Privatisation the 'tallying and out-turn report' unit***

As already mentioned, a tallying and out-turn report unit is administered under the port administration in unit level. This system is inefficient and ineffective in providing reliable information because a port should not have both service providers and tallying and out-turn report of the cargo handled. In reality, in order to make the data more reliable and trusty, the tallying and out-turn report as a witness should have been done by a neutral third party, that is by an independent company. Besides, this creates accountability and responsibility for the port, and trust among the port and port users. Moreover,

it reduces the pilferage in the port. Therefore, it is better to be an independent company.

***iii. Developing (Strengthening) the Marketing Section:***

In Massawa Port, the marketing section is only structured on the organisational structure though it is obvious that it has a great role in improving the port performance and productivity. Yet it has not been provided with sufficient human and material resources. Thus, It has not started the work. Therefore, as the marketing unit has the following objectives, the port should develop the marketing section in all aspects including the strengthening of its competent manpower:

- To market the port
- To represent the port at international exhibitions and local exhibitions.
- To promote port services to its clients
- To give feedback on the concerns and problems of port users to the port authorities
- To ensure good and professional relations between the port and its clients
- To perform market analysis of the port competitors to improve upon their services.

***iv. Strong and applicable port regulations:***

This is very important solution for the customers who are the problem by defrauding the rules of the port. Up to now the port regulations were nominal or were not in practice efficiently. Consequently, when the customers (consignees or ship owners) broke the rule, they were not penalised. Thus, similar mistakes have occurred frequently such as over-stowed cargo. Therefore, the port has to facilitate the new port regulations, which are under study and will have to apply strictly and equally to all customers. This will increase trust and improve the productivity.

v. *Simplified customs regulations*

This assists to fastening the delivery system, which is the main means of relieving the storage congestion. Customs regulations in Massawa Port are very restrictive that enforced all goods, item by item to be checked. Checking is done when the owner of the cargo is coming to take off the cargo, that is either at the stacking area or at the gate of the port.

The main reason for checking has already been mentioned in the previous chapter. Though the reason for checking is genuine, but using this very traditional system of checking affects negatively the time, performance and productivity of port very severely. If this problem is solved, the delivery of cargo is estimated to increase by 15%, that is from 170 trucks to 200 trucks per day. (Massawa Port Report, 1998, p.3). Therefore, the port has to co-ordinate and convinces the customs office either to improve the system of their work or to do it outside port premises.

### **5.3. *Inadequacy of Management Information System***

It is obvious that the importance of accurate, relevant and comprehensive information plays a great role to obtain efficient and effective port activities. All sections of the port have their own system of data collection, compilation, analysis and presentation according to their objectives, leaving aside how effective it is. All sections report about the result of their tasks to the General Manager Office. Then, it is compiled by the PPU because the main task of the PPU is to compile and co-ordinate the data, which is reported to the manager, and prepare a general report.

The main problem is the utilisation of information in Massawa Port. The information has been collected and organised, but it has never been interpreted and analysed to search and diagnose the port performance problems. The management, most of the time, makes a decision by calling meetings and discussions with the managers based on their experiences.

The utilisation of information at Massawa Port is at its early stage. The manager, sub-managers, supervisors and their subordinates, are not yet familiar with the advantage and importance of information for decision making. Information is mostly collected for the sake of reports to the higher authority, that is 'board of director'. The problem is lack of co-ordination and feedback. The planning and programming unit, though nominally, does this task; its main deficiency is that it is not organised well to do the job and therefore could not disseminate the necessary information to all sections according to their requirements. Thus, the information is only a one-way flow, that is from down to top not from top to down. The other problem is although all sections are dependent on each other, they could not exchange of information among each other. As a result, there is a duplication information and work, because although they use different forms and analysis, the information, which they use, is similar or the same.

\* **Solution:**

In order to save the duplication of work as well as speed of the data process, it is important to integrate all the separate elements (Engineering, Operation, Supply, Administration and Finance, Harbour, and Planning and programming information) within one, or unified formalised system which is called Management Information System (MIS). The MIS has similar objectives with the planning and programming unit. Thus, updating and reorganising the PPU to the level of MIS will give very high benefit to the port.

The special advantage of the MIS is it helps different sections to have all the required data by integrating all the data from different sources including external companies without or little interference of human beings through the help of the computerised system. The data are compiled and presented in the simplest and easiest way for making decisions. MIS is a good system for managing the port and serve as the best

instrument to make good management decisions. As a result, the management duty concerned will be to analyse their own section according to their strategic objectives. To develop such system for the port's internal sections is not very difficult. Though it is in elementary way in one of the main Eritrean ports, Assab Port where it is tested in the following sections: Operation, Technical Service, and Administration and Finance sections including the Main Cost Centre, PPU showing a good results. Therefore, as its practicability is not very difficult; the management must facilitate the updating of PPU to MIS level.

MIS will have to use a computerised system. Although it is relatively expensive, requiring high skills, its benefits are greater than the drawbacks. The benefits are:

- Data can be quickly and easily stored;
- It is easy to link well-designed computer systems together;
- The computer relieves all sections (departments) of the time-consuming burden of analysing, summarising and circulating data;
- One computer data entry can be used in a variety of contexts, serving several systems and functions.
- Saves time, improves quality of records and analyses, and increases competitiveness;
- Increases operational efficiency, effectiveness and responsiveness, and reduces costs as a result of modification initiated by analyses of the aggregated asset sub-system data. (UNCTAD, 1990, p. 178-180).

Therefore, the port PPU should be upgraded to enable it to function as MIS Centre.

#### **5.4. Lack of EDI System**

In Massawa Port, the EDI system has not been installed and introduced yet though its importance is unquestionable. Massawa Port uses external information for

operational planning of handling cargo ship handling activities. The main users of this information are the operation section, the harbour master section, and planing and programming unit. The source of information is mostly from shipping agents through traditional ways though rarely from ship captains when the information is delayed.

The disadvantages of unavailability of EDI are:

- Photocopying or rewriting each document is costly
- Immense wasting of time in preparing the document
- Typing error and omitting cargoes from lists are common
- Inaccurate and unreliable of information as the result of passing through a lot of human interference.
- Problems of correcting errors on time and evenly for all bodies or organisations concerned.
- Users of the information such as port are exposed on the duplication of information to change into their own data form system.
- Impossible/difficult to trace the information after ordering them

\* **Solution**

This EDI system is very important for the port to get and process the information on time. Mainly, it comprises information concerning cargo, transport and handling equipment, the suppliers, and consignees. In order to alleviate the above problems, at present, the port will have to introduce a new communications system whose its function is to link with external systems. One of the best means of communication for linking among ports and users port is Electronic Data Interchange (EDI). It is a communication system between two or more computer systems. 'This system can also be used for marketing, advertising, and sales; supply and subcontracting; finance and insurance; ordering, delivery, invoicing and payment; product servicing, support and maintenance; transport and logistics, and accounting'. (Port & harbour, March 1999, V.44, No. 3).

The advantage of installing EDI to the port and port users is as follows:

***a. Cost and time savings***

EDI saves clerical costs by avoiding re-entry of data and avoids errors in re-entering and transmission of data. It assists in accomplishing the process of information of ports and port users with little paper work, no defects and delays. This system can solve one of the main problems in Massawa Port, that is duplication of information and documents. For instance, the harbour master section, different units of the operation section, different units of the administration and finance section, the technical service section and the PPU obtain the same or similar documentation (information) from the shipping agent, but using it in different forms and titles.

Nevertheless, using the EDI system is saving time and cost (communication, manpower, and capital cost); minimising the requirement of manpower; reducing manual work; eliminating duplication of work; reducing human error; and providing better inventory control through restructuring, co-ordinating, and centralising the information system in all aspects, such as port, shipping agent and other port users. As a result, it increases productivity, improves the delivery system, and reduce the dwelling time at port, waiting time of ships, and capital cost of the infrastructure.

***b. Open access with other external customers markets***

At present any trading agreement can be done through this communications system. It facilitates just-in-time ordering by the port.

***c. Fulfilling customers' requirements***

Many customers at present require the computerisation access. For instance, the ship owners seriously require the port as well as the agents to have

computerisation access, because firstly, they believe that this access is more reliable system than mailing. Secondly, it saves cost of paper, because, the ship-owners directly or indirectly are asked to submit above 8 documents of 3-10 copies for each document. As most of the ships handled at the port are conventional, copies are voluminous and costly. (Appendix 5).

***d. Increase the speed of the information flow***

One of the main problems in Massawa Port is the flow of information. First, there are no consistent procedures for flow of information. Second, there is no accountability for the deficiency of providing the information on time to the port. Third, the information, that is provided by the shipping agent is not reliable as it passed through different human interference specially when the information is retyped manually. The consequence of this, inefficient flow of information has influenced considerably the operational planning including the storage planning and tracing. The inefficient flow of the information frequently appeared both from and to the port. However, installing and introducing an electronic computerisation system can solve or minimise all these problems.

***e. Improved efficiency, competitiveness and quality of services***

At present, the efficiency of the information flow is one of the main factors of competition in the modern ports. Using the EDI system makes the work more efficient and reliable by making the process, inflow and outflow of information easy and simple. This gives an opportunity for minimising cost and time of the port, ship-owners, ship agents and other port users. Although Massawa Port has more comparative advantage over its competitors, the competitors also have comparative advantage of this system access at Massawa Port. In short, EDI is a very determinant system for competitiveness. The UNCTAD Monographic No. 4 p.37 states clearly and precisely the importance of EDI that:

‘the traditional handling of the various transport documents by each operator in his own information system generally involves multiple entries of data that

give rise to lost time, mistakes and corruption of the data, and hence to costs. Direct exchanges of information between the computerised systems of the enterprises concerned, therefore, emerge as impressive stake in competitiveness'.

Another advantage of EDI is it is one of the means for paving way to quality of services such as reducing waiting time, turn-around time, handling productivity, more efficient use of storage area and equipment, faster and more rigorous administrative procedures, and working hours in port. Besides, it is a means of flexibility, reliability, punctuality, lessening penalties, pilferage, damage or loss of properties, and dwindling idle time in port.

Moreover, the EDI system has also given great contribution to the facilitation of customs office tasks because it makes it possible to reduce the transit time. It helps the customs office to inspect the customs status before the arrival of the goods. This procedure contributes to distinguishing which cargo needs an indirect route or direct route, and enabling the port to organise the transport according to the requirements of the cargo. EDI banishes or at least minimises the bureaucratic procedures of the customs office on which many clients or customers are disconsolate. Besides, it minimises the corruption or illegal actions. Furthermore, it facilitates faster border controls and customs clearance of goods.

***f. Reviewing port performance and forecasting***

Reviewing port performance and forecasting requires accurate and reliable information. EDI is better and more reliable than manual system of collecting information because manual systems have more human interference. The more interference of human beings, the more the errors. Therefore, EDI is the means of reliable and accurate information, which is very important for the reviewing of the port performance and forecasting.

**In summary, the** benefit of introducing of an EDI system is higher than its shortcomings (shortage of competent and skilled manpower, and low level of capacity of capital to invest high capital cost system). Thus, the port must install the elementary level of the EDI system co-operating with its users (port, shipping agent and custom office) according to their financial ability for the short and medium term in order to communicate efficiently and effectively among themselves and external customers. The special advantage of EDI is it can develop the existing system into a more advanced system in the long term.

### **5.5. Low level of skill**

In Massawa Port, there are more than 442 permanent office workers and 255 permanent labourers. Although most of the employees are experienced, they are unskilled. The author considered the unskilled labourers in terms of education level because though the majority of all port workers are experienced, especially technical workers and equipment operators, experience only without education is no longer important as technology is changing and developing fast. Therefore, high level of education is very important as the manual and mechanical work is becoming out of date. Everything is depending upon computerisation and more sophisticated electronics. Thus, though experience is good, experience without education is no longer useful. The level of education at Massawa Port can be summarised as in the following Table 14.

**Table 14. Level of Education in Massawa Port**

<b>Level of skill</b>	<b>Permanent</b>		
	<b>Stuff workers</b>	<b>Dockers</b>	<b>Total</b>
Lower skill	48.6%	92.9%	67.3%
Semi skill	40.6%	7.1%	26.4%
Vocational	6.6%	-	3.8%
Medium skill	3.7%	-	2.1%
High skill	0.6%	-	0.3%

**Source:** provided by the author based on the Massawa Port report of 1998

According to Table 14 the port has acute shortage of skilled manpower especially at the operation unit which is the core body of the port operation. Almost all supervisors including the operational planning planners are experienced personnel, but they are semi-skilled.

The level of educated manpower is a nation wide problem. Though the port has had very fit skills criteria for each required job, it could not succeed in recruiting skilled labourers. These are due to two big problems:

- a. Skilled labourers are very scarce in the country. As the demand for the skilled labourers are high, the skilled labourers have many job opportunities and prefer to work in high land areas to ports which are located in low land areas with a relatively hot climate, lower facilities and accommodation. As a result, the port is forced to recruit or promote for some positions below the requirements.
- b. There is inadequate training centre. For instance, although the port knows that training can only solve the illiteracy of the operators, yet the port has not organised the structure well including professional trainers.

\* **Solution:**

According to Professor Ma Shuo is lecture, "Management is an art and a science as well". (Ma. 1998, P.2). It means only experience without education is not effective. Therefore, giving efficient and appropriate training to their current jobs can only solve the problem of the skilled labourers in the port. Of course, the training must be accompanied with efficient procedures and rules, attractive working conditions, greater flexibility in salary, and sound labour-management relations. Besides, it must be based on mutual trust and confidence enabling productivity improvement. Moreover, the objective of the training has to be able to provide port workers with skills necessary for safe and efficient performance of their work.

## **5.6. Unaccountability of workers and Incompetent supervisors**

Traditionally, the workers are working not by their own initiation but what is being told or ordered to do by their managers or bosses. None of the workers are delegated the responsibility and authority. Consequently, they do not accept accountability for their performance. The problem of the port is not the problem of structuring but the way of practising modern management with great effort, such as delegating the responsibility, authority and accountability. According to UNCTAD Publication that is 'improving port performance: port equipment: policy, management and maintenance: a seminar for policy maker' (IPP3), the delegation and accountability of the work must be based on principles or rules. For instance,

'every manager should be given full responsibility for running his section, subsection or unit, every workshop manager or superintending engineer made entirely responsible for the operation of his workshop (including realistic authority for ordering tools, consumables and spare parts), every foreman given full control over his gangs and the work they do, and each individual allowed (under appropriately supervision) to perform his tasks to the best of his ability, with full support and encouragement from above'.  
(UNCTAD, 1990, p. 9).

This can be applied just by providing the detailed job description for the workers and procedures of their tasks. This assists the workers in knowing their duties, responsibilities and line of authority. However, although this rule or principle has existed at the port, the main problem is in its applicability and follows up. As a result, it does not show a significant role to give the accountability for the workers. A case in point is the consequence of the unaccountability of the equipment operators. As is known, the equipment operator is the first person who knows the cause or the diagnosis of the break down. However, the operators are not willing to tell or make a report of the exact situation of the break down. Here, the problem is not only spent on the time for investigating the diagnosis, but it also leads to the improper utilisation of working time of the workshop. The other problem is although

the operators according to port regulations are responsible for doing all the pre-driving checking of the breakdown of the equipment, in reality they do not apply.

\* **Solution**

Promote human resource development. This concept is elaborated in details in later of this chapter at sub title of 'solution for inadequate training.

### ***5.7. Inadequacy of Training***

There is a very small training centre in Massawa Port. The objective of the training centre is to give on the job training. However, the problem is in its practicability to reach the objectives. There are problems of inadequacy of the training centre, unavailability of well-structured curriculum, and lack of modern teaching facilities and manpower development plan. As a result, the trainees are selected when the course is scheduled to be given. The subjects of the course are selected traditionally just because they were given in the previous periods and not based on the objectives. The achievement of the course objective and target is not clear. Thus, the training does not play a significant role in changing to the workers' attitude or skills. Of course, there might be some other reasons beyond the mentioned factors, such as the training is not being accompanied with salary increment or not taking the result as priority criteria for promotion or not having direct link with the current job.

\* **Solution**

#### **Applying Efficient Human Resource Development**

In Massawa Port, like any developing countries' port, the lack of human resource development is the greatest problem. This is as it is explained in UNCTAD publication, it is because of:

'Human resource is probably the most difficult one to master and use. Because, in addition to the difficulties inherent in personnel management, there are the specific characteristics of ports, the burden of the past, the habits and traditions which are some times valuable but are sometimes scarcely compatible with the principles of modern management" (TD/B/C.4/AC.7/B. p. 63).

Human Resource Development (HRD) comprises manpower development, employee attitude, and training.

#### **A. Manpower development**

Manpower development is the formulation of suitable policies for recruitment, justifiable performance appraisal, flexible in salaries, promotion and career patterns.

##### *i. Policies for recruitment*

Recruiting responsible men with the necessary aptitude is one of the policies. The port has a critical shortage of skilled senior managers, engineers and technicians. The problem is not only shortages of the skilled manpower, but also their level of education is low to continue further education, because the standards of the maritime universities are not allowed to accept that level of education. Therefore, the port has to reform the recruitment policy, that is a fixed salary system has to be changed and should be flexible with market standards through negotiation with the Board of Directors. Otherwise, the future hopes of the port will be uncertain because let alone recruiting new skilled employees, it will also be impossible to keep up the existing skilled labour and control the turn over. In short, in order for the port to survive in good condition it has to use flexible salaries and other benefits at least to fulfil house accommodation. The special advantage of these professionals is they are able to develop self-development training. This means, they can update their skills with modern development by using different means of communication and books.

Besides, all technicians at least must have a vocational profession from a technical school because on the one hand they are easy to train, but on the other hand it is impossible at the moment to repair and maintain the modern equipment and machines with unskilled and traditional workers.

**ii. *Justifiable Performance Appraisal***

The objective of the appraisal is not to punish the employees for their failure at work. However, as it is natural, to see the failings of employees at work, the managers' task should be to investigate the causes and look for possible correction. For example, the failing of workers doing their job might be due to the following main reasons:

- inadequate intelligence to the task
  - emotional instability such as depression
  - de motivation to work
  - the firm situation such as inappropriate organisational standards, poor communication, insufficient managerial support, excessive spans of managerial control, and responsibility with out authority.
  - external influence such economic forces and changes in location, ...
- (Stewart, 1980, pp.121-122).

The main solution to the above failures is training and development though counselling through vocational guidance and changing the job (put at the right place) have their own contribution to the solutions.

**iii. *Policies for promotion and salaries***

Training will have better result if it is supported with the increment of salary, promising promotion and modern facilities especially if the result of the training assessment give due consideration in future promotion.

**iv. *Set up reliable and achievable target***

It is the most relevant measurement for the performance of any work. This target is also very important for evaluating the performance and appraising the

achievement. For instance, the employee must have performance appraisal to assess the achievement of the target and to get the feed back so as to be motivated by the result of his/her positive side and correct his weak side. Of course, other motivations and incentives play a great role in achieving the target.

v. *policies for career patterns*

Policies for career patters comprises specification of the career structures' need and details of job description. It will give more advantageous if the details of job description are specified with the skilled requires, that is achievable.

**B. Employees attitude**

Employee's attitude can be improved by encouraging the following factors. These are the need for incentive, sound labour-management relations, mutual trust and confidence, attractive working conditions, welfare and other motivational schemes.

i. *The need for incentives*

- Incentive is very important to encourage the employees to achieve the target of the port performance and enhancing productivity. The incentives are varied from one port to another, but in Massawa Port the five Maslow's Hierarchy theories and the three Alderfer theories can be used as an incentive particularly the first two of Maslow's or the first of Alderfer's principles are the highest for almost all employees. These are physiological needs (fair salary, comfortable working conditions, and air-conditioning) and safety needs (safe working conditions, job security, fringe benefits, that is rent free house, bonus, allowance) [see Appendix 6].
- The port should give equal opportunity of benefits such as salary increment, training and promotion with out discrimination, that is based on the performance appraisals of employees and manpower planning.

- Moreover, sound labour management between the employees and management is also very important because it helps to develop the mutual trust and confidence between them.
- Making the salary flexible according to the market or private sector levels because though the present level of salary is satisfactory, naturally workers, always compare their salary with other companies. Therefore, flexible salary motivates the employees specially the skilled employees to stay for a long life in the port.

*ii. Other motivational schemes*

Non monetary incentives are another factor for motivation that enhance the performance and productivity because as the Eritrean culture is based on moral, it is the most powerful incentive system compared to other incentives including the monetary system. However, the managers including the supervisors have not yet developed this custom. Therefore, in order to improve the productivity without any additional cost, the managers should develop this culture. The details of this motivation can be summarised as follows:

- Culturally the employees do not like to be treated equally with the lazy and undisciplined employees. Demotivation for some undisciplined workers can be motivation for good workers because these can not stand to be exploited by unproductive workers who are not and will not be interested in bad habits. Therefore, the port has to revise the long and complex disciplinary policy by negotiating with the labour union and labour office in order to have justifiable disciplinary policy.
- The management will have to provide a good environment or working atmosphere to motivate the workers to do their work efficiently, to the best of their ability.
- The moral motivation gives conscientious to be accountable for their jobs regardless of money benefits. For example, one might work hard and effectively to gain the praise of respected superior or for fear of criticism, or

to be respect by colleagues for fulfilling agreed production norms'. (Prokopenko, 1987, p.213). However, the supervisors and managers have not developed the culture of appreciation for the good performance and innovation of their workers either orally, appreciation letter or any other rewards. Consequently, the port has not been the beneficiary of these non-financial incentives for increasing labour performance. Therefore, considering the importance of moral motivation, the supervisors have to be trained to develop this culture, so as to lead the workers to achieve the targeted goal.

- Debriefing meetings is very important to share up to date information between the management staff and employees and among the employees themselves. This debriefing meeting has to consists of general development, the problem occurred and their solutions, and the attainment of the target and shortcomings. This motivates the formulation of a good and harmonised team and creates mutual understanding and trust among each other.
- The workers should be allowed to participate in different activities, such as giving concrete suggestions about the current situation of the port and workers. Besides, workers should be consulted on matters that affect them in their work especially in decision-making within the enterprise. This is not only a moral obligation for management; it is also a motivational measure. As a result, the workers are committed to implement the decisions taken by the port conscientiously. (Prokopenko, 1987, p.214).

### **C. Training**

Training is one of the elements of the Human Resource Development and the most effective of all solutions, because though ports introduce very sophisticated technology, without training the manpower will not have any good results. One of the ways of developing human resources is giving an appropriate and practicable training. According to Professor Ma Shou 'management is an art and a science as

well'. (Ma, 1999. p.1). It means; only experience without education is ineffective. Training has a big role in developing quality to the port performance and productivity, because this improvement of quality assists the port to cope with the day to day technological change or development of ships. Quality requires higher managerial skills and better know-how than the highest capital for investing in terminals, facilities and equipment. In short, there is no flexibility without efficient skilled manpower particularly as the problems of the ports are accidents happen there frequently.

In short training has the following importance: First, it increases the quality of manpower fit to carry out qualified tasks because at present. It is the quality of the workers, which is important. This is because the development of technology is growing fast, and it can not be handled unless cope up with unless the port has its own quality (skilled) labour. Second, it enhances job performance, and achievement of goals. Third, it is the basis for commitment. Fourth, training helps to provide all new staff with appropriate know-how for their new jobs, and the existent workers to update with the latest development of their jobs and recent technological changes. Fifth, it assists the jobs to be done according to the objectives and guidelines of the port as well as the customs demands; and sixth, it assists in having flexible employees by training to be a multi-skilled (Integrated gang system).

In summary, training can assist in developing quality, safety and business cultures, respecting customers, efficient experts, and flexibility. Moreover, training assists in solving traditionalism. Training should be based on the objectives, business plans (including future trend), strategies and manpower analysis of the port. In addition, pre and post training course must be evaluated. In order to have an effective training the following solutions are important:

**i. Selection of appropriate techniques**

Training must have an objective and a manpower development plan with full details and specification, that is what subject of training for whom, such as for

new workers, remedial and refresher training, promotional upgrading, retraining and/or for motivating the workforce.

The training must be studied carefully. The study must take into account the type of employees to be trained, type of development, and type of development especially for managers and other trainers at higher education will give important contribution in updating their managerial skills and awareness. This idea is supported by Robinson:

'The training plan is a practical document which brings together all the training needs derived from the business and manpower plans, the performance review system and any other recognised sources. It is not only sets out what the needs are, how they were established and what standards are to be achieved, but also indicates the means by which they are to be satisfied, with the estimated time scales. The person or persons who will be responsible for the training are specified and budget allocations stated'. (Robinson, 1988, p. 34).

Although training is necessary for all employees according to the objectives and manpower development plan, the nomination of promotional upgrading candidates and senior managers must be based on the result of the individual performance evaluation of workers, such as competence of workers for their job, degree of attainment of assigned objectives, innovative capacities, approach and attitude towards colleagues, customers, and the organisation. (Thomas and Roach, 1989, pp. 191-195).

Finally, manpower planning should assist in analysing the current availability of the employees and the future necessity of the workforce. This includes level of skills within the range of the plan that take into account the resignations, retirements, deaths, redundancies, transfers, and the frequency of the turnover as well as future needs of workers. Based on this, the port will formulate its

future port plan and use training as a tool for fulfilling the requirement of the port to achieve its target (see appendix 7).

**Priority:** depends upon the urgency and importance of the position. As the most problems are from top management to bottom, the priority steps are mentioned as follows:

Firstly, Managers: As all the decisions require high skills and current management knowledge and intellectuality, training the managers at first level is very important. Besides, managers can share their experience/skills through on the job training and a good instruction of the job to their subordinates/employees if they are skilled.

Secondly, Supervisors: As the main duty of the supervisor is to satisfy both the management and the workers, it is very important to give training next priority to the managers;

Finally, others include specialities, craftsmen, operators, office workers and graduates according to the objective and training plan of the port.

The above concepts can be summarised on the following Table 15:

Regarding the cost-benefit, it will be including in the study of the manpower plan. Most of the course can be given in the Massawa Port Training Centre by trainers either from the port professionals who were trained at the WMU or inviting contract lecturers from universities, institutions or co-operation with other organisations including co-operation with the other Eritrean Port, that is port of Assab. The course, which is given by the Training Centre, can consist of two hours a day and five days a week in a par-time schedule, which will not affect the port operations. For the employees who are intended to be trained abroad or at local institutions as their number is low can be either covered by par-time or recruiting a contract workers.

The overseas training can be given to those undergraduates in the following training centres: Rotterdam Port (The Nether Lands), Le Havre Port (France), Alexandria

(Egypt), Mombassa Port (Kenya), and Ghana Ports and Harbours Authority (Ghana). For those graduated can train them in WMU for post graduate Master of Science in Port Management. Regarding the age of the trainees, this is included the study of manpower planning in relation to cost-benefit analysis of the port.

**ii. Training systems and programmes for all categories of the workforce**

The training must have direct relation with the present job or future tangible promotion. For instance, training for equipment operators must assist in having more information and know how about the machines and enabling them to make reliable pre-shift inspections and to repair minor defects. Above all, the training will have to help the equipment operator to update his/her knowledge with the new technological development.

As most of the training is concerned with on the job training, it is very important to have an adequate internal training centre, well-structured curriculum, and experienced trainers such as supervisors, senior managers, the professionals who have trained in maritime universities, and invited guest lecturers. Furthermore, training for the trainers and senior managers to higher maritime education such as WMU has great benefits in upgrading the attitude of the employees.

Participation of managers in the training programmes of UNCTAD is very important and necessary because it assists in acquiring an updated skills about the recent and modern developments of the human resource management.

**iii. Training for all employees according to the manpower plan:**

As working activities of the port are interrelated to each other, training is important at all levels for all employees according to the objectives, manpower plan and training plan. The training can be given to the existing as well as for the new recruited workers. Moreover, special training for managers must be done by selecting personnel who need the specific knowledge, skills, attitudes, and understanding to manage the current and future positions; the same applies to

promotional upgrading of employees. However, in order for the training to give a significant contribution, a continuous supervision by the experts, while the education is in process, is very important.

The training can be given through the following methods:

**a. *Seminars, Conferences, and Self-development such as correspondence.***

**b. *Induction of training***

This type of training is important for the newly recruited employees at least debriefing before being allocated to the section where he is appointed to work. The contents of the work consists of orientation and familiarisation with the port structure and the organisation, objectives and ranges of activities, safety and security rules, regulations of the port, the employee roles and duties to the position, right and duties of the employees, and terms and conditions of the work.

**c. *Management Trainee Programmes (MTP)***

This training is given to professional employees, about the tasks of all sections of the port before taking-up his/her appointed position. This type of training (course) is vital, because it assists the new employees in having broad experience as possible before specialising in a particular field. This helps the employees to distinguish and know the interrelations and differentiation of various fields of the port and be able to participate fully in the team approach thereafter. In short, MTP gives first-hand experience of all aspects of the work of the department of the port as a whole such as engineering, finance, marketing, personnel, operations, supplies and legal management.

**d. *On the job and in service training***

'On the job training' is given to the new employees, while 'in service training' is given to the existing or experienced employees on some new job tasks. In service training is mostly done when something new is introduced in the port such as computerisation package or new type of equipment.

***e. Refresher and remedial training***

It is obvious that with the passing of time people will forget some of he/she has learnt. This is often clearly in the case of workers who are appointed to do the routine work. Thus, it is essential to give refresher and remedial courses at interval to all workers. This type of course is also important for all workers including technicians, staff, professionals and others according to their objectives of the port because it assists them in updating their knowledge.

***f. Training for promotion***

This type of training is provided for new promotion purpose. Candidates are selected depending up on the performance appraisal of the workers by his supervisors, managers' or nominated committee.

***g. Conducting programmes***

This is on the job training, vestibule training, and classroom training. The 'on the job training' is the training given by a supervisor or other experienced workers. Vestibule training is training in a classroom or away from the actual work area in colleges, institutions or universities. Classroom training is the training given by lecture, formal presentation, conference or small discussion.

***h. The management development training***

This type of training is basically rendered into two ways: the first one is on-the-job programme. It basically depends on the job experience, job rotation, and coaching (teaching job skills and knowledge by supervisors for their subordinates). The other one is a formal management development programme, which is given by conducted training centres, other ports, or maritime universities like World Maritime University. (UNCTAD, 1990, pp 147-158).

**iv. Developing Training Centre**

As the port is a different service sector, it is necessary that the port has its own training centre. In Massawa Port, there is a training centre, but it is very small and

incapable of developing the skilled manpower of the port. This indicates that the port has to improve and develop a better standard of training, which can give more satisfactory result in developing manpower skills. This training centre could improve by expanding the existing building of the training centre and supplying other resources such as staffs, teaching materials, and facilities. Moreover, organising and co-ordinating professionals of different organisation, including the universities or institutions is another means of developing the training centre.

The other importance of 'developing a training centre' is to do Manpower Development Plan (MDP) together with the personnel administration. MDP is very important as a prerequisite for all trainings, because the training will be fruitful if it is based on the MDP. Thus, in order to make a practicable MDP, the training centre must stand independently as a unit. This idea is supported by UNCTAD publication as follows: 'Training managers themselves require training in how to assess training needs, prepare manpower plan, staff and organise their units' (UNCTAD, 1990, p 145). As a result, the main functions of the training centre should comprise the factors that are mentioned in Appendix 8.

Finally, developing the appropriate and structured curriculum is one part of the ways of developing the training centre. The curriculum training must reflect the objective of the port. The training should be in the Manpower Development Plan, which is based according to the degree of the problems and its emergencies.

#### **v. Applying possible and achievable objectives**

Training must have objectives. The objectives comprise the following elements: First, the training should have a direct relationship with the current job or future tangible promotion. Second, the training should give significant new knowledge that increases the safety and efficiency of the performance. Third, the training should be delivered at all levels of work or jobs based on the manpower plan because as all work in the port is interrelated with each other. Fourth, the training should increase

the quality of managers, senior managers and junior managers. Fifth, the training should minimise the shortage of the management talent, and ensure the long run success of the organisation; and last, the training should assist in plotting achievable goals.

**vi. Having Effective Procedures for setting programmes for training**

The procedures for setting training programs should be concise and effective. These procedures should comprise the steps which are mentioned in appendix 9.

**vii. Using effective Performance Appraisal**

This is very important for the workers as well as the port because it enables the people to learn from their mistakes and encourage them from the success of their work results. The success and mistakes are evaluated in terms of the co-ordination of the employee's work with the work of others with whom they interact. However, in order for the performance appraisal to be acceptable by the employees, it should have a straight forward, free from bias and nepotism, and righteous criteria, that is based on knowledge, competence, problem-solving ability, supervisory skills, commitment and attitudes of the employee. Moreover, there should be evidence for any remark given to the employees before giving feedback to employees; otherwise the performance appraisal will not give a good result. The appraisal should concern everybody in the port including the senior managers and staff members

In short, the justifiable performance appraisal should be the basic prerequisite for the training. The training should be given based on the comment on the performance appraisal by the immediate supervisor in order to give the best result that could solve the current problems.

**viii. Acceptable Policy**

The training policy must be clear and acceptable elements. The details of these elements can be seen on Appendix 10.

In summary, it is very difficult to analysis the benefits of training because the data is uncertain, its cost is high, and has complex characteristics to analyse the results before and after the training. However, it is obvious that there are some benefits from training manpower. The benefits are mainly increasing profits as the result of increasing productivity and safety, and/or reducing costs such as saving fuel consumption, reducing maintenance and repair cost, and reducing paper and other supply materials consumption just by adding more awareness to the employees. In short,

"the main purposes of training is to maximising productivity and output; maximising the best use of available material resources equipment and methods; standardising organisational practices and procedures, increasing job satisfaction, motivation, and moral; developing flexibility and employability of human resources, developing the cohesiveness of the whole organisation and its sub groups; and developing a consciousness of the importance of safety at work and improving standards' (Hamid, p.70).

Therefore, the above concepts should be achieved in order for the training to be fruitful for the improvement of port performance and productivity.

### ***5.8. Shortage of Finance for Investment***

Though the government has given priority to the investment on the Port rehabilitation and reconstruction, the volume of the investment is low enough to bring some major change on performance and productivity. This is because firstly, the port's infrastructure and superstructure were highly damaged by war and required high finance. . For instance, expansion of port area by demolishing the a few residence houses and offices and repairing paves and ways required for the government high amount of finance. Secondly, the other economic sectors such as agriculture, and maintaining and reconstructing of infrastructure and superstructure which are the prerequisite for the development country have also required high investment. Thus, there is insufficiency of finance for investment.

### **\* Solution**

The country's economy has grown up on average by 8% and will estimate to grow up on average by 7% until year 2010 (Gebremichael, 1998, p.2). Besides, the Port's throughput has also grown up by 7% particularly container traffic by 93%. The port should provide projects that assist to improve the performance and productivity. The projects should undertake feasibility study which should take into account the future growth of the port. Therefore, based on these studies, the port should look for funds either loans (such as World Bank), aids, or through bilateral agreements.

### **Summary:**

As is shown above there are many solutions mentioned for different problems of the port. However, training is the best and most indispensable solution because all other solutions are based on the training. In short, training can help to build a common understanding of the organisation's purpose; show the management's commitment and loyalty to employees; and develop people so they can increase their responsibilities and contribute to the organisation in new ways. Paritcularly, as Captain Jan Hork explained in a port operations management lecture that almost 80% of the errors are made by failure or incompetence of managers (Hork, 1999). This indicates that investment in training prior to any other investment is the primary solution. Therefore, the port, like the government of Eritrea, will have to give priority to training and its development.

## **CHAPTER 6**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **6.1. Conclusions**

Since the end of the long war period, Eritrea has undertaken the reconstruction of its economy. Accordingly, the actual throughput of the Massawa port has steadily increased by an average of 7% per year for general cargo, and a 93% for containers. Berth output and gang output has also grown up by 15% and 4% respectively. The main reason of this growth is the increase of cargo throughput, number of ships, number of gangs deployed, and some investment on expansion of the storage area, a few investment on infrastructure, superstructure including equipment and other facilities.

However, Massawa Port generally has a lower in performance and productivity in comparison to European ports particularly in container handling operation (see Table 4 and 13). The government has tried to improve them. For instance, the reconstruction of berth number 6 that will be completed in the year 2000 will increase the capacity of the port from 1.2 million to over 1.5 million MT. Nevertheless, the rehabilitation of this additional berth can be considered as a short and medium term solution. In the long run, the extension of the port is very difficult because the port is located on an island, surrounded by Massawa City residence-houses. Therefore, the government has already commissioned a study to look for alternative suitable area for the expansion/construction of the port and to purchase

modern equipment to develop the Port's performance and productivity (see Appendix 12).

Investment in infrastructure and equipment will greatly improve the port when completed, however; a significant change implies that the following problems concerning their utilisation are also solved.

The main causes of the problems are:

- low availability and utilisation of the equipment, and high berth occupancy as the result of inadequacy of management.,
- inadequacy of MIS,
- unskilled labour,
- lack of business culture,
- complex regulation of customs and other documentation procedures.
- Insufficient depth in front of the berths

This listing of major problems show that their origin is effectively due to poor level of education and/or training of the staff members as well as shortage of finance for investment.

The possible solutions to improve port performances and productivity are to improve the operational methods together with a good management; reliable information; effective training; restructuring, upgrading and at last privatising some units. Moreover, simplified customs regulations are also needed compulsory to complement the efforts of the other members of the port community. Some of the solutions are explained in detail as Port of the recommendation in the next title.

## **6.2. Recommendation**

The author proposed some solutions to the existing obstacles of the port performance and productivity in chapter 5. Since implementation of all the solutions are difficult, the following recommendations are suggested to be undertaken on the short term and medium term.

### **6.2.1. Training.**

As the port's main problem has a direct link with the human resource, promoting human resource development can give the best solution to the port. Therefore, the port should develop an effective manpower development plan, which is based on efficient policies for recruitment, promotion, salaries, and career patterns. Besides, as training is one of the best solutions, the port should develop training centre and give proper training based on the manpower planning. Furthermore, as most of the problems are linked with the management staff, the priority of the training should be given first to the top management and step down to the bottom. The main reason is a trained manager/supervisor can give good instructions, such as on the job training to one's employees. In addition, since sending managers to the training programmes of UNCTAD seminars aims at acquiring an up-to-date skills about the recent and modern development of the human resources management, the port should give due consideration to such kind of opportunities. The details of proposed manpower plan of training has been proposed in Table 15. Some of the elements take into consideration are status of employees to be trained, type of development (education, training, workshops, seminars and conferences), and the period of implementation.

**TABLE 15. TRAINING NEEDS FOR EMPLOYEES ACCORDING TO THE STATUS IN THE SHORT TERM AND MEDIUM TERM**

Status of employees		Details status employees to be trained	Type of development	Number of trainee *	Type of courses or subjects
<b>- Top Management</b>		General Manager and section heads	Education, Training, Visiting to the experienced ports, Workshop, Seminar, in service training, and Conferences	11	Shipping and Port Administration, Principle of Management, financial and material accounting, human resource development, and personnel management, Logistics and other port related courses, harbour and pilot related courses, Statistics, and economics.
<b>-Middle Management</b>		Higher managerial and administrative manpower such as co-ordinators, supervisors, and unit heads	Education, Training, Workshop, Seminar and Conferences	33	IPP1, IPP2, IPP3 and IPP4, logistics, marketing, supply management, Management and accounting, Safety and IMDG code. In Service Training, Elementary Principle of Management/personnel management, and in service training ,Statistics, and economics
<b>-Lower Middle Management</b>		Intermediate managerial, administrative and senior managerial manpower such as foreman, and sub unit heads	Education, and Training and Seminars	67	Principle of Management and accounting training IPP1, Warehousing Management, and other elementary Management Courses, personnel management, and financial and material accounting, statistics
<b>-Semi Skilled Working</b>	Semi Skilled Manpower	Technicians such pilots, mechanics, electrician, drafts man, crafts man, and others	Education, Training, and Seminars	5	Pilot and harbour related course, Mechanical, electrical, and civil engineer courses including vocational courses such as in higher universities or polytechnic.
		Others such junior managerial manpower such as statisticians, economists, and accountants	Education, Training, and Seminars	61	Principle of Management/personnel management, and financial and material accounting, accounting, and secretary courses, Logistics, Marketing, Material Accounting and Supply Management, computer specialisation, statistics and economics
<b>Unskilled Working</b>	Semi-skilled and unskilled, manpower	Technicians: assistance of electricians and mechanics including experienced technicians but unskilled, and equipment operators	Education, Training, and Seminars	95	On job and in service training from their immediate supervisors
		Others as operation clerks, store keepers, financial clerks, and other employees.	Education, Training, and Seminars	425	On job training , in service training, and Integrated Gang System as well as seminars, from their immediate supervisors

**Source: \*DMT, 1998**

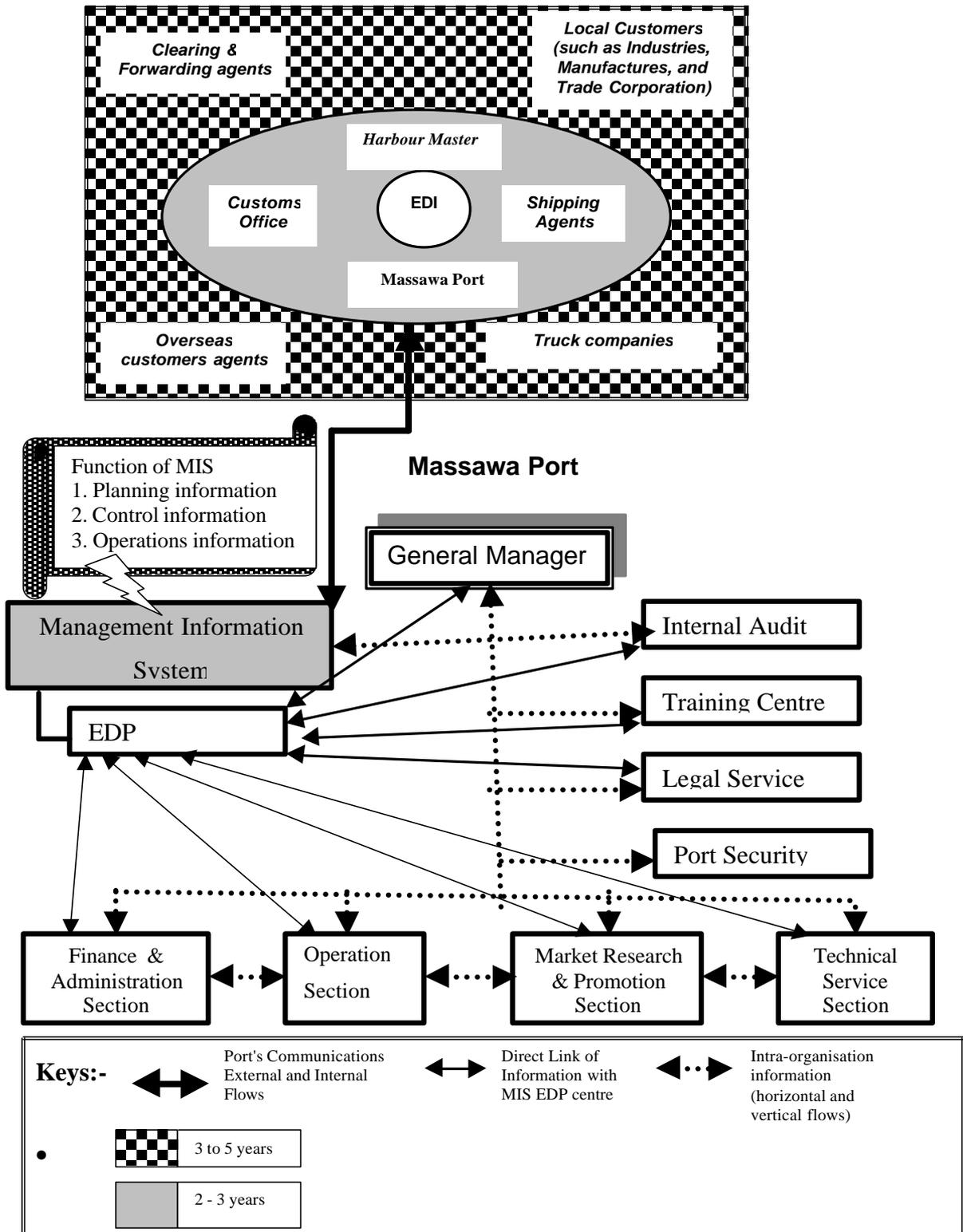
**IPP2** = container terminal strategy  
**IPP3**= Strategic port policy

**Key =>**

- The duration of the training varies according to the type of courses such as from seminars up-to 2-4 years
- Education is a training that is given by institutions or universities level
- The higher education should be allowed for the employees who have less or equal to 40 years old, because the port will return its cost by getting the trained skill.
- Dockers (that is. 255) are part of unskilled manpower
- The training consists from seminar of two weeks to the Master of science of 19 months.
- Place of training internal, local and overseas that is. training centre, institutions, colleges, polytechnics and universities

## 6.2.2. MIS and EDI.

Figure 7: Proposed computerise MIS



The port should develop a MIS and set EDI system to ease the documentation and administrative procedures internally and externally. This should be done by upgrading the planning and programming unit to work as MIS unit supplied with competent manpower and efficient computerisation system including EDI. This can be done in two phases according to the urgency and capacity of the port community to invest. (see Figure 7).

- In the first phase, the port should introduce computerisation that supports to develop MIS. According to the experts of BIT Computer Centre, a local private company, the installation of computerisation in Eritrean Ports, Harbour Master Administration, and Shipping Agents will require at least 18 months including training encoders and experts. This is because all these organisations' tasks are closely inter-linked and dependant on each other. Regarding the customs office, the installation of computerisation has been undertaking since the last two years.
- In second phase, the clearing and forwarding agencies trucking companies and overseas customers should be linked with the port communities. In this case, there is no reason to stay for a long period but it depends upon the development of the cargo throughput and productivity, because the higher the throughput and productivity are, the lower the unit fixed costs will be.

### **6.2.3. Improvement of the management of equipment.**

- The shortage of equipment will be solved or at least minimised in this current year by purchasing different pieces of new equipment (see appendix 13).
- However, for the long term, the port should learn from the past experience that effective maintenance policy is essential to increase the availability of equipment
- Moreover, developing a procurement and property management policy with trained manpower is very important to provide for the TSS (Engineering section) with the spare parts and consumable materials when needed.

#### **6.2.4. Revising the customs procedures.**

The port should negotiate with customs office regarding revising and simplifying documentation and cargo clearance procedures.

#### **6.2.5. Privatisation: an ultimate recommendation for the future.**

Privatisation is nowadays considered as the best way to improve efficiency at ports because the private sector has less constraints than the public sector has, such as raising its own capital for investment.

The port should privatise the 'tallying and out turn-report' unit because it is the best means of creating trust and a good relationship between the port and its customers.

#### **6.2.6. Restructuring, upgrading and developing some units in the organisational structure**

As the existing organisational structure has certain shortcomings, the port should amend the existing structure according to the proposal of the author (see Appendix 3). This mainly consists of restructuring the transport equipment unit, and procurement and property management unit; and upgrading planning and programming unit, and developing marketing section.

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## Appendix 1: Berth And Storage Facilities

### A. BERTH

Description	Number	Length (meter)	Depth (meter)	Maximum-cargo weight per vessel	Maximum-vessel length of vessel
▪ Dry Multi-purpose berths	6	907	5-9	24,000 MT	200 m
▪ Special berths of cement, salt and oil terminal	4	Not available	5.4-9.6	Not available	Not available

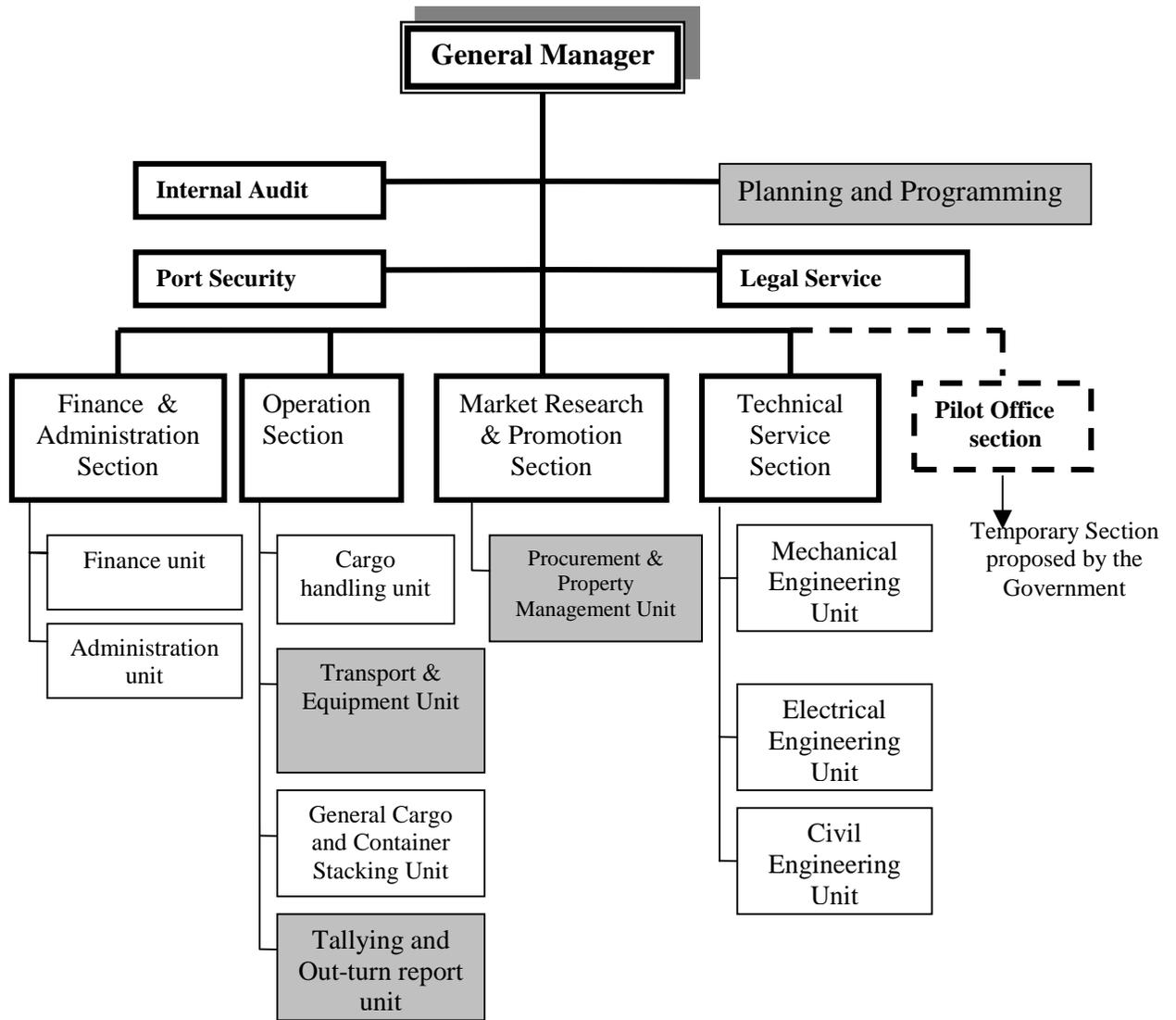
*Source:* Massawa Port Report of 1998

### B. STORAGE AREA AND HOLDING CAPACITY

Description	Area (square kilometre)	Holding capacity (MT)
Warehouse	38,500	19,000
Open shed	7,200	40,000
Open area	158,400	91,000
Total	204,100	150,000

*Source:* Massawa Port Report of 1998

**Appendix 2: Current Organisational Chart of Massawa Port**

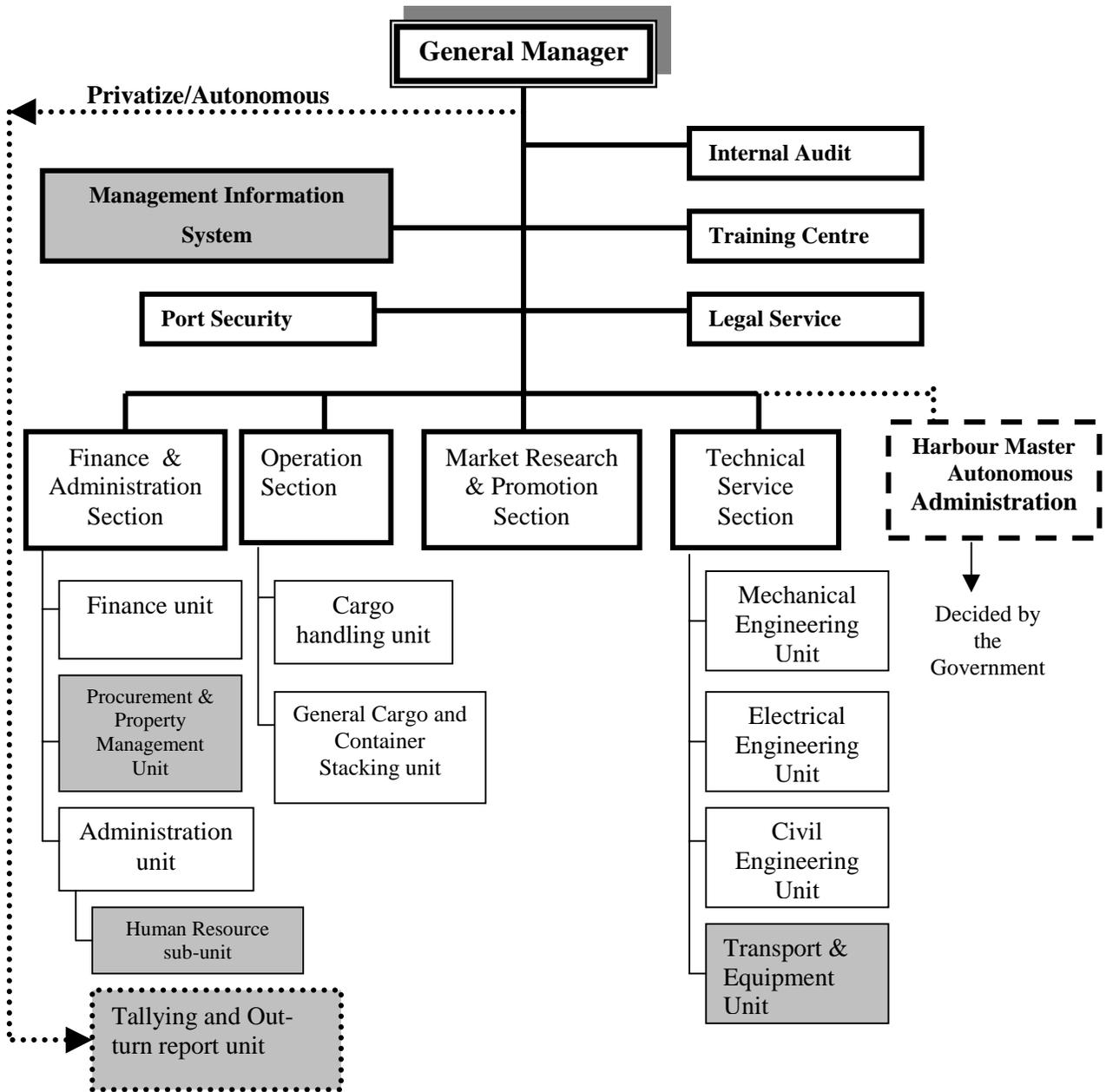


**Key**



**Proposed to be restructuring, upgrading and privatising**

**Appendix 3: Massawa Port Proposed Organisational Chart**



**Key:**  **New Proposals of restructuring, upgrading and privatizing**



**Appendix 4: Kalmar Port Equipment Manufacturer Recommendation on different type of Equipment**

- Note that normal operating is 2000 running hours per year, which is also the number of running hours in the warranty conditions. This is applicable on all our products.
- Note that the table below concerns only the products that are produced in the Lidhult (Sweden) factory. Other products within Kalmar Industries belongs to product line Industrial, Terminal Systems, Terminal Tractors and Customer Support (manufacturing in Sweden, Finland and USA).

<b>Machine type</b>	<b>Type of handling</b>	<b>Lifting capacity</b>	<b>Maintenance period</b>
<ul style="list-style-type: none"> <li>• Reachstacker</li> <li>• ContChamp (make)</li> <li>• DRD420-450</li> </ul>	<ul style="list-style-type: none"> <li>• Container handling</li> </ul>	<ul style="list-style-type: none"> <li>• 42-45 tons</li> </ul>	<ul style="list-style-type: none"> <li>• At 200, 600 and 1000 running hours</li> <li>• According to instruction manual – check or action</li> </ul>
<ul style="list-style-type: none"> <li>• Reachstacker</li> <li>• ContChamp (make)</li> <li>• DRD100-200</li> </ul>	<ul style="list-style-type: none"> <li>• Empty Container handling</li> </ul>	<ul style="list-style-type: none"> <li>• 10-20 tons</li> </ul>	<ul style="list-style-type: none"> <li>• At 200, 600 and 1000 running hours</li> <li>• According to instruction manual – check or action</li> </ul>
<ul style="list-style-type: none"> <li>• Forklift trucks</li> <li>• DCD180-520</li> </ul>	<ul style="list-style-type: none"> <li>• Diverse handling in harbours, industrial sights etc</li> </ul>	<ul style="list-style-type: none"> <li>• 18-52 tons</li> </ul>	<ul style="list-style-type: none"> <li>• At 200, 600 and 1000 running hours</li> <li>• According to instruction manual – check or action</li> </ul>

**Source:** Vuokko Henricson (Market Intelligence)  
**Kalmar Industries Sverige AB**  
 Lidhult 13/08/99

**Appendix 5: Copies of Information Required from each of Ship call at by the Port**

<b>Source of information</b>	<b>No. of copies</b>
Cargo manifest	10
Cargo list	>10
Stowage plan	3
Dangerous cargo manifest	3
Hatch distribution list	3
Heavy lift cargo list	3
Exception cargo list	3
Loading plan	1
Hatch plan	1

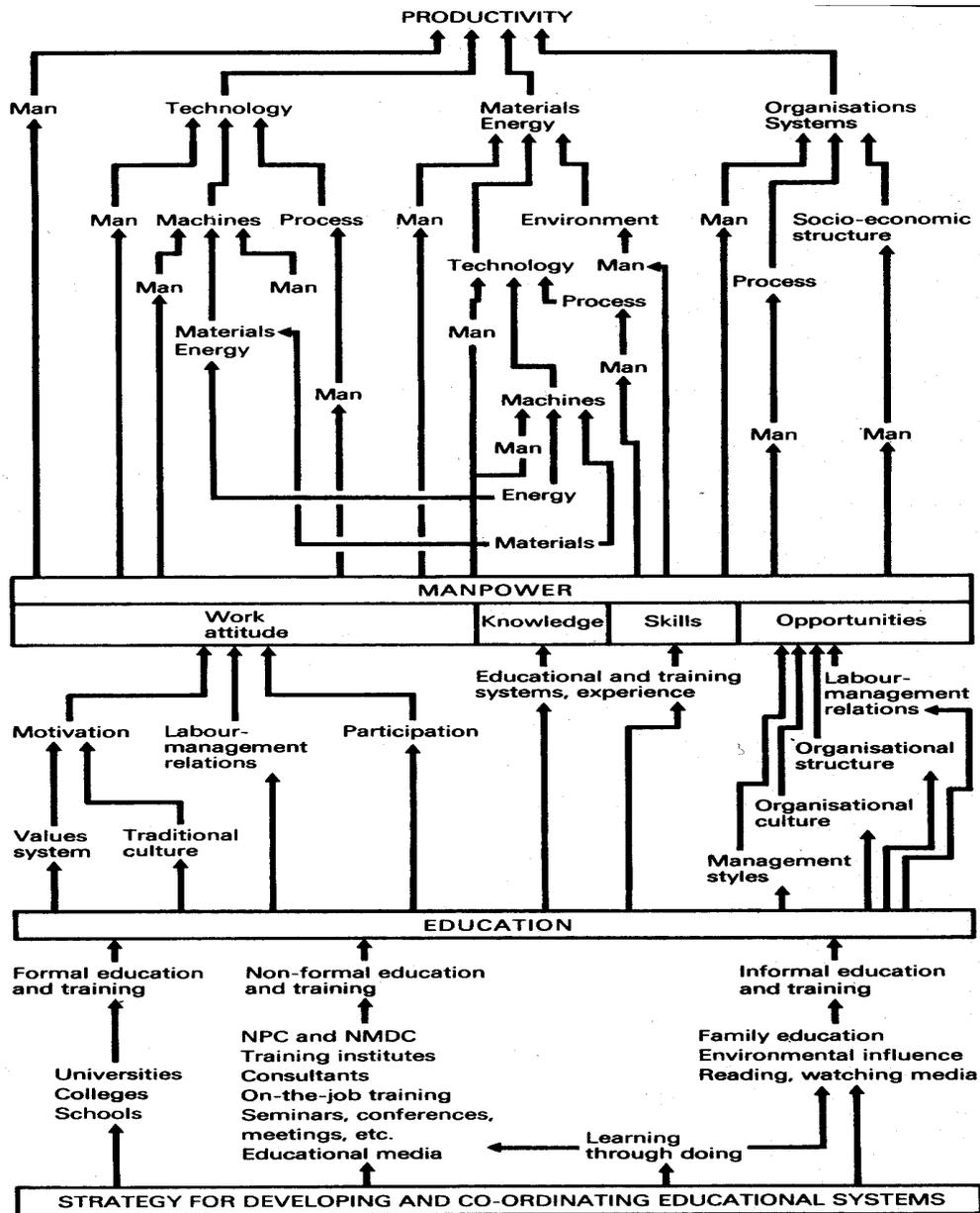
*Source: Eritrean Port Information, 1997*

**Appendix 6 Areas of management influence in the five Maslow need hierarchies  
Categories and three Alderfer need theory**

	<b>Maslows Need Category</b>	<b>Management Influence Areas</b>	<b>Alderfer Need Category</b>
<b>Higher Order Needs</b>	Self-actualization	Challenge in a job. Provide advancement opportunities. Permit creativity. Encourage high achievement.	<b>Growth Needs</b>
	Esteem	Recognize and publicize good performance. Significant job activities. Respectful job titles.	
<b>Lower Order Needs</b>	Social	Permit social interaction. Keep groups stable. Encourage co-operation.	<b>Relative Needs</b>
	Safety	Safe working conditions. Job security. Fringe benefits.	<b>Existence needs</b>
	Physiological	Fair salary. Comfortable working conditions. Heat, lighting, space, air conditioning.	

*Source: Donnelly, Gibson, and Ivancevich, 1987, p.297; and Francou, 1999, p.39*

## Appendix 7: Links between productivity and education



Source: Prokopenko, 1987, p. 241

## **Appendix 8: Functions of the Training Centre**

1. Working with management to produce corporate plans (including manpower plans) and business strategies
2. Producing training policies, plans and budgets
3. Providing a training input to management development
4. Selecting trainees (forexample, apprentices, student trainees, graduates)
5. Arranging and partly carrying out training programmes, including course design
6. Organising further education for employees
7. Measuring, evaluating and following up training
8. Developing training staff
9. Liaising with educational establishments, government training organisations, professional associations...etc.
10. Providing a training advisory and information service
11. Controlling all training resources
12. Advancing the cause of training as a profession

*Source: Robinson, 1983, p.23*

## **Appendix 9: Procedures for setting programmes for training**

1. Locate problems that are to pinpoint the place of the problems.
2. Set objectives, which are concise, accurate, meaningful, and challenging
3. Performance objectives to spell out precisely such as what the trainee should be able to do after the training, (in terms of observable action, conditions and standards of performance)
4. Complete list of defined objective, which is the basis for scheduling
5. Structure subjects
6. Prepare curriculum according to the manpower development plan
7. Schedule (time table) that consists of full details of the duration of the training
8. Fix programme (education) and the duration of the training
9. Setting training methods
10. Create materials to be used
11. Hire/employ required qualified instructors

*Source: UNCTAD, 1986 ,pp 151-153*

## Appendix 10: Training Policy

1. The training plan will have to be established by reference to the requirements of the port's plan.
2. Training-needs should be originated from the performance review system, appraisal performance, internal policies or external factors.
3. The needs and availability of time, location, learning style, and use of the material and human resources should be taken into account when formulating a reliable programme.
4. The training centre should have to have its own a training manager, budget and human resources. The human resource can be either by recruit, co-ordinate or organise trainers from the port or external experts and professionals.
5. All new employees should have to receive induction training before engagement.
6. The port should encourage employees for strengthening their commitments through different factors of motivations, which have already mentioned chapter 5.

## Appendix 11: Storage Capacity

Storage type	Type of cargo or container stored	Total area (m2)	Usable Area %	Stowage height M/pieces	Stowage factor m3/pieces	Holding capacity in units or tons	Turnover
<b>Container Terminal</b>	<b>Container (TEU)</b>	23,400	0.7	3	2.5	19,656	239,148
<b>Open Area</b>	<b>General cargo (MT)</b>	135,000	0.9	2.8	3	113,400	827,820
	<b>Bagged cargo (MT)</b>	135,000	0.9	4	1.5	324,000	1,971,000
<b>Open shed</b>	<b>General cargo (MT)</b>	7,200	0.88	2.8	3	5,914	53,962
	<b>Bagged cargo (MT)</b>	7,200	0.88	4	1.5	16,896	102,784
<b>Closed shed</b>	<b>General cargo (MT)</b>	38,500	0.85	2.8	3	30,543	237,198
	<b>Bagged cargo (MT)</b>	38,500	0.85	4	1.5	87,267	530,872
<b>Total</b>	<b>Container (TEU)</b>	23,400	-	-	-	19,656	19,656
	<b>General cargo (MT)</b>	180,700	-	-	-	149,857	1,118,979

Source: Massawa Port Report of 1998

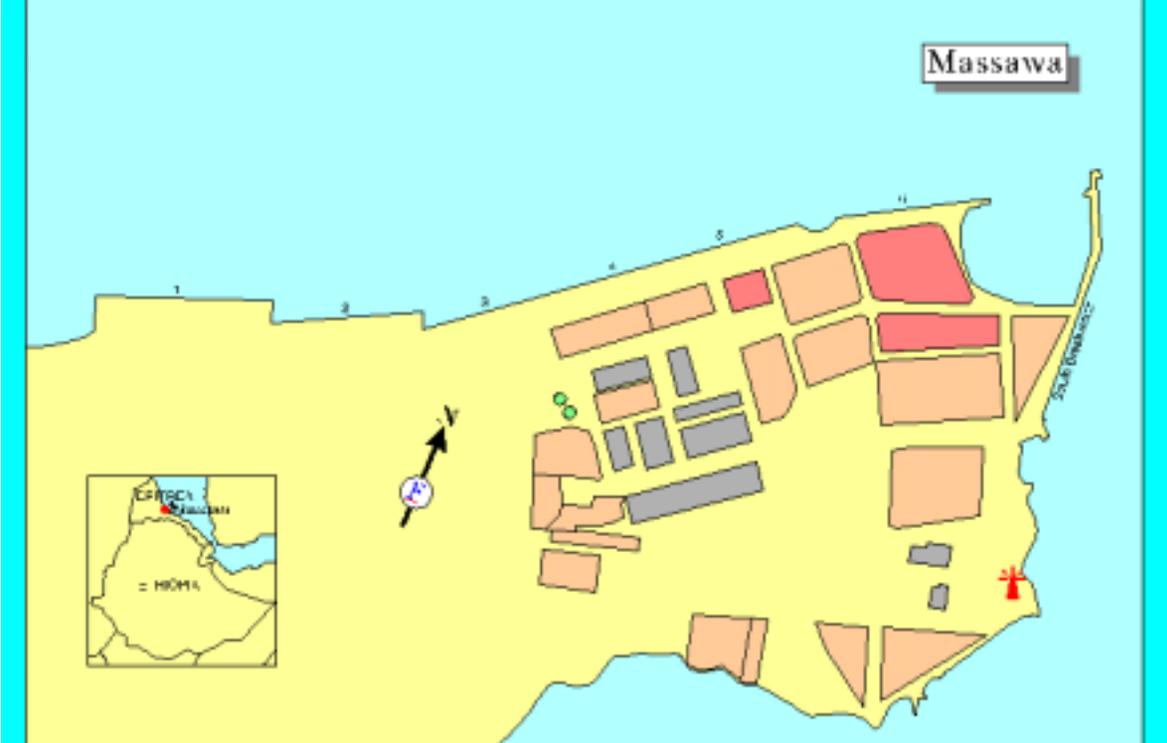
**Appendix 12: Massawa Port Rehabilitation Project to be Completed in**

Category	Component Description	Cost Estimate (\$millions)
Civil Works	a. Repairs of berths No. 5 and 6	11.00
	b. Cleaning of quay aprons	1.80
	c. Administrative Building	0.90
	d. Workshop including equipment	1.50
	e. Equipment shed	0.65
	f. Warehouse	0.80
	Total	16.65
Environment	Equipment & facilities for improving practices and maritime safety	0.80
Consultant	a. Supervision civil works	1.65
	b. Short term consultants (30mm)	0.75
	c. Technical assistance (20mm)	0.40
	Total	2.80
Studies	Development Study, Phase ii and iii	1.50
Training	Training	0.30

Category	Component Description	Number	Cost Estimate (\$millions)
Equipment	Ship-to-shore tower crane	1	3.00
	Mobile Crane (20t)	1	0.30
	Tugmaster	3	0.45
	Trailers	9	0.25
	Fire fighting truck	1	0.45
	Shore Cranes	3	2.55
	Cargo handling gear	1	0.15
	Communication Equipment	-	0.20
	Spare parts fork lifts, shore cranes, and pilot boat	-	0.80
	Total		8.15
<b>Total estimated cost of the project</b>		<b>US\$30.20 million</b>	

Source, Eritrean Ports Rehabilitation Project, 1998

**Appendix 13: Master Plan of Massawa Port**



*Source: Fairplay, 1999*

