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Management of empty containers in liner shipping : in the context of the West African Port of Abidjan, Côte d'Ivoire

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MANAGEMENT OF EMPTY CONTAINERS IN LINER SHIPPING: IN THE CONTEXT OF THE WEST AFRICAN PORT OF ABIDJAN, CÔTE D´IVOIRE.

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(S08052)

Dissertation submitted to the World Maritime University in partial fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE
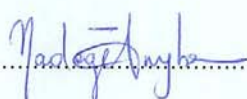## In
MARITIME AFFAIRS

(SHIPPING MANAGEMENT)

2008

DECLARATION

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

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ABSTRACT

Management of Empty Containers in Liner Shipping: In the Context of
The West African Port of Abidjan, Côte D´ Ivoire.
MSc

This dissertation analyses marine containers traffic at the port of Abidjan with a focus on the movement and accumulation of empty containers and how their use may be optimized with the use of special crops.

Logistics integration and management is a key activity for agribusiness, especially for export oriented traders. For the port of Abidjan it is the only survival tool to competitive gain and cost reduction, the only way to face the international trade challenges.

The rationale behind this study is to examine the problematic of the management of empty containers and to discover the root causes giving rise to empty container movements on the international stage and in the area of study.

A review of the strategies in place to tackle the empties problem is presented, so as to ascertain the way to adequately achieve the study objectives.

The concept of port regionalization is selected as the decision making process for effective logistic planning. Regionalization integrates the port activities to its hinterland for efficient cargo and containers movement.

A system to optimize the management of empty marine containers through the use of special crop is proposed. The challenges of addressing the problem at the port level are critically discussed and analyzed. The need for special crop producers in the countryside and the hinterland to integrated their activities with the port supply chain management system, so that cost can be minimize and optimize the use of empty container is addressed.

KEYWORDS: Containerisation, Empty container, Container management, Container logistics, Freight distribution, Identity preserved crops, Agribusiness, Inland loading, Port loading , Hinterland, Port regionalisation.

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1   INTRODUCTION

1.1 BACKGROUND

In 2006, container shipping was 50 years old, an innovation that has had a tremendous effect on the geography of production and distribution. It has led to a better usage of the notion of comparative advantage while distribution systems were able to interact more efficiently (Notteboom & Rodrigue, 2008). The shift from production base to process base in manufacturing and assembling operations has led to a greater role for liner shipping companies. This phenomenon has given rise to the liner shipping business logistics complexity because of the increasing time-base delivery competition (just-in-time manufacturing and reduce cycle time). Cargo transportation is a socio-economic and environmental activity of great importance for the sustainable development of world trade. From dry bulk and liquid bulk handling, there have been some changes in cargo handling techniques, amongst which the most important has been the introduction of containers in the late 1950s-1960s.

Containers have transformed sea transport activities from a port-to-port to a door-to-door service. In one word, from single sea mode to multi-mode: sea, road, rail, and air transport. The worldwide container service network complicates traffic forecasting (Olivo, Zuddas, Francesco, & Manca, 2005). Many competitive Asian currencies have made Asian products cheaper for Americans and Europeans, and Western products expensive in Asia. Consequently, imports have not increased as fast as exports. This economic event has led to the overwhelming growth and prosperity in recent years of the people of the Republic of China and India among others. This imbalance in trade has affected the liner trade balance on these routes; leading to empty containers being stranded in Europe and on the coast of the USA. Although the container was a maritime transport innovation, the global supply chains have now placed pressure on implementing containerization over the inland freight distribution system. One of the liner shipping logistic manager's goals is the

transport of loaded containers not empties. Unfortunately, trade imbalance creates empty container flows in the system. Empty container repositioning does not produce any economic benefit to the carrier; meanwhile it raises the management costs. The repositioning mode is done in two ways (Bin & Zhongchen, 2007):

- Land-carriage
- Sea- carriage

The high cost of acquiring, holding and handling container makes it a prime asset, and if not managed carefully the whole system of liner shipping becomes inefficient. The imbalance trade flows, the accessibility and capacity constraints of containers are among the issues that make it difficult to fully enjoy the benefits of container shipping.

1.2 PROBLEM STATEMENT

Globalization has led to growth in international trade which in return has led to an increasing demand for maritime transport from 5,885 millions tons in 2000 to 7,415 millions in 2006 (Shuo Ma, 2008). The container shipping industry growth is mainly due to the Chinese economic boom. High value cargos, especially manufactured goods are transported in containers. This represents 75% of the world cargo value transported by sea. The production sides of the manufactured goods are now basically located in East Asia especially in China, and the consumption side is located in Europe and North America. The international trade between the two sides is imbalance. This international trade imbalance creates an imbalance directional flow of container in which the manufactured goods are transported door-to-door. Maritime transport demand is derived from trade, therefore highly correlated. The international trade behavior is as shown in Figure 1 the biggest source of container directional imbalance.
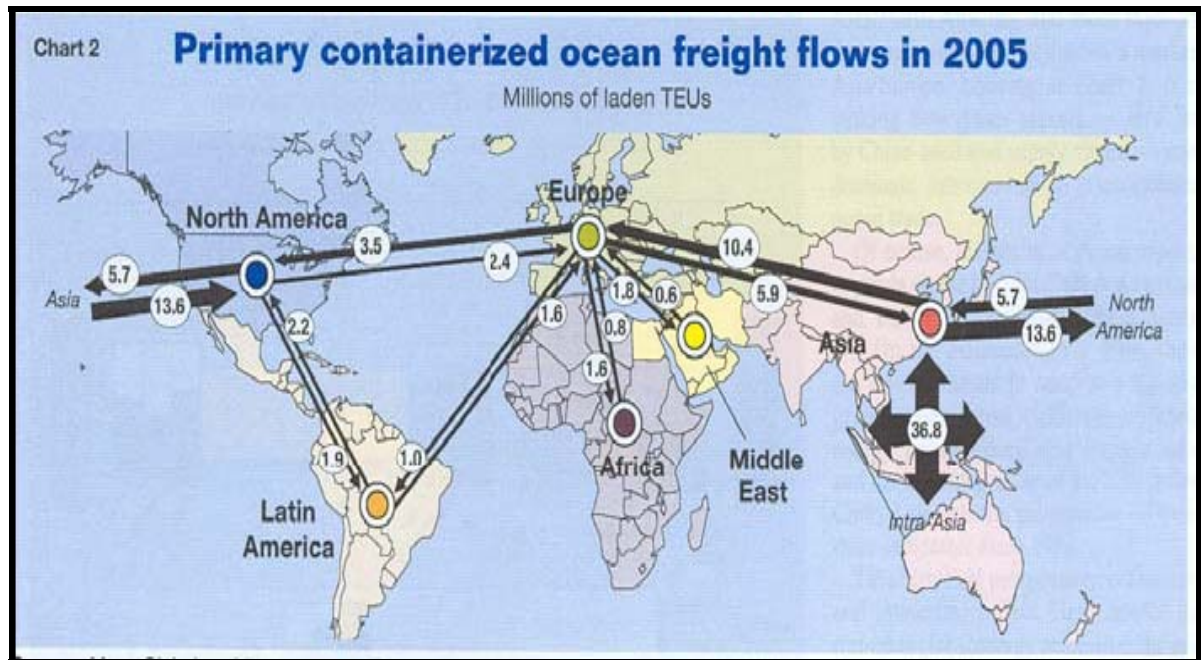
Figure 1 World Map of Containerized trade 2005
Source: Merge Global 2006 as cited in (Ma, 2007 - 2008)

Freight transport by road, rail, sea or air, usually generates a significant number of empty vehicle movements caused by the imbalance directional flow between two specific points. This is an intrinsic element of vehicles fleet management and the logistics scheduling process (Shintani, Imai, Nishimura, & Papadimitriou, 2007).

In the last 50 years container volume around the world has increased tremendously as seen in Table 1.

Table 1 Container volume

	World wide TEU shipment
1990	28.7 million
2002	77.8 million
2015(Estimate)	177.6 million

Source: UNESCAP 2005(Notteboom & Rodrigue, 2008)

To cope with the demand in container traffic, the liner shipping industry is increasing its supply. This increase in supply is putting pressure on existing transport and port

facilities for instance route, rail, terminal location and operation which worsens the imbalance phenomenon and leads to an urgent need for empty container management techniques.

According to Boile (2006) 2.5 million empty TEUs are stored world wide waiting to be used. Today the cost of repositioning these empties is more than $25 billion globally. In 2010, based on this trend, it will be beyond $50 billion (Bin & Zhongchen, 2007). The container repositioning problem addressed in this study corresponds to the issue of optimizing the use of empties which will result in maximizing profit while transporting liner containerized cargoes.

The liner companies usually operate weekly services with fixed schedules and routes for a period of time, months or a year. The design depends on seasonal cargo fluctuations, market demands, and companies' policy and so forth. The companies therefore must estimate the potential maritime demand at each calling port according to their schedule and try to construct a network. They take into consideration the incurred costs and revenues during the planning period.

The problem statement is therefore the growth in liner service has given rise to an increase in container movement in the port of Abidjan. This growth has occurred without an adequate management of the system. This situation has led to one third of the containers being exported empty. The interaction of container transport logistic and Côte d´ Ivoire international trade need careful integrated long-term planning to ensure an optimal use of containers.

The problematic of the movement of empty container in the port is show in the figure 2 below.

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┌─────────────────────────────┐
│   Economic Globalization     │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│ Increased International Trade │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│ 70% of international Trade in │
│ value (2007) is Seaborne Trade│
│ (7415 million Mt) Increase in │
│ Maritime Transport Demand     │
└─────────────────────────────┘
```

90% of Africa International Trade is Seaborne Trade

27% Seaborne trade in Liner shipping 426 millions TEU handled (2006) Increase in liner shipping demand

Côte d´Ivoire international Trade imbalance in (2007) 56% Import : 8, 403,994 Tons 44% Export : 6, 629,632 Tons

Imbalance Africa - Europe Liner Seaborne trade 1.8 Import 0.8 Export

Imbalance in World liner trade and Shipping

Port of Abidjan imbalance container traffic At a time of socio-politic stability Import 2040760 tons Export 1068830 tons

Empty container Movement: Port of Abidjan (PAA) 31% of TEU exported are Empty

Increase in logistics cost

Increase in Maritime transport total cost

Low level of Liner service

Figure 2 Problem Tree
Source: Author constructed June 2008

The main stages in the development of the problem are outline in the section 1 to 7 as follows:

1. Economic Globalization: To achieve competitiveness industries have shifted

5

their activity bases beyond national border. This economic concept has globalized the way trading is done.

2. Increased International Trade: globalization has tremendously increased the exchange of goods and services around the world as shown in figure 3 below. The average annual change in world trade from 1950 to 2006 is 6%. Manufactured goods, which are high value and basically transported in containers have an annual increase of 7.5% for the same time period.
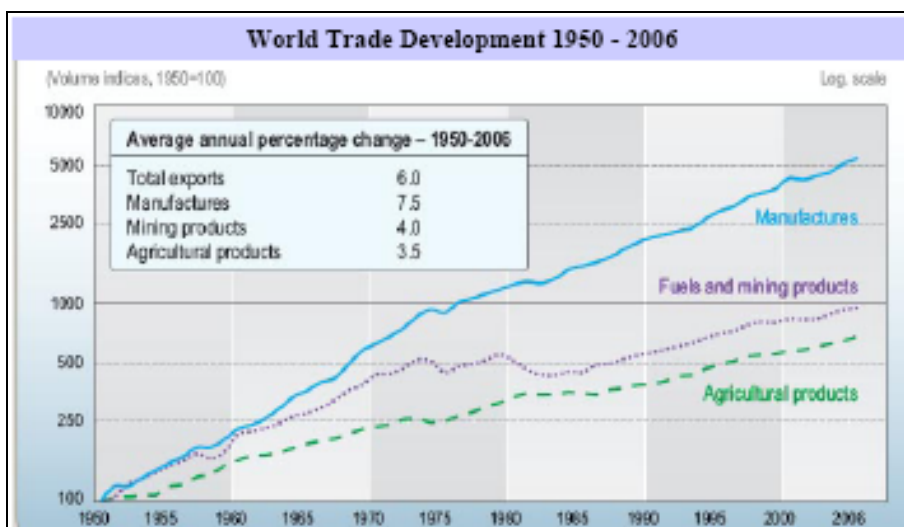
Figure 3 World trade trends 1950- 2006
Source World Trade Development 2007 as citied in (Ma, 2007 - 2008)

3. Increase in maritime transport demand: 70% of international Trade in value (2006) is carried by sea (Seaborne Trade 7415 million Mt) as shown in figure 4 below. Maritime transport demand is derived from trade.
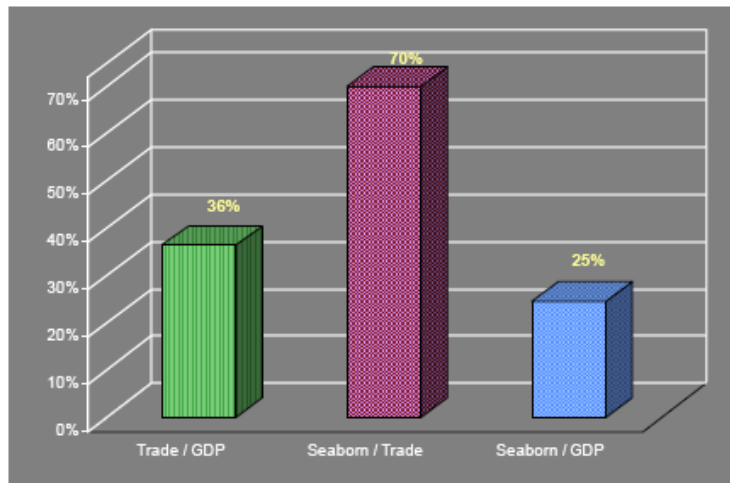
Figure 4 Trade and maritime transport demand dependency
Source World Trade Development 2007 as citied in (Ma, 2007 - 2008)

Increase in maritime transport demand is linked to the increase in trade; in 1980 maritime traffic was 3590 million Mt, in 1990 (4008 million Mt), in 2000 (5885 million Mt) finally 7415 million Mt in 2006 (Ma, 2007 - 2008, p. 1 Chapter 3).

As shown above, increase in manufactured goods means increase in liner shipping. The global supply chain management, because of its imbalance flow, has created an intense pressure on container logistics management.

4. <u>World liner shipping Trade imbalance</u>: The volumes of container imported and exported are not balanced as seen in the table below.

Table 2 Laden TEU in million flows in 2005

Liner route	Import	Export	Ratio
North America - Asia	13.6	5.7	2.4: 1
North America – Europe	3.5	2.4	1.5 : 1
Europe – Asia	10.4	5.9	1.8 : 1
Africa - Europe	1.6	0.8	2 : 1

Source: Merge Global 2006 as cited in (Ma, 2007 - 2008)

The imbalance is crucial in the North America – Asia route with a 2.4: 1 ratio North America import 2.4 times fully laden container than their export. On the Africa - Europe route, Africa imports 2 times more fully laden containers than its exports.

5. <u>Côte d´ Ivoire international Trade imbalance</u>: After 2002 the Ivorian international trade has shown a deficit, table 3.

Except for 2002 when the political unrest started, the past year had shown that Côte d´ Ivoire imported more than their export at an average of 1.3 imports for 1 export.

Table 3 Côte d´Ivoire International Trade volume

	2002	2003	2004	2005	2006	2007
Import to Export ratio	0:1.4	1.2:1	1.3:1	1.4:1	1.35:1	1.26:1

Source: Côte d´ Ivoire Ministry of Commerce (Customs statistics / MC-MISD) 2008

6. <u>Port of Abidjan empty container issues</u>: 1/3 of the containers leaving the port of Abidjan are empty. This situation will worsen with the project of increased capacity with the new terminal on Ile Bouley. Before the political instability 1/4 of the containers were leaving the port empty, the problem of empties was always there and needs to be addressed.

7. <u>Increase in logistics cost:</u> The transfer of mode from vessel to truck or rail, in Côte d´Ivoire is not properly done, the cargo are stripped and loaded on a truck before they leave the port, which is a double handling (container handling + bulk handling).The methods leads to an increase in logistic cost for the consignee. This has definitely led to a low level of Liner shipping service.

For the shipping line and the Port of Abidjan, the transfer of modes has been a challenge to deal with first of all, because of the reliability and cost requirements of the global supply chain, secondly the trade flow imbalance and finally accessibility and capacity constraints. These challenges are among the issues that are making it difficult for liner service to enjoy the full advantage of containerization (Notteboom & Rodrigue, 2008) especially in Côte d´Ivoire.

Therefore this study will propose an opportunity to fill the empty containers with return freight movements, and provide the agricultural producers of the study area with a way of fully utilizing international shipping containers in order to reach new markets.

1.3 OBJECTIVES OF THE STUDY

The study is expected to achieve the following objectives:

- To examine the problematic of management of empty containers
- To analyze the various strategies in place for managing empty containers
- To propose a system to optimize the management of empty containers in the Port of Abidjan, Côte d´Ivoire.

1.4 RESEARCH QUESTION & HYPOTHESIS

This study is being carried out to highlight the existence of empty container management problem in an Ivorian port. In Abidjan in 2006, 1/ 3 of the total containers exported were empty. This has led to large repositioning costs for the shipping companies which are largely translated into high trade costs for the country. It is important to find an adequate solution to reduce the impact of empty containers on the country's international trade.

To achieve the set objectives this study has sought to answer the following concerns:

1. The circumstance that gives rise to the container traffic directional imbalance.
2. The possible management solution to empty containers
3. The various strategies in place for managing empty containers.
4. The state of liner shipping container traffic in the Port of Abidjan
5. The possibility of using special crops as a means to optimize the use of containers and curb the empty container traffic challenge?

The transport of empties needs careful planning in order to reduce the cost of mobility. This can be done through an integrated long-term logistic system using an empty container management model and Agri-business management tool.

The hypothesis, that movement of empty containers in the Port of Abidjan can be managed by transporting special crops, needs to be tested. If this hypothesis is proved to be acceptable, then appropriate measures should be taken to address the issue.

It is therefore hoped that the outcome of this study is beneficial for those liners serving the West African market.

1.5 STUDY METHODOLOGY: CASE STUDY APPROACH

1.5.1 Study Approach

Empty container management is a logistic phenomenon which shapes the liner shipping profitability. It is a socio-economic factor. To properly understand and analyze the complexity of the phenomenon it is important that the research be done in a specific environment. For this reason the choice of the case study as a research method was adopted.

The case study approach allows an open-ended and in-depth analysis of the phenomenon occurring over a small, specific geographical scope. A mixture of quantitative and qualitative techniques, with emphasis on the qualitative analysis, was considered to be the most appropriate. The study has to be exploratory because there was a lack of adequate studies focusing on the use of special crops as a means of empty container management in the maritime community.

The case study as a research methodology satisfies these conditions. Figure 5 identifies the various areas of the study.

Empty Container Management
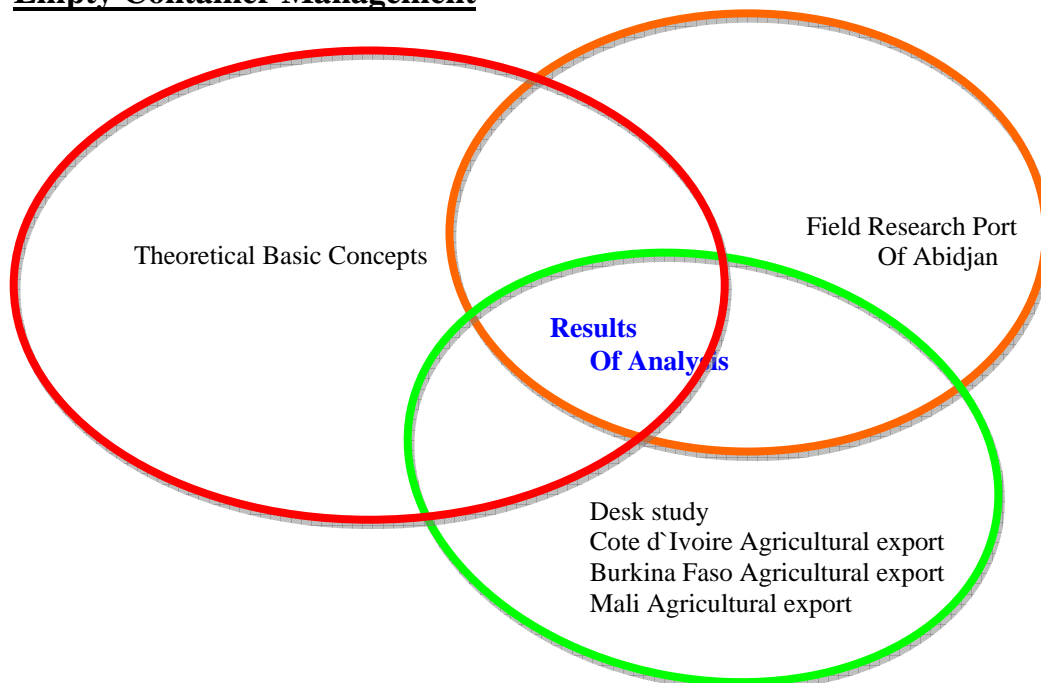
Figure 5: Study Model
Source: Author constructed, adapted from Robles (2001)

1.5.2 Selection of the case

The area studied is the port of Abidjan. The port mostly serve as a getaway to three countries, border in black in figure 6 below, Côte d´ Ivoire, Burkina Faso, and Mali; which have respectively surface areas of 322462, 274000 and 1124200 square Km and a population of 18468000, 13586000 and 13911000 people (FAO, 2005-2006). The average population growth is of 4.3% and a trade per capita of US$ 1045 for Côte d´ Ivoire, US$ 139 for Burkina Faso and US$ 351 for Mali (WorldBank, 2008a).

Figure 6: Côte d´ Ivoire and its hinterland
Source: World Atlas

The selection of the case was based on the following elements:

- The Port of Abidjan has a directional imbalance of container traffic.
- The containerization of general cargo in Cote d´ Ivoire is less than 40%
- Sensitive agricultural products are still transported in break bulk.

- Customer demand for a door to door delivery and just in time service of healthy and environmentally friendly goods.

1.5.3 Data sources

Two main sources of data were considered for this study, primary and secondary data collection.

- Primary sources: Quote from Liner Company and dry bulk company.
                   Field pictures of cargo handling processes
- Secondary sources: Literature review, cases studies of key concepts of empty container management.

1.5.4 Organization of the study

The study is organized into four chapters. The first chapter is an introduction to the study, including a statement of the research problem, the objectives and the methods used to carry out the study. The second chapter concentrates on the definition of the main concepts used to carry out the study, and framework for analysis of empty container management case study. The third chapter is based on the analysis and interpretation of the data collected on container traffic and the movement of crops in the Port of Abidjan. Finally, the fourth chapter presents a discussion of the major findings and its recommendations and finally the conclusion.

1.6 LIMITATION OF THE STUDY

This study although carried out, was not without limitation. Some difficulties were encountered in obtaining data from the logistics companies'. This has a great impact on the output of the work.

2 CONCEPT AND APPLICATION OF MODEL FOR EMPTY CONTAINER MANAGEMENT

A lot of scientific literature has been produced since the boom of containerization especially focusing on empty equipment management. These studies have emphasized the issue of empty container transportation optimization.

2.1 PROBLEMATIC OF EMPTY CONTAINER MANAGEMENT

The container has radically enhanced general cargo movement, improved productivity and reduced total cost due to its dual dimension, first as ship equipment and secondly as a packaging device for shippers. This study considers as its exploratory base a case study related to the marine container services in Côte d´ Ivoire at the Port of Abidjan. Christopher (1997) claims that companies acquire competitive advantage by managing their logistics activities.

Management in maritime transport, especially in liner services, deals with the coordination of materials and flow of goods among suppliers, manufacturers, distributors and customers. Reducing expenditure and becoming more responsive to customers demands is the key to profitability.

Due to the imbalances in international trade from different economic needs in different countries, a liner shipping company accumulates a large amount of empty containers in the import-dominant ports, whilst the export-dominant ports request them (Cheung and Cheng 1998). As a result, containers must be repositioned to satisfy customer demand in the subsequent planning periods. How to allocate empty containers from the supply side to the demand side has become the industry's bottleneck. Unlike loaded containers, empties do not have fixed origins and destinations(Olivo et al., 2005). Empty container management has become a fundamental international maritime transport management tool, which finds its answer in logistics management.

Logistics is a key activity in shipping. Its constant changes are tied to the search for better competitiveness and cost reductions. In this regard integrated logistics is a strategy for the liner industry when it adds value to customers´ service, cuts cost and increases the level of customer service. The logistics challenge for liner services is therefore better management of company-owned and leased containers in reducing inventory costs.

Boile (2005) approached the empty container management problem with these data:

- The global container fleet was 18.8 million TEUs in 2004. It was expected to grow to 21 millions TEUs in 2005 and 23.3 millions in 2006.

- Cargo movement management represents $ 100 billion / year, $16.8 billion of which is associated to inefficient container operations, including empty containers and idle time.

- 20% of the ports movements are empty container repositioning representing $3.5 billion / year in costs.

A new dry container nowadays is estimated to cost between $1,500 and $ 2,000. Confronted with all these facts, ocean carriers, the main container owners, must improve container Empty – Full – Empty – Full management and especially control the flow imbalance context.

Global carrier	Global Shipper	Port of Discharging	Exporter
Empty TEU		**Empty TEU**	
Carrier pay transport	Shipper ´s transport	Carrier's transport	Shipper's transport

The Multimodal transport of containers
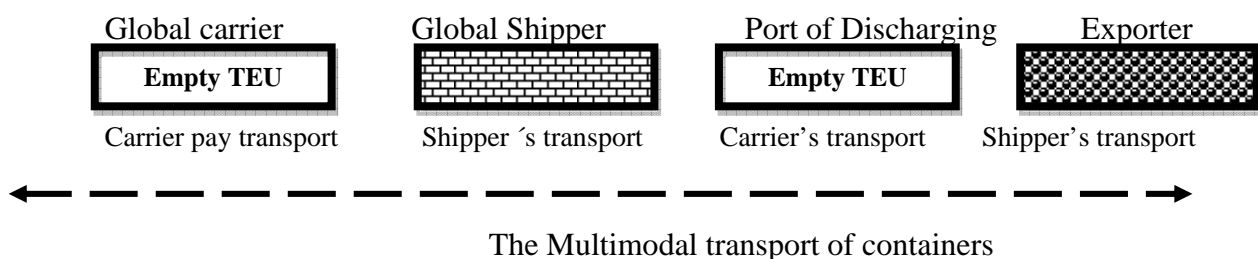
Loaded movement takes place in response to customer demand, which bears the transportation cost. Empty movement generates a cost for the carrier and represents most of the time an avoidable phase in freight distribution. Carriers relocate empties with the hope that if adequately positioned, they will take advantage of future opportunities.

Resources spent for empty transport are of primary importance, it is therefore not surprising that carriers are examining the possibility of reducing this unproductive cost.

2.2 CONCEPT FOR EMPTY CONTAINER MANAGEMENT

Many scholars have analyzed the strategies of liner shipping empty containers management system. For Boile et al. (2006) the strategies should take into consideration foreign trade, repositioning cost and manufacturing and container lease cost.

- Foreign trade imbalances, in particular the relative role played by region as importer or exporter.
- Repositioning cost should include local inland and international transport cost.
- Manufacturing and lease cost versus repositioning, when the former is cheaper then the container is left empty to accumulate in the terminal.

Figure 7 illustrates the agents and movements that compose the management and repositioning process in the liner shipping industry.

Container Flow and repositioning
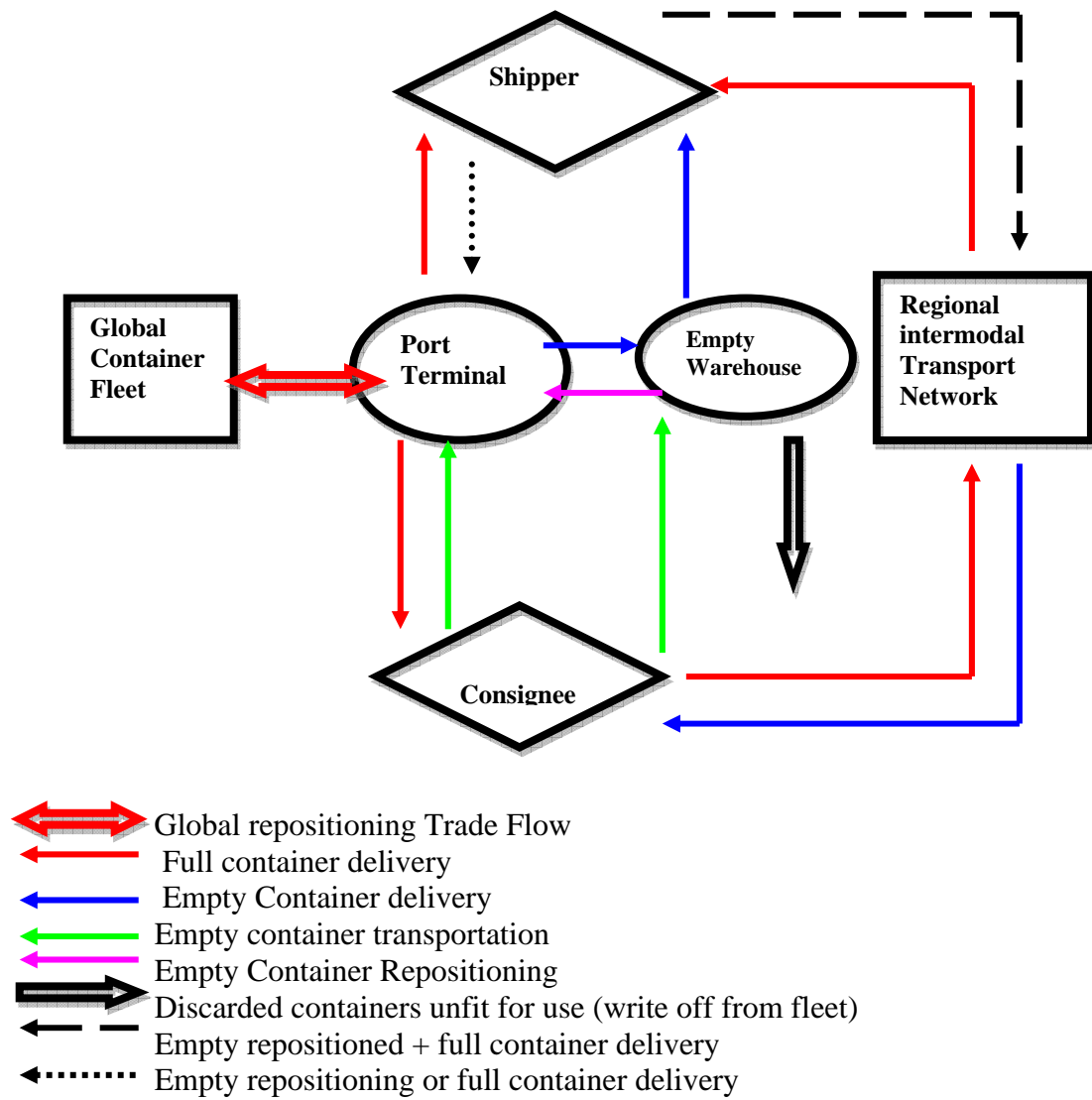
Figure 7-Container Flow and repositioning
Source: Author constructed, adapted from Boile et al (2006)

Containers can be repositioned in various ways:

- Local: When the container is moved locally in the country. This repositioning is often short-term.

- Regional: when the repositioning extends beyond national boundaries to neighboring countries, influencing the hinterland area.

- Global: international, interrelationship among exporting and importing regions. This repositioning involves more time and higher cost.

2.3 OPERATIONAL MODEL FOR EMPTY CONTAINER MANAGEMENT

The rapid growth and globalization in the container shipping market gave rise to intense competition among key players such as shipping lines, port authorities, and logistics agents. In order to survive competition and gain more business, these players are forced to adopt innovative, productivity enhancing and cost-cutting strategies. At an operational level, a very important cost-cutting strategy is to efficiently and effectively manage the container fleet.

The causes of empties movement are due to commodity flow imbalances between import and export, vehicle specialization (liner service deals with reefer containers and dry containers which in turn are mostly in TEU or FEU), intercompany agreements with slot sharing or government regulation. The problem therefore affects not only the carriers, but also, ports, and depots whose congestion decreases the terminal productivity.

The management decision is consequently done at various planning levels. Container fleet management is complicated due to dynamic operation, uncertainty and demand imbalance. Important decisions in container fleet management include fleet sizing, container leasing, laden container distributing and empty container repositioning. These decisions are highly related and should be carefully managed. The overall

objective of the project is to develop an effective tool that is able to deal with container fleet management at the port of Abidjan. As stated in chapter one the volume of laden containers on the Europe – Africa route has a ratio of 2:1 import to export. Côte d´ Ivoire for the last 10 years had an import export trade volume ratio of 1.6:1. This is mainly due to the fact that the main Ivorian exports are agricultural products (cocoa, coffee, timber, cotton), which are less than the country's imports of manufactured goods and some agricultural foodstuffs such as rice over 1.1 million tons in 2006, milk products , wheat and fruits.

Logistics strategies design must maintain inventory costs at their lowest possible level. It must control asset and turnaround speed (Bowersox et al. 2006:146). Container management is one of the most important issues in the liner shipping industry (Song et al. 2005). A lot of research on finding the optimal container management system has been done. Gavish´s (1981) decision support system for vehicles fleet management was adapted to empty container relocation at the demand point base at marginal cost. Cheung and Chen (1998) developed a stochastic model to tackle the problem, based on the general network without assuming the topological structure of the maritime route. It focuses on a specific route; the result may not be directly applicable to other types of routes Kochel et al. (2003) also followed the same concept. Other methods based on a network with topological structure are e.g. the hub and spoke system Du and Hall (1997), cyclic routes Hall and Sabnani (2002) two depot shuttle services (Song 2005)). Looking into the choice of route on the effectiveness of container management system is an interesting issue.

The methodologies used in previous research are divided in two groups. The first is the optimal solution using mathematical programming (e.g. Cheung and Chen 1998), recently Chong et. al. (2002) developed an integer programming formulation with the use of both long term and short-term lease containers. This is a tactical management of empty containers for intermodal transportation networks. It deals with empty container distribution in a broad geographical area. Kochel et al. (2003) and Olivo et

al. (2005) also opted for mathematical programming. In contrast, Li et al (2004) focused on a smaller geographical area, the hinterland of a specific port.

As we know, mathematical programming requires a lot of data, and the logic of the program is often not available at the operational level, the terminal operator.

The second group focuses on deriving the structure, a constructing easy-to operate near- optimal control solution e.g. inventory policy Du and Hall (1997), recently Song (2005, 2007). The inventory policy approach is based on a threshold control solution, which is to import up to U units of containers when the number of empty containers is below U. To export empty containers down to D units when the number is more the D and doing nothing otherwise.

This study focuses on empty container balancing strategies within the context of network design problems. The proposed concept minimizes the total logistics cost of empty containers while satisfying customer demand on network reliability. Inland distribution is becoming a very important dimension of globalization (Notteboom & Rodrigue, 2008). Freight transportation has to adapt to the rapid change in politics, social and economic trends, particularly in Côte d´Ivoire which has been in socio-political turmoil between 2000 and 2007. The country, being divided from 2002-2007 into two, has changed the transport logistics design, as the northern market became inaccessible. Crainic and Laporte (1997), and Crainic (1998, 2000) as cited in (Boile, 2006) saw the situation as a tactical planning problem in the logistic network design to create an empty container balancing strategy. The concept aimed at locating depots for empty containers as close as possible to the cargo supply zone.

The best way to solve the repositioning problem in the total service network, is by integrating port activities to liner shipping networks (Notteboom & Rodrigue, 2008). This balancing strategy in the context of a total network design is called regionalization as shown in Figure 8.
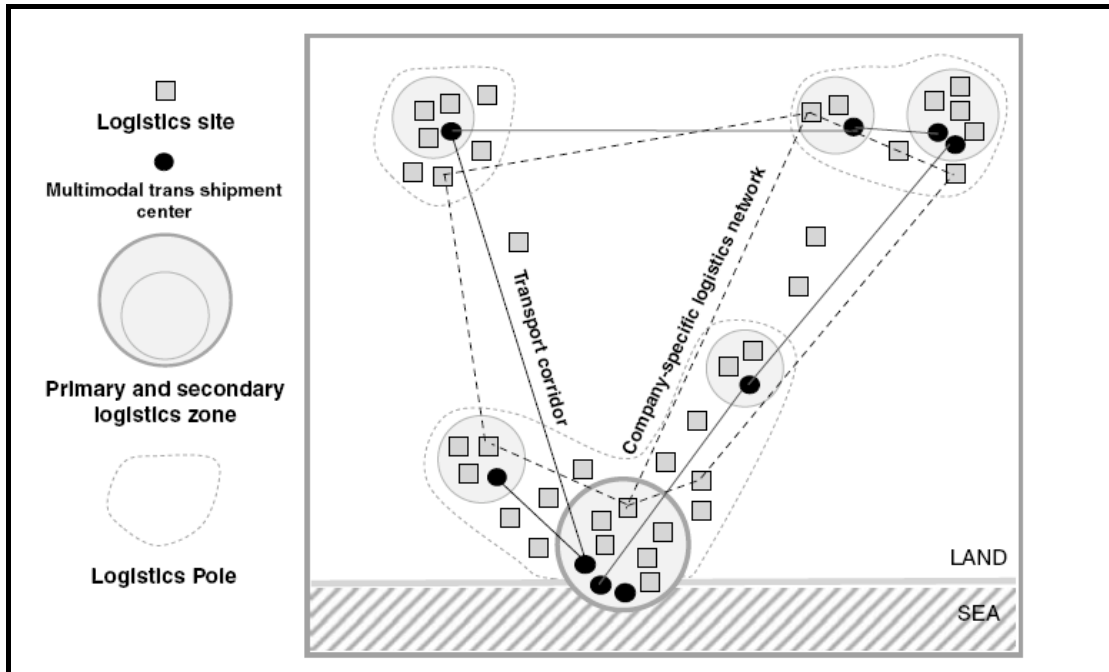
Figure 8: Port regionalization and development of logistics poles
Source:(Notteboom & Rodrigue, 2008)

Port regionalization aims at expanding the hinterland reach of port and liner shipping through the creation of inland freight centre. The study area being an agricultural exporter is therefore important to create an agricultural freight centre. It can be attested that empty container management through the use of special agricultural crops is a recent concept that needs to be studied so as to assess its feasibility in solving the problem in specific countries. With the mounting pressure of freight distribution, product integrity preservation, just in time logistic system, it is argued that the development of a multi-port region will offer not only flexibility in container management, especially dealing with the issue of empty containers, but also brings a quality service to the total logistic leg. This conclusion is in line with the findings of Notteboom (Notteboom & Rodrigue, 2008)

2.4 MODEL APPLICATION OF EMPTY CONTAINER MANAGEMENT

As shown in Figure 8 above, the routing of empty containers is an unavoidable activity of the intermodal chain. An imported container arriving at a national port is heading to an interior destination, and when emptied, it must return to the port for an export voyage. Ocean carriers have to organize the maritime segment and the inland segment, because they want to increase their market share in carrier-haulage. The inland segment therefore has become part of the maritime transport evolution.

A liner manager seeks to reduce the cost of activities by using the mechanism of coordination. This coordination must be defined and framed by a contract between all the stakeholders of the operation. The challenge here is how to choose their organizational form (coordination) to relocate their empty containers?

In repositioning activities the carrier usually buys a service which is an exchange between the inland repositioning provider and ocean carrier. This activity creates a cost of exchanging and coordinating which is a transaction cost (Ronald Coase 1937). The economic theory of transaction cost is a tool to analyze the contract that frames the repositioning transaction so as to understand how it is done, controlled, monitored and evaluated, to finally reduce the cost related to the transaction.

CMA CGM for example, spent in 1998, US $145 million in container logistic management of 250,000 TEUs (Lopez & INRETS (The National Institute for Transport Research, 2003). To minimize the cost of repositioning, a liner company must make some geographical decisions so as to minimize or even eliminate empty legs in the chain. For example:

- Reduce the distance and time of the empty voyage
- Locate container parks and hubs in an area of high freight traffic.

In North America, when the problem of empty containers is most acute, the Canadian companies have resorted to the use of unconventional means like the movement of grain in containers as back haulage.

2.4.1 Movement of Special Crops: Canadian Grain handling and transport system

High value goods are imported from Asia pacific and lower-value agricultural commodities are returned. Balancing of revenue between head haul and backhaul movement, can be a challenge. For shipping lines, the head haul (import) movements generate 85 to 90% of the country's total revenue; therefore they have the tendency to protect head haulage and foregoing back haulage. Back haulage can be just as important given meticulous planning. In countries such as the study area, where imports out weight export, this study aims at making the back haulage the preferred option. The overarching challenge in the movement of grains in container is therefore exact logistic planning, as Lambert wrote in 1998 "The process of planning implementing and controlling the efficient effective flow and storage of goods, services and related information from point of origin to point of consumption for the purpose of conforming to customer requirement". The lack of harmonization in the total process from farm to container vessel is due to poor flow of communication among the various players stated below.
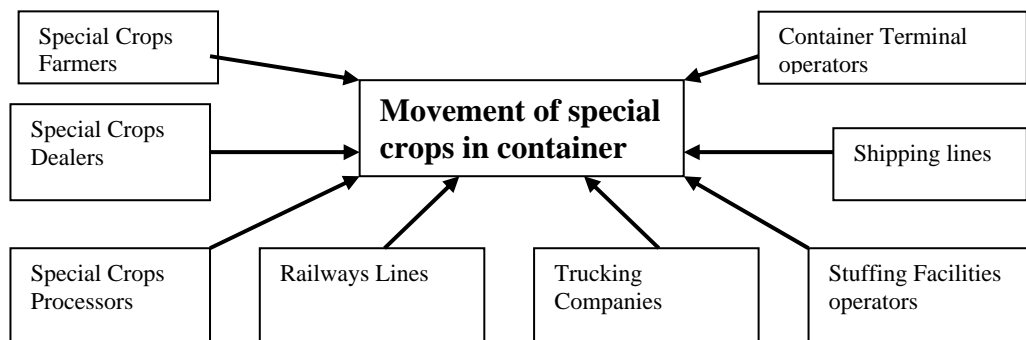
Figure 9: Stakeholders involve in the movement of special grains in container
Source: Author constructed 2008

  i)   Containerize grain market

The Canadian containerize grain market as shown in Figure 10, indicates that for the last 15 years there has been an increase in the proportion of special crop produced in Canada. The special crop proportion increased in 1990 to 12% and in 2001 to 22%.

These changes have had an impact on grain handling and the transportation system. In 1990 the agricultural commodities exported in containers was less than 5% of the total export. In 2004 it had increased to 14% (in the port of Vancouver). The volume of agricultural commodities moved in containers has doubled from 0.68 million tons in 1995 to 1.2 million tons in 2003. For special crops the transportation through containers went from 38% in 1995 to 51% in 2003 (Quorum Cooperation, 2005-2006). The container lines and railways have pursued the grain market in converting specific grains from the bulk to container mode. Crop identity preservation, small volume carriage, bagged products and the inability to handle bulk products at the discharging port are the reasons why the container as a packing and transportation device has become the preferred choice of the special crops industry.
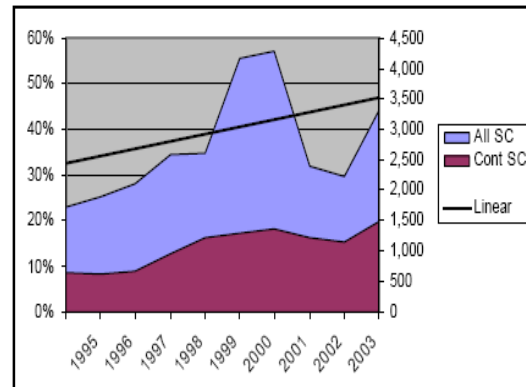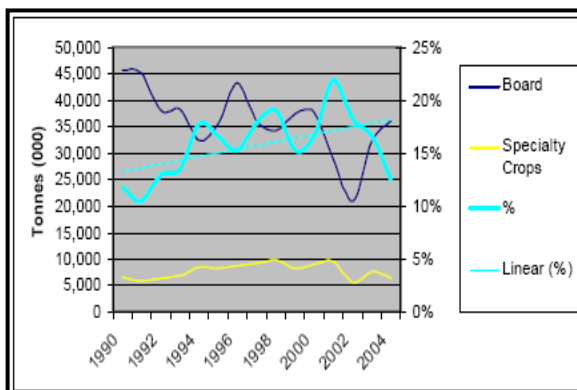
Figure 10- Western Canada Crop Production   **Figure 11**-Specialty Crop movements
In the Port of Vancouver

Source: (Quorum Cooperation, 2005-2006) page 11

ii)   Industry Structure: Containerized grain movement

The container trade into Canada has grown substantially in the last 10 years with a 183% increase throughput for the Port of Vancouver and 56% for the Port of Montreal (Quorum Cooperation, 2005-2006). After bringing the inbound manufactured commodities from Asia the container line in turn sought opportunities to fill the empty containers with return freight at a price sufficient to recover their

variable cost. This backhaul concept rate has given the crop producers an opportunity to use these container shipping lines and reach new markets.

The movement of grains in containers is driven basically by the buyer wanting to receive the grains in small lots and in a manner that reduces handling and assures product integrity. There are two approaches to the movement of commodities by container:

- Loading at source which is in the prairies or farms
- Loading at a port where the container stuffing facilities are located.

The driving factor between these two options depends on the availability of empty containers. The marketing processing used by the producer so as to assure the delivery of higher value crops is shown in the figure below:
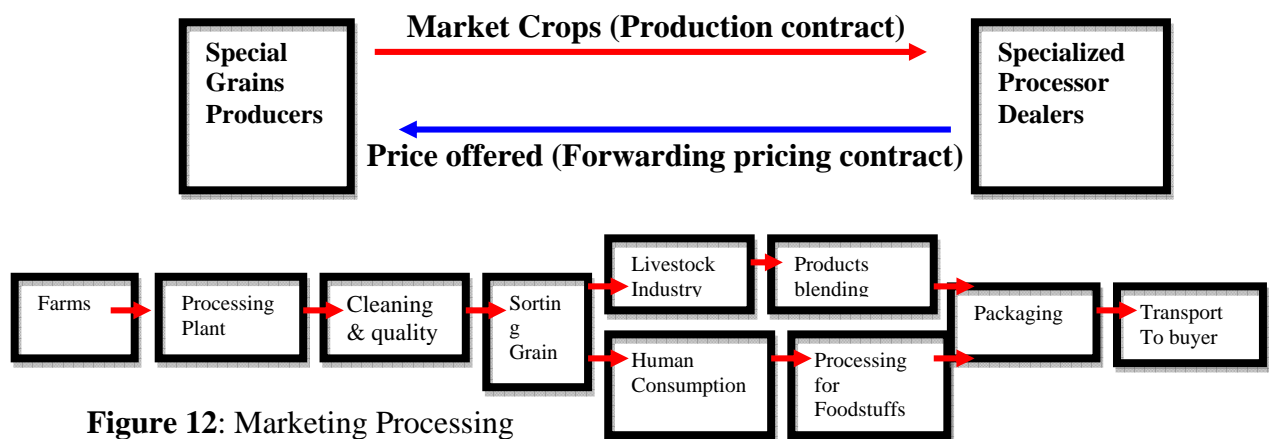
Figure 12: Marketing Processing
Source: Author constructed, adapted from (Quorum Cooperation, 2005-2006)

iii)   Business Model: Containerize grain total logistics cost

- Bulk Movement of Grains
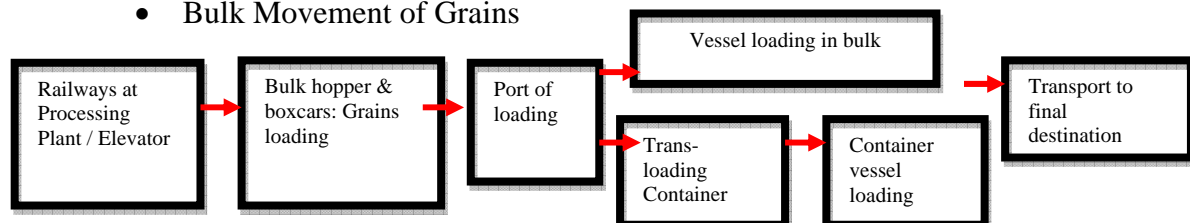
- Container Movement of grains: Source loading
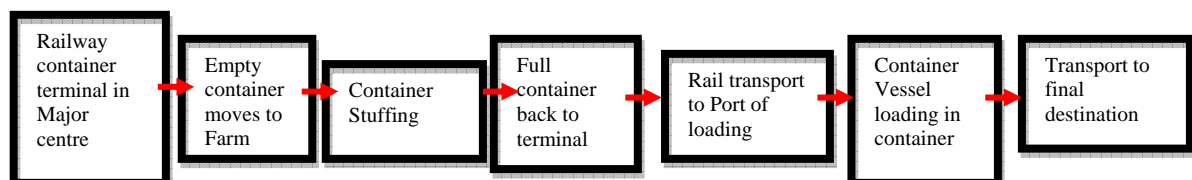
3   ANALYSIS OF STUDY AREA

This chapter analyzes the export pattern in Côte d´ Ivoire and its hinterland, and assesses the implications for liner shipping transportation.

3.1 IVORIAN & HINTERLAND COMMODITIES EXPORT: MARKET SIZE

Container traffic started informally in the Port of Abidjan in 1970; the container terminal of Vridi became functional in 1982. Containerized traffic is still limited in many African ports and West African ports are no exception. This is due to several factors such as the structure of the trade, limited investment, inadequate transport facilities and procedures and tariffs that penalize container traffic (Sub-Sahara Africa Transport Policy Program, 2007). Nevertheless, during the five years 2002-2007, there has been significant growth of container traffic in the whole of the continent, especially in West Africa. Delmas, which is now call CMA-CGM, is a big player in West Africa 75% of the Europe-west Africa traffic (Sub-Sahara Africa Transport Policy Program, 2007) and in 2002 had a traffic size of 1206000 TEUs that had increase to 1441000 TEUs in 2005 representing a rise of 1.2% in volume . It is expected that the volume will continue to increase for the future due to the growing trade and the increasing participation of the private sector in the management and the development of the ports (WorldBank-SSATP & Palsson, 1998). By going into joint partnership with the private sector, world class carriers and terminal operators, the ports are being expanded (an extra 2000 ha in Côte d´ Ivoire), new equipment is being purchased gantry cranes in Côte d´ Ivoire and Ghana for instance, dredging plans are made so that larger vessel can be accommodated., information technology is being improved and human resource training is taking place. All this will improve the ports throughput especially in containerization (Harding, Palsson, & Raballand, 2007) and revitalize the area's international trade.

Following the international trade trend, most of the Ivorian trade is done by sea, about 95%, with the port of Abidjan's (PAA) share being about 90% (Bonnifait,

2006) this contributes to 60% of the country's annual budget (Transport & Abidjan, 2006), It is therefore called the lung of the Ivorian economy. The port is also the gateway for landlocked countries such as Burkina Faso, Mali and Niger, therefore an important asset for regional economic integration and development. Côte d´ Ivoire was hit by a political crisis from 2002 to 2007, which had direct consequences on the port throughput of an important hub in West Africa, impeding the movement of goods and services in the area.

3.1.1 Market outlook: Country export per commodity

In 2007, 48% of the Ivorian cocoa beans were exported through the port of Abidjan (Bonnifait, 2006); commodities such as cotton fiber and seeds, pineapple, banana, rubber, canned fish, timber and coffee were also exported through the port. The volume and composition of production varies from season to season according to the market prices, and seasonal rainfall patterns.

Table 4: Population & and economic indicators (2007)
Source: (WorldBank, 2008b)

Countries	Population (000)	Per Capita GDP ($)	Trade per Capita ($)	Agriculture share of Export	Agriculture share of GDP
Burkina Faso	13,393	492	139	69.6%	33%
Cote d´ Ivoire	16,897	1051	1045	39.3%	25%
Mali	13,409	570	351	70%	38%

As shown in Table 4 above, agriculture represents more than 25% of each country's GDP and at least 70% of their working population is engaged in some form of agricultural activity. Table 5 below shows the importance of the agricultural sector in the area. The volatility of the sector is shown where agricultural produce depends on the seasonal factors, political stability and international trade price. Côte d´ Ivoire had a negative export growth from 2000 to 2006 which corresponds to the period of relative political and economic instability. Burkina Faso's -9.5 is mainly due to the poor cotton harvest (FAO, 2005-2006).

Table 5 World Trade share of export growth in percentage

	1995-99	**2000-04**	**2005-06**	**latest**
Côte d´ Ivoire	3.1	-0.3	-4.7	8.3
Burkina Faso	-0.5	-0.4	0.6	-9.5
Mali	5.1	4.3	-1.8	7.5

Source: (WorldBank, 2008b)

3.1.2   Special crops

Besides cocoa and cotton, commodities such as pineapple, banana, rubber, and canned fish, are among the products exported through the port. For the purpose of this study, focus is put on cocoa, coffee, log timber, sawn timber, cashew nuts, shear nut, cotton fiber and cotton seed as special export crops because they represent the major crops exported by the countries and handled by the port. The special crops production is increasing steadily as shown in Figure 13. They represented 56% of the total agricultural production in 2007 as against 44% in 2002, an increase of 12% in five years, this was due to increase in commodities price, favorable weather and better yield with improved methods of Agriculture.
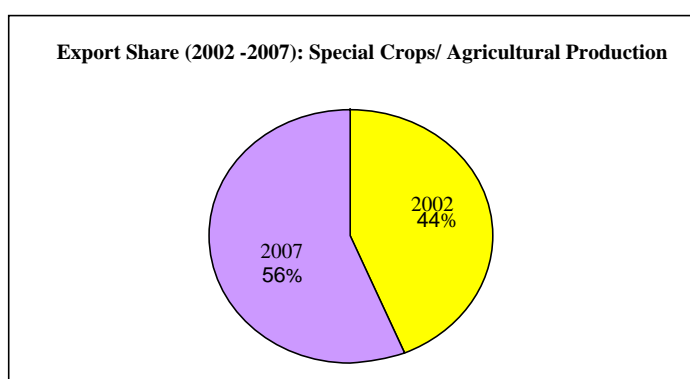
Figure 13 Special crops export share of Agriculture
Source: Côte d´ Ivoire Ministry of Commerce and Port of Abidjan (Jacque Bonnifait, 2006)

The global economic trend of Asia increasing its market share is also a factor in the area. Trade with Asia, in particular China and India, has increased dramatically. As shown in Figure 14, in Côte d´ Ivoire special crops trade with Asia went from 20% in

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2003 to 40% in 2007 of the country's total special crops. The North American traffic went from 4% to 19%, and European Union traffic today accounts for 41%.
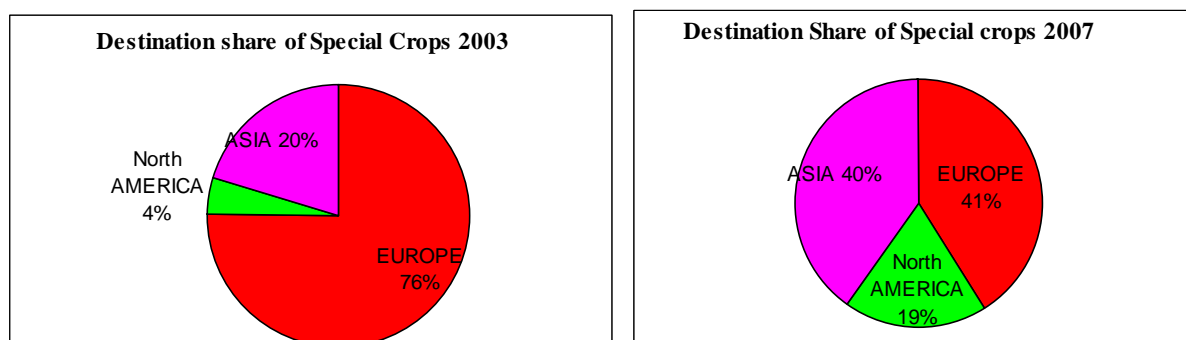
Figure 14 Special crops destination
Source: Côte d´ Ivoire Ministry of Commerce and Port of Abidjan (Bonnifait, 2006)

The increase in the Asian market is mainly due to the cotton export to China and cashew nuts, and timber exports to India. The North American traffic is due to the increase in cocoa exports toward the United States. The decrease in the European export is mainly due to the fact that the change in Government and the civil crisis have prompted the Ivorian government to diversify its trading partners. Globalization has made it possible for the county to trade cocoa with the USA and other crops directly with the Asian market. Côte d´ Ivoire, Burkina Faso and Mali are large worldwide exporters of cotton and Cocoa beans. Côte d´ Ivoire is the world's number one producer of cocoa beans, while with Mali, and Burkina Faso they are West Africa's largest cotton producers and the world's fifth largest producers (FAO, 2005-2006). It is worth taking a closer look at the traffic of these commodities because of the important role they play in the countries´ GDP.

i)   Cocoa production

Most of the world's cocoa production is found in West Africa, as shown in Figure 15 .
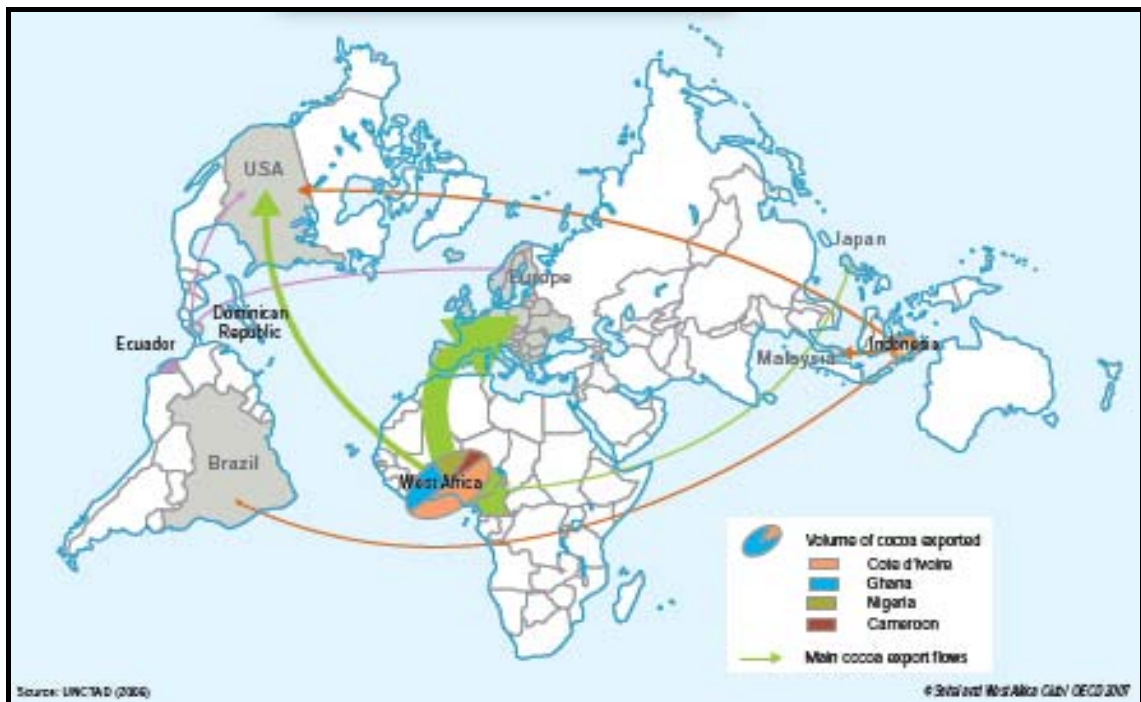
Figure 15 Flow of cocoa export worldwide
Source: UNTACD 2006

The world's largest cocoa production is found in Côte d´ Ivoire and Ghana about 60% of the total tonnage. According to the International Cocoa Organization reports (ICCO, 2006-1998), the volume of cocoa produced in Côte d´ Ivoire was 1,410,000 tons in 2007 (FAO, 2005-2006). In Côte d´ Ivoire cocoa production is done in the southern part of the country mostly in the forest areas as shown in Figure 16. Transport logistic provision should accommodate the geographical area. The southwestern farms produce over 100000 tons per administrative (05) unit and the southeastern farms produce up to 100000 tons per administrative unit (03) (FAO, 2005-2006).
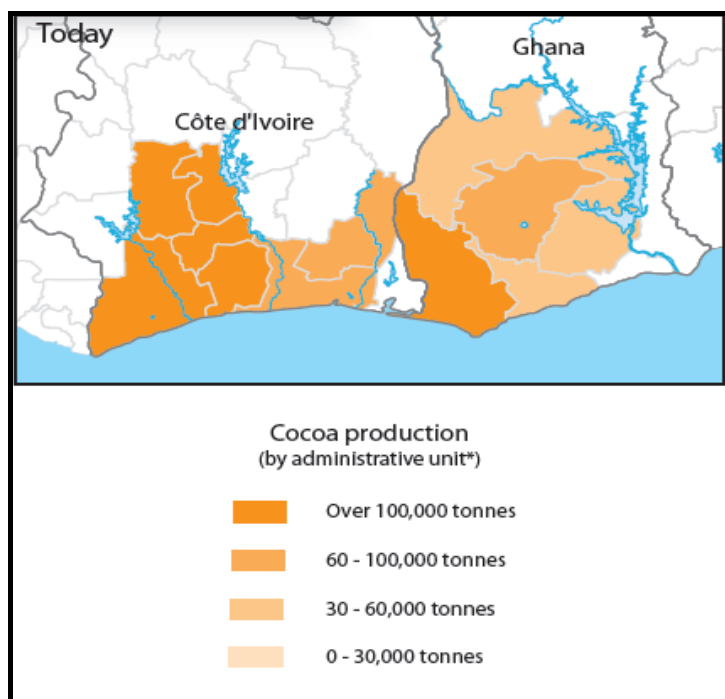
Figure16: Cocoa zone production
Source: FAO Statistics

Cocoa plays a major role in the Ivoirian's economy as shown in Table 6. It represents 37% of the country's total export and 50% of the agricultural exports. The Ivorian economy is linked to cocoa production any impact on the market is felt in all the sectors. Improvements needed in this sector are therefore highly encouraged for stability in the country.

Table 6 Economic Importance of Cocoa production

Average for 2001-2007	Cocoa Export in US$	Volume exported in tons	Share of World export	Share in Agriculture Export	Share in Country total export
Côte d´Ivoire	1.1 billion	810 000	40%	50%	37%

Source: FAO Statistics department 2006

Cocoa production is price sensitive, and its cycle moves closely with the term of international trade (WorldBank, 2007), therefore its integrity needs to be preserved by better handling from the farm to the importer.

Cotton is a major crop exported in the area as shown in Figure 16.

West Africa is the world's 5Th largest cotton producer after China, the USA, India and Pakistan (FAO, 2005-2006).
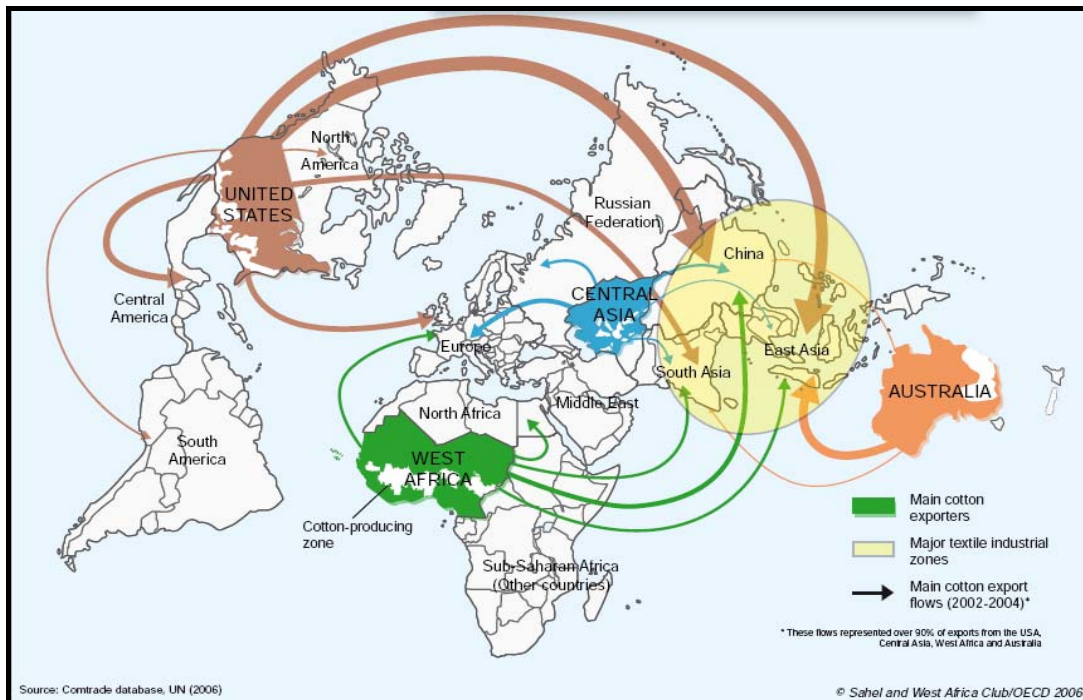
Figure 17: Flow of Cotton Export Worldwide
Source: Comtrade, UN (2006)

The region has increased its production 10 times since 1960 to reach more than 1 million tons of fiber per year. According to the Comtrade database 2006, 46% of the West African cotton is exported to China, 17% to South Asia and 17% to East Asia, making the Asian total export 80%; The European export is 14% and the North African 3% (FAO, 2005-2006).

In 1960 Côte d´Ivoire, Mali, Burkina Faso and Guinea, represented only 15% of the West African export whereas in 2005 they represented 51% of the total volume exported as shown in the Figure 18.
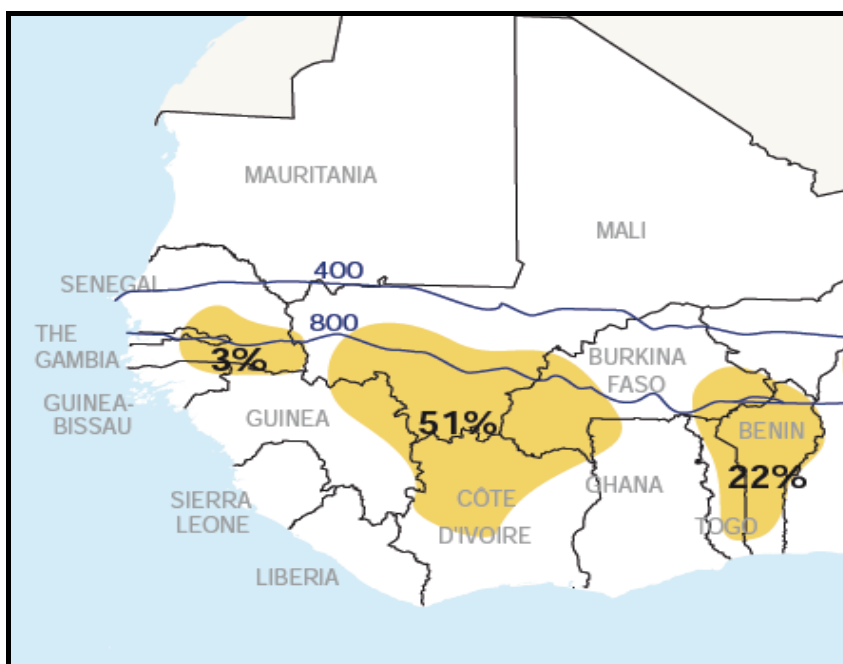
Figure 18: Cotton production basin (51% of total West Africa production)
Source: Atlas on regional integration, SWAC / OECD initiative 2006

The total average for Côte d´ Ivoire, Mali and Burkina Faso between 2000 and 2004 represented 55% of the regional export with the cotton seed volume reaching 950000 tons (FAO, 2005-2006). In Burkina Faso and Mali the cotton export represented more than 60% of the agricultural export and more than 30% of the country's total export. The cotton export determines the countries economy as shown in the table below.

Table 7 Economic importance of cotton production for the area

Average for 200-2004	Cotton fiber export in US$	Share of West Africa export	Share in Agriculture export	Share in Country total export
Burkina Faso	154 000 000	17%	75%	56%
Côte d´ Ivoire	147 700 000	17%	6%	4%
Mali	188 100 000	21%	63%	30%

Source: FAO Statistics department 2006

Subsidies given to cotton farmers in other cotton producing countries have endangered the western area's cotton sector; therefore there is a need to revamp the

production by reducing costs in the transport system and preserving the integrity of the crop.

3.2 BULK AND CONTAINERIZED CARGO MOVEMENT

3.2.1   Port of Abidjan

As previously stated in this study, the port of Abidjan is a major hub in West Africa (Containerisation-International, 2008). It became operational in 1951 and serves not only Côte d´ Ivoire but also landlocked countries such as Mali, Burkina Faso, Niger and some coastal countries Liberia and Sierra Leone (Transport & Abidjan, 2006). The port has shown a steady growth from handling 9254752 tons in 1985 to 21000000 tons in 2007 almost triple its throughput in 23 years.

The port of Abidjan has allocated some space to the hinterland:

- Mali: 6000 meter square of warehouse
    - 4682 meter square of sheds
    - 22401 meter square of open space
    - Adding an 11000 meter square warehouse this year.
- Burkina Faso: 3204 meter square of warehouse
    - 13336 meter square of sheds

The Port also has representatives in both countries to be close to their economic operators. The port characteristics shown is Table 8 asserts that the port can handle container vessel up to 2000 TEUs (WorldBank-SSATP & Palsson, 1998).

Table 8 Port of Abidjan characteristics

Port of Abidjan characteristics	
Draft / harbour mouth	Vridi canal =10.5m
Draft at Quay	12.5m
Max vessel length	260m
Pilot	Available 24 hours
Cranes	03 gantry cranes and 01 mobile gottwald 45t capacity
Number of deep water quay	34
Container terminal	15- 40 moves / hour
Warehousing	143,507 square meter of shed and covered warehouse 407,568 square meter of open storage
Length of quay	Berth 22-25 (container birth) 1000m draft 10.6m Berth 1-15 length 3500m draft 9.4m
Roro berth	One 12.5m deep with 03 gantry crane of 40T
Rail connections	All quays are connected Link to Burkina Faso and Niger
Industrial area	770 ha (60% of the country industrial activities)

Source: Author constructed from (Bonnifait, 2006) (Transport & Abidjan, 2006)

Container shipping started informally in 1971; and has also grown steadily from 261325 TEU handled in 1995 to 432000 TEUs in 2007 and has increased more than 1.65 times. As shown in Figure 19 container throughput has been declining, from representing a third of cargo volume handled to representing in 2006 less than a forth; 4.2 million out of the 18.8 million tons handle by the port. This reduction in volume handle is mainly due to the cost of liner services in the area and the Hinterland volume being deviated to neighbouring ports such as Lomé in Togo and Tema in Ghana.
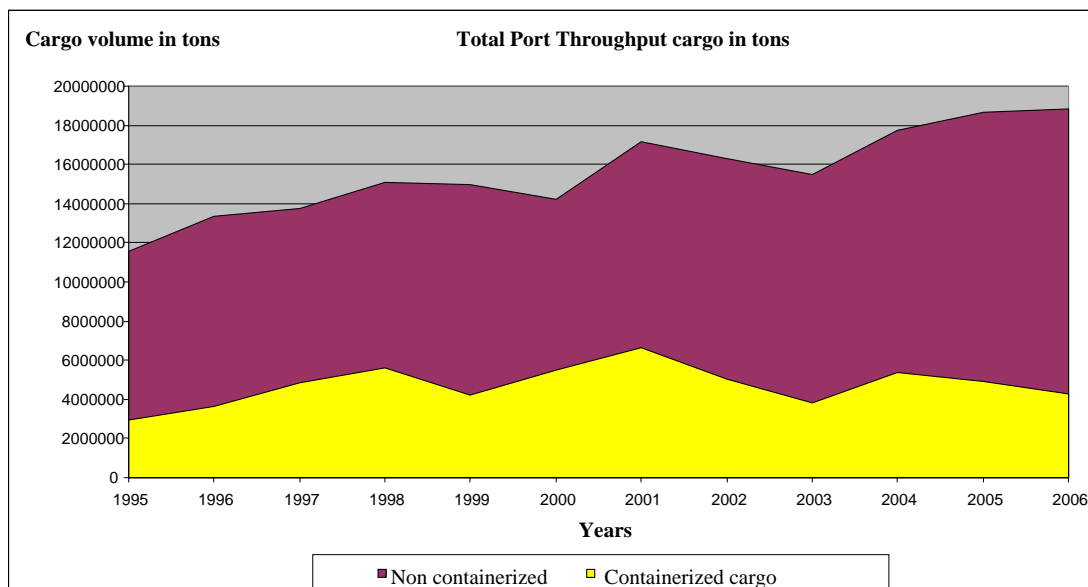
Figure 19: Port Traffic (all traffic vs. containerized)

Source: Port of Abidjan Reports (1996-2006)

However, the region's export prospects have improved with the recent commodity boom and access to new markets and partners and mainly the return of socio-political stability in the area.

3.2.2 Port Traffic

The port traffic, as shown in Figure 20, has not been smooth over the last 8 years.
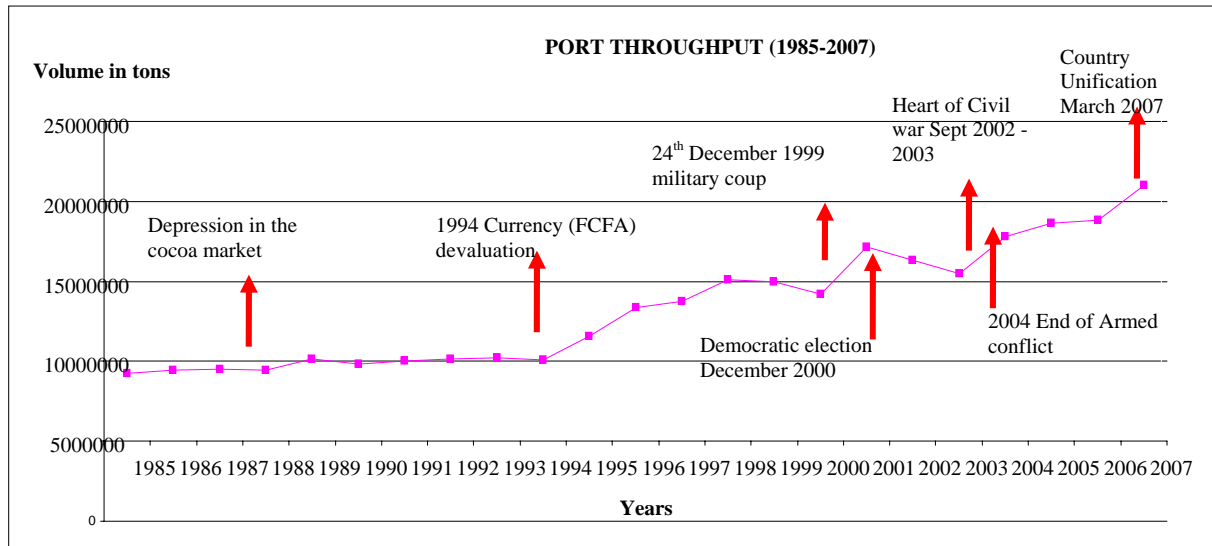
Figure 20: Port Throughput over 1985-2007
Source: Port of Abidjan Reports (1996-2006)

The period of 2002-2006 was marked by a slowdown in economic activity. In fact since September 19, 2002 a page was turned in the history of Côte d´Ivoire with the advent of political instability. This brought about a difficult socio-political, economic, and financial situation in the country. The port's total throughputs shown in Figure 20 above illustrate the impact of the socio-political instability on the country's international trade.

1985-1993: The commodity export price fell creating an extended depression as can be seen in the curve.

1994: Major transition in the country's economy; the FCFA the country's currency, was devalued. This action coincides with the increase in cocoa and coffee prices and the trade accordingly (WorldBank, 2007).

24th December 1999: The fall of cocoa (US$ 3000 in 1980 to US$ 1000 in 2000 (WorldBank, 2007)) and political turmoil spark the first ever military coup.

2000: The effect of instability is seen in the drop of the port throughput (14953529 tons in 1999 to 14220633 tons in 2000 (Port of Abidjan, 1999-2007)). The port

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traffic before the political instability from 1994 to 2000 had registered an annual growth rate of 3%

December 2000: An election was organized, a civilian took power. Change in the administration and in the Port of Abidjan. This democratic action saw the port activity increase in 2001 up to the third quarter of 2002.

19[th] September 2002: An armed conflict begins, dividing the country into two, the North and the South, and destroying the economic infrastructure. The Port Authority loses cargo from the northern part of the country and the hinterland. This effect is seen in the drop of the throughput from 17179000 tons in 2001 to 16310000 tons in 2003. Port of Abidjan, (1995-2004)).

From January 2002 to August the port registered an increase of 0.4% in its traffic, and then came the war in September. From October to December the traffic registered a 20.3% fall. Therefore, in 2002 the total reduction in traffic was 5.1% (Transport & Abidjan, 2006).

2003: Represents the heart of the armed conflict; the traffic of the hinterland is diverted to the neighboring ports. The port throughput fell from 16310000 tons in 2002 to 15520000 tons in 2003 (Port of Abidjan, 2001-2006).

2002 and 2003 the country experienced a negative GDP growth -1.4% and 1.6% (WorldBank, 2007).

2004: Represents the end of the armed conflict. The port of Abidjan established a marketing plan to reclaim the hinterland market. The result is an increase in activity and the return of some of the hinterland economic operators. The throughput passed from 15520000 tons in 2003 to 17770000 tons. The country's GDP for the year was 1.8% (WTO, 2007).

March 2007: The country was unified. This return to stability is directly seen in an increase in the real GDP growth of 1.6 for 2007 and an estimated 2.8 for 2008. The port throughput increased from 18857000 tons in 2006 to 21000000 tons which represents a 1.12% change.

Figure 20 shows the impact of the Ivorian socio political instability on the international trade therefore its maritime transport. Maritime transport is derived

from trade and political events. The disturbance in the Ivorian political setting had an impact on its trade volume; transport of cargo from the north could not efficiently reach the port; farmers running away during the crisis led to harvest losses in the north, the area's big cotton zone and the west, a major cocoa area where cocoa harvest and transport was also disturbed.

3.2.2   Break bulk cargo export

The Agricultural export is mainly done in bulk. It represents in 2006, 43% of the cargo exported as shown in the table below.

Table 9: Brake bulk traffic export

years	port Throughput (000) of tons	Total Export (000) of tons (Dry, Liquid bulk and general cargo	Break bulk export volume
2001	17179	7043	3522
2002	16310	6198	3443
2003	15520	5898	2809
2004	17770	6655	3697
2005	18662	7511	4173
2006	18857	7818	4343
2007	21000	9491	4519

Source:(Bonnifait, 2006) and (Transport & Abidjan, 2006)

The rest of the export, Liquid bulk represents 37% and container cargo 20% (Transport & Abidjan, 2006).

i)   Hinterland International Transit Traffic

During the socio-political situation, the country was divided; access to the north and the hinterland was very difficult. At the end of 2003 the worse part of the crisis, the hinterland traffic registered an 85.4% decrease. Figure 21 below shows the hinterland cargo flow to the port from 1995 to 2006.
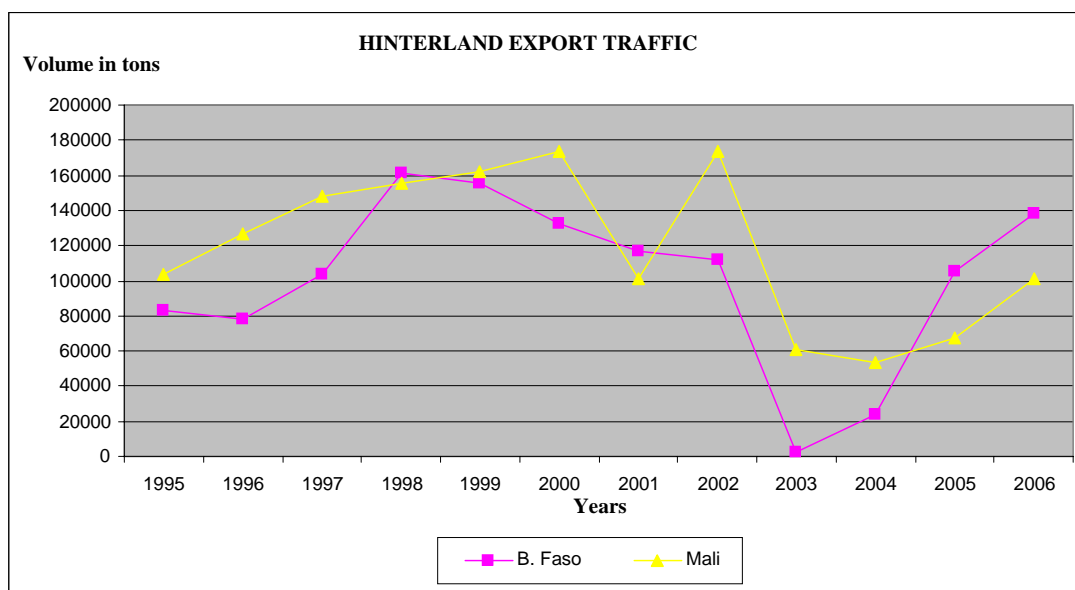
Figure 21 Hinterland Export traffic
Source: Port of Abidjan Reports (1996-2006)

Before the socio-political crisis of 2002 the port was managing more than 65% of the hinterland traffic. This market share was drastically reduced to 8% in 2003 at the heart of the crisis. This crisis lasted from 2002 to March 2007, but the armed conflict was from 2002- to 2003, the rebellion in the north and the ruling party in the south. The hinterland located in the north was therefore cut from the south where the two Ivorian ports (Abidjan and San Pedro) are located. The Burkina Faso and Mali economic operators found themselves stranded and obliged to direct their traffic to other regional ports. Tables 10 and 11 shows the evolution of the traffic in these ports from 2001 before the crisis to 2003 at the heart of the crisis.

Table 10: Burkina Faso traffic repartition

Share of Burkina Faso traffic			
Corridors / Years	2001	2002	2003
Togo- Lomé	18.78%	17.66%	53.74%
Benin- Cotonou	0.31	0.9%	2.92%
Ghana - Tema	16.7%	25.01%	41.61%

Source: Burkina Faso Shippers council

Table 11: Mali traffic repartition

Share of Mali traffic			
Corridors / Years	2001	2002	2003
Senegal - Dakar	27.51%	26.67%	29.65%
Guinea - Conakry	0.27%	1.06%	3.25%
Mauritania - Nouakchott	0.15%	0.15%	0.51%
Togo - Lomé	3.55%	9.96%	30.24%
Ghana – Tema + Takoradi	2.44%	7.54%	22.01%

Source: Mali warehouses in the Ports

An aggressive marketing from the port in 2006 and the promise of return to stability in Côte d´Ivoire has brought the traffic to 38.5% (50.5 % for Burkina Faso and 26.4% for Mali) as indicated in the figure below.
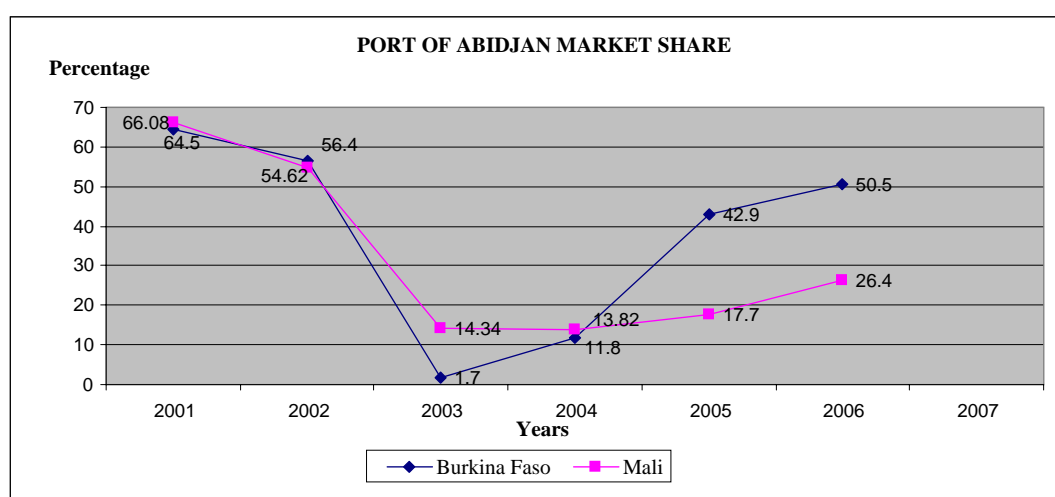
Figure 22 Port of Abidjan Hinterland Traffic Share
Source: Author constructed and (Transport & Abidjan, 2006)

The hinterland traffic went from 5929580 tons in 2004 to 762250 tons in 2005 and exceeded 1000000 tons in 2006 this represents a 31.4% increase from 2005 to 2006. The hinterland traffic structure over the years is shown in the Figure 23. Cotton fiber in 2007 represents 80%, and cotton seed 1% of the Burkina Faso export among its top five exports.
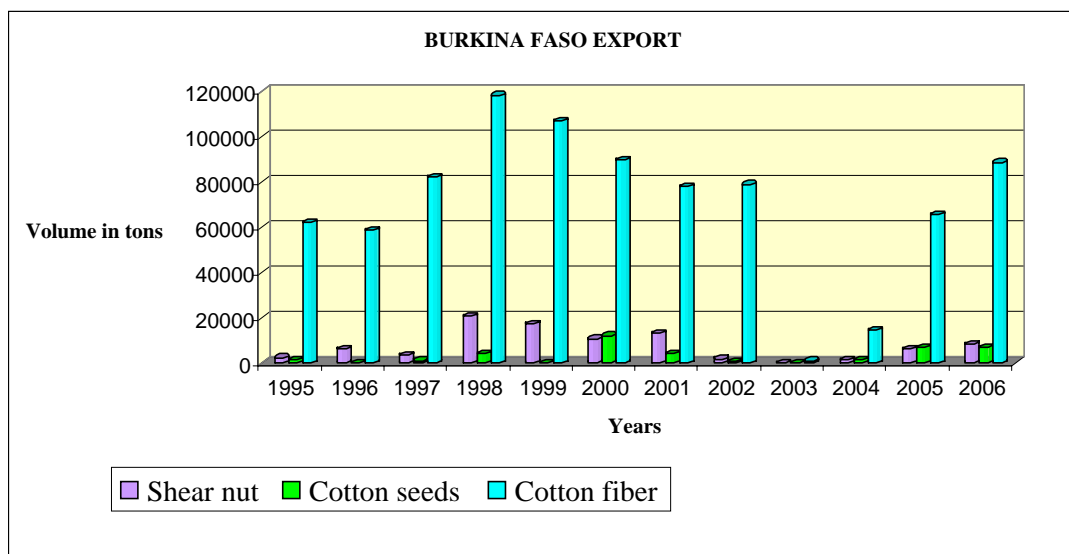
Figure 23 Burkina Faso Major Crops Export Traffic – Port of Abidjan
Source: Port of Abidjan Reports (1996-2006)(Transport & Abidjan, 2006)

In 2006, cotton fiber represents 81%, and cotton seed 1% of the Malian export among top five exports.
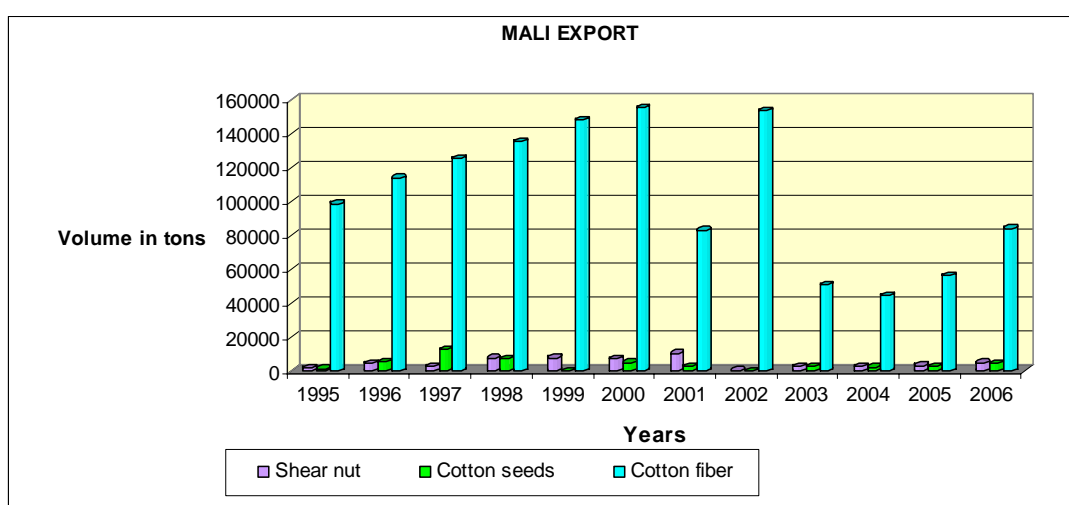
Figure 24 Mali Major Crops Export Traffic – Port of Abidjan
Source: Port of Abidjan Reports (1996-2006)(Transport & Abidjan, 2006)

ii)   Côte d´ Ivoire Traffic

The major trade partners of Côte d´Ivoire outside the continent are Europe, North America and Asia. Figure 25 shows the trade pattern for the last five years. The European traffic is decreasing while the others are gaining in volume. Since the

commodities are agricultural, the exports are highly correlated to the international market price. In 2007 cocoa beans represent 37% and wood 5% of the country's export among the top five exports.

The area, as all other African countries, has turned to Asia for industrial and manufactured goods, because of the high value of the Euro on the market.

The European trade is losing momentum and so is the Europe – West Africa liner service, due to the operating cost (crew, insurance, security provision) sharp increase, high repositioning expense and hinterland road haulage tariff escalation (Containerisation-International, 2008).
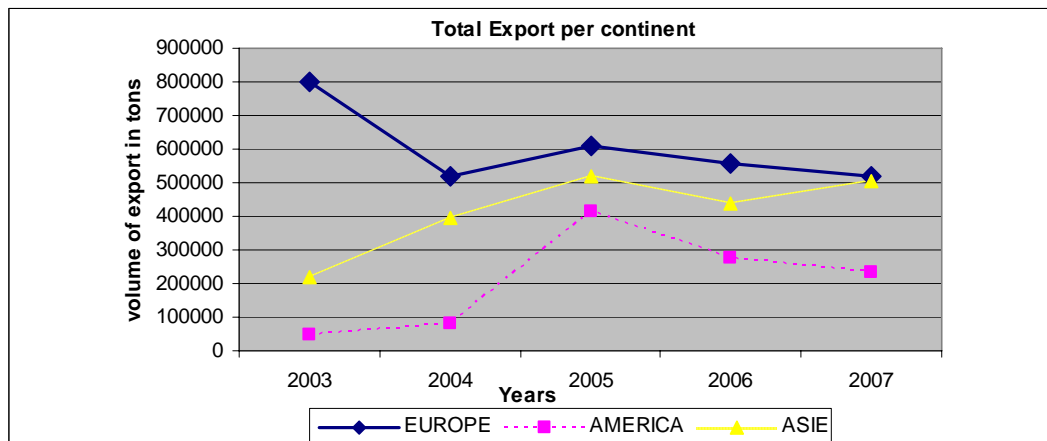
Figure 25 Côte D´Ivoire Export per continent
Source: Author, constructed from Côte D´Ivoire Ministry of Commerce Statistics department

Even though the total export towards Europe is decreasing, it is still the largest client of the port outside Africa. Cocoa and coffee are the main crops exported to Europe, where the grinding, chocolate factories, and 64% of the world's chocolate consumption are located (ICCO, 2006-1998). About 20% to 22% of this traffic is containerized; there is fresh pineapple, banana and canned tuna fish. Figure 26 represents the export traffic towards Europe.
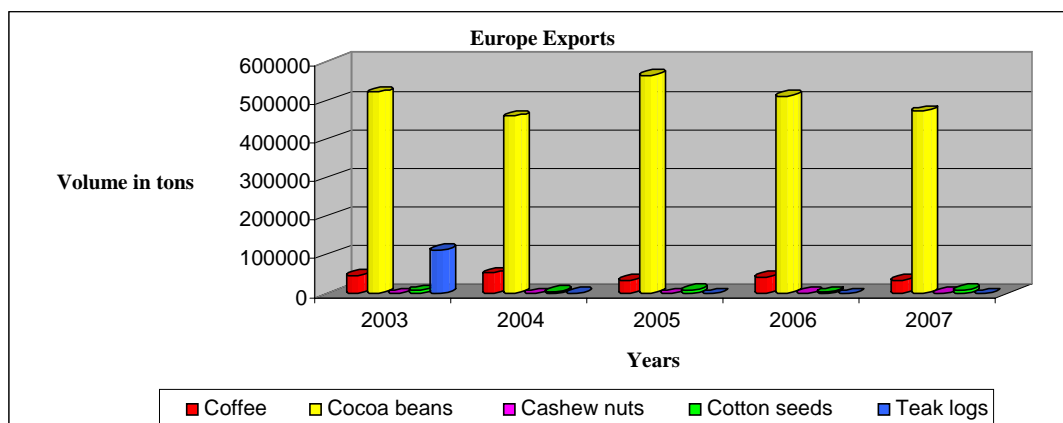
Figure 26 Major Crops Export to Europe
Source: Author constructed from Côte D´Ivoire Ministry of Commerce Statistics department

As shown in the Figure 27, the Asian market is responding well to the various crops exported. Cashew nuts, log teak, cotton, and cocoa are the major exports due to the boom in construction, and textiles business and an increase in the middle class citizens ready to consume new products. The Asian traffic has become the second largest for the port of Abidjan where exports are concerned.
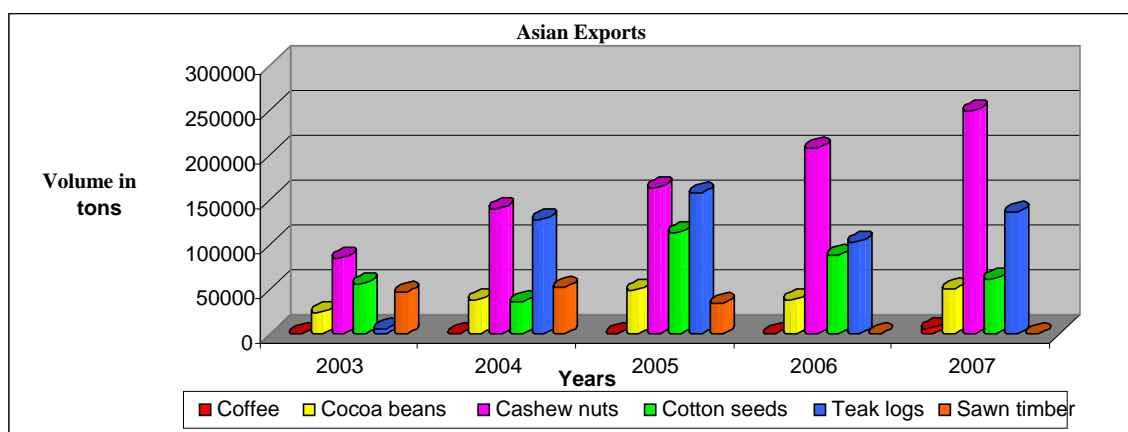
Figure 27 Major Crops Export to Asia
Source: Author, constructed from Côte D´Ivoire Ministry of Commerce Statistics department
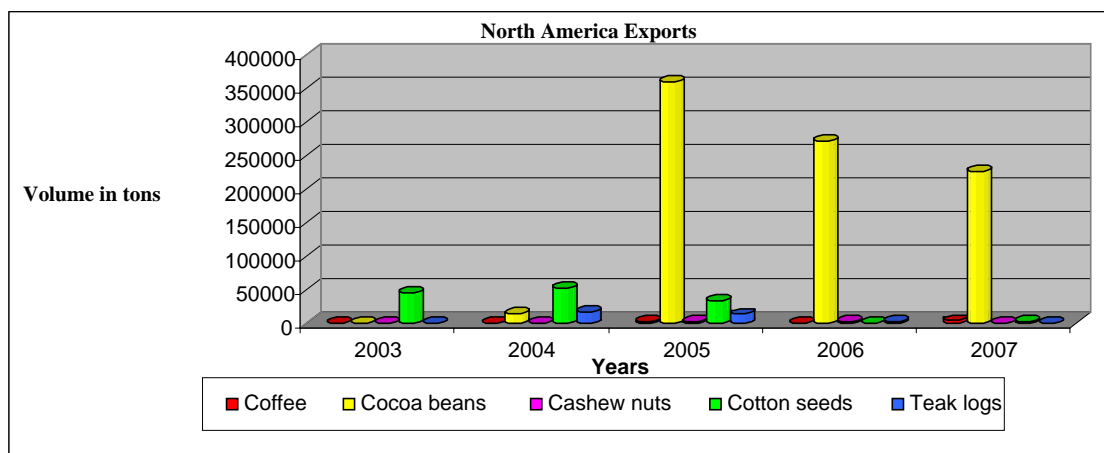
Figure 28 Major Crops Export to North America
Source: Author, constructed from Côte D´Ivoire Ministry of Commerce Statistics department

3.2.3   Containerized cargo export

Born out of the need to reduce the cost of doing business, container traffic has opened the world markets, and accelerated trade and transport flow. The need to transport products in small lots and the need to move high value and delicate cargo has increased the use of container movements.

Containerization has been important for the port it represents; from 1995 to 2007, 25.7% to 38.8% of the port throughput (Transport & Abidjan, 2006). It has enabled the port to achieve some good results; however the traffic has slowed down due to the socio-political crisis and the high container transport costs. The figure below shows the volume of containerized cargo handled by the port over the years. The volume decreased in 1999 and 2003 at the time when the country was in turmoil.
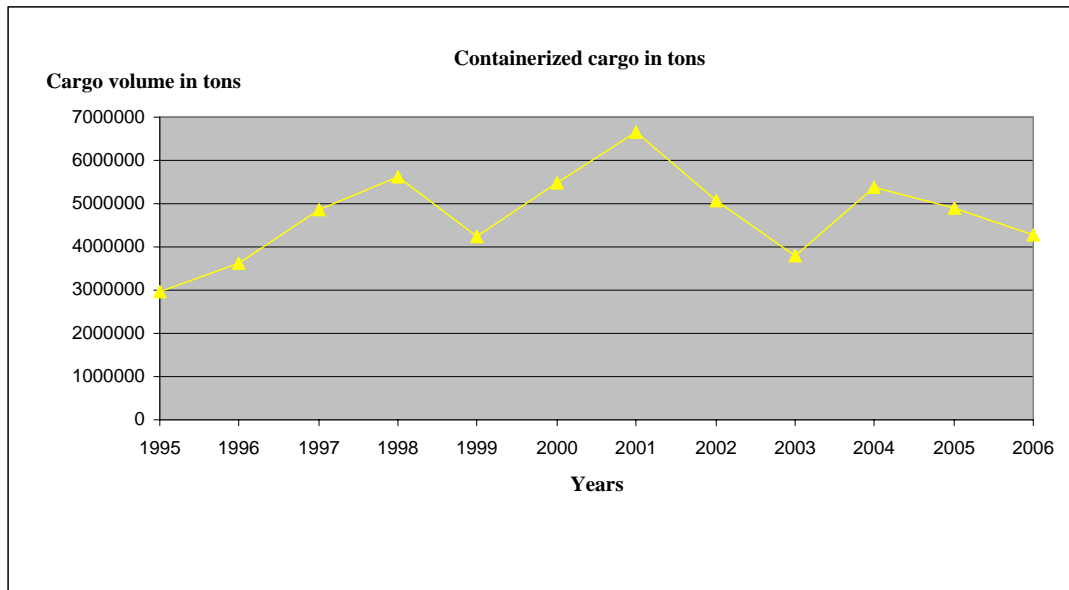
Figure 29: Traffic of Containerized Cargo in tons
Source: Author, constructed from (Transport & Abidjan, 2006)

The container traffic was 507119 TEU in 2006 against 571674 TEU in 2005 and 669843 TEU in 2004, which represents an 11.3% downturn. This result is due to a reduction in transshipment volume from the hinterland going to the neighboring ports. The containerized cargo is usually fruits, canned food, and cocoa and, coffee processed products.

3.3 CONTAINER TRANSPORT CHALLENGES: PORT OF ABIDJAN

3.3.1 Issues

i) Port Container stuffing and Stripping

About 80% of the TEUs arriving at the port for direct traffic are stripped and stuffed in the port area (USITC, 2007). The commodities are therefore either loaded on to trucks or on trains for the rest of the logistics chain, taking away the large incentive of containerization in the first place. Container lines prefer to have control over their containers and properly manage their inventory, therefore having the container not leaving the port area is their preferred choice. An inadequate infrastructure for container management in the country and the hinterland has also strengthened this position.

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ii) <u>Container Deposit</u>

The few containers, about 20%, leaving the port area must be secured so that the equipment is not stolen; the shippers are therefore asked to pay a deposit.

- TEU moving from the Port of Abidjan to Burkina Faso: deposit

  2286.74 Euro / TEU (CMA-CGM, 2007)

  1829.39 Euro / TEU (MSc, 2007)

- TEU moving from the Port of Abidjan to Mali : deposit

  4573.47 Euro / TEU (CMA-CGM, 2007)

  3658.77 Euro / TEU (MSc, 2007)

- TEU moving from the Port of Abidjan for the countryside: deposit

  914.69 Euro / TEU (CMA-CGM, 2007)

  838.47 Euro / TEU (MSc, 2007)

This is done to secure the return of the container intact and on time because the shipper is given a 20-day limit for the container to be back to the carrier at the port.

iii) <u>The railway line SITARAIL</u> (Société Internationale de Transport Africain par Rail)

In Cote d´Ivoire the railway system is a public/private partnership on a concessional basic SITARAIL is managed by Bolloré partnered with CMA CGM. It runs from Abidjan in Cote d´Ivoire to Ouagadougou in Burkina Faso. The SITARAIL train is shown below; it is a very old type of train which is also a problem where infrastructure efficiency is concerned.

Figure 30 SITARAIL train Abidjan –Bobodioulasso - Ouagadougou
Source: SITARAIL 2008

SITARAIL, the railway line linking Côte d´Ivoire to Burkina Faso, has two daily mixed goods trains pulling out of Bobodioulasso bound for Abidjan. SITARAIL offers a tariff of 800.36 Euro / TEU (SITARAIL- 2007), and a penalty of 38.11 Euro / ton for every extra ton for a TEU over 20 tons.

iii)   TEU Tracking System

Truck drivers are supposed to phone to give their location. Once on the train the carrier relies on the conductor to know the position of the train. This inadequate tracking system makes it difficult for the carrier to complete its part of the logistics system, which is TEU from door to door as it is done in other parts of the world. The container can only be scanned at the port. For security purposes the carrier will prefer to have total control of his/ her transport length.

3.3.2 Problems

The total volume of container exported from the port are not only has decreased, but also a third of the box is leaving the port empty as shown in Figure 31.
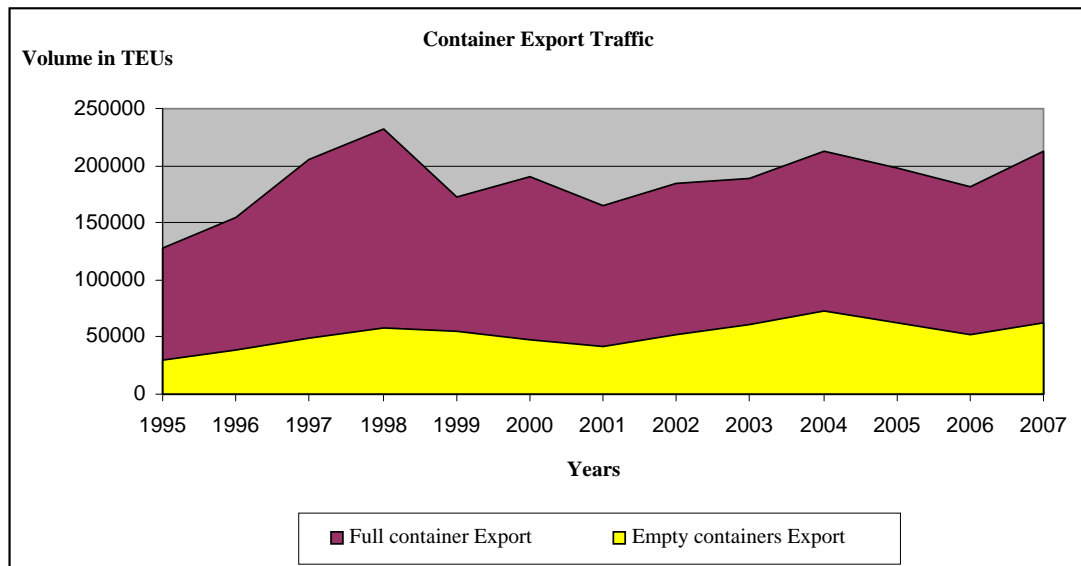
Figure 31: Volume of TEUs exported
Source: Port of Abidjan Reports (1996-2006)

The port of Abidjan is in a liner trade route that is extremely challenging to serve with both highly and less predictable operating costs than other world trade routes (Containerisation-International, 2008). This is basically due to port congestion, port delays, corruption, terrorism and piracy in Nigerian port which is part of the area's liner route.

i)   Inadequate Warehouse

Once at the port non-containerized cargoes for export and the imported stripped containers battle for warehouse space while waiting to be either stuffed into containers or put on to trucks or trains for distribution. This situation puts a tremendous pressure on the port warehousing facilities.

A container can only stay 10 days in free warehousing from the time of arrival to the shipper collecting his cargo. On the 11th day there is a fine of 1.50 Euro / TEU / day. After the 15th day it is 3.00 Euro / TEU / day.

For the hinterland traffic, all dry bulk commodities have 20 days free storage facilities for tonnage less than 5000 tons, and 30 days for tonnage more than 5000 tons. This applies from the day of arrival of the product. After the free time limit there is a penalty of 0.5 Euro / ton / day (General Directorate of Port and Maritime

Affairs Abidjan, 2006). A container for Abidjan area stays at the port for a minimum of 10days, for the hinterland 15 days in free warehousing.

ii)   Port Area Congestion

There is an inadequate container stuffing and stripping area, therefore container stuffing or stripping is done wherever possible. This habit is a hindrance to the traffic flow in the port area, because fork lifts and cargo handling equipment conflict with the car, truck and train movements. The end result is port congestion, delays in port operations, and cargo damages, all leading to an increase in maritime transport costs and a low level of liner service. Port terminal congestion is a major problem according to (Notteboom, 2006) being the main cause of schedule unreliability.

iii)   Empty Container Export

The port of Abidjan exports empty containers to ports around the world. The proportion and volume of empty TEUs to the total container throughput exported is shown in Figure 32 and 33. Before the socio-political crisis, 25% of containers exported from the port were empties (Transport & Abidjan, 2006). Since 2002 the number of empties moved represents about 1/3 of containers exported, the impact of the crisis has worsened the empties management problem.
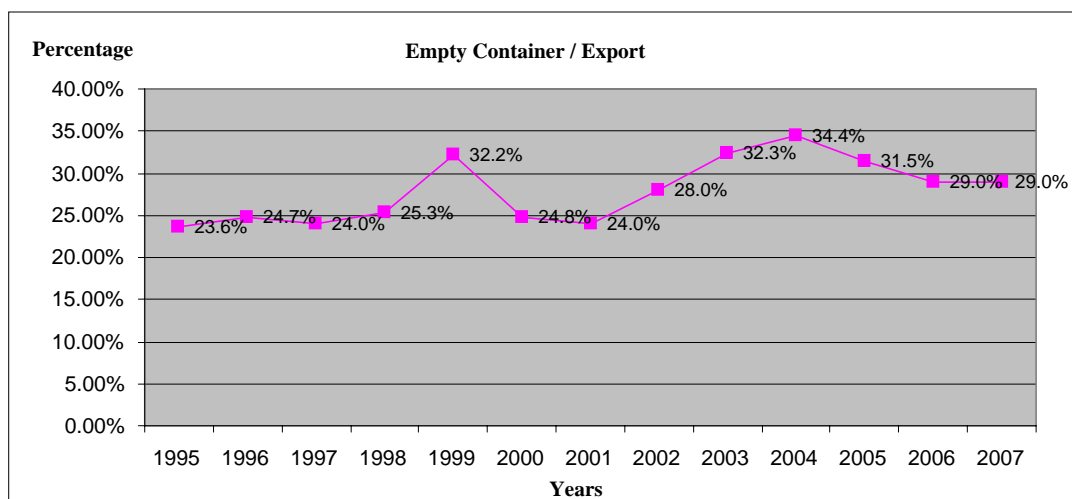
Figure 32: Empty Container in % TEU of export
Source: Author, constructed from (Transport & Abidjan, 2006)

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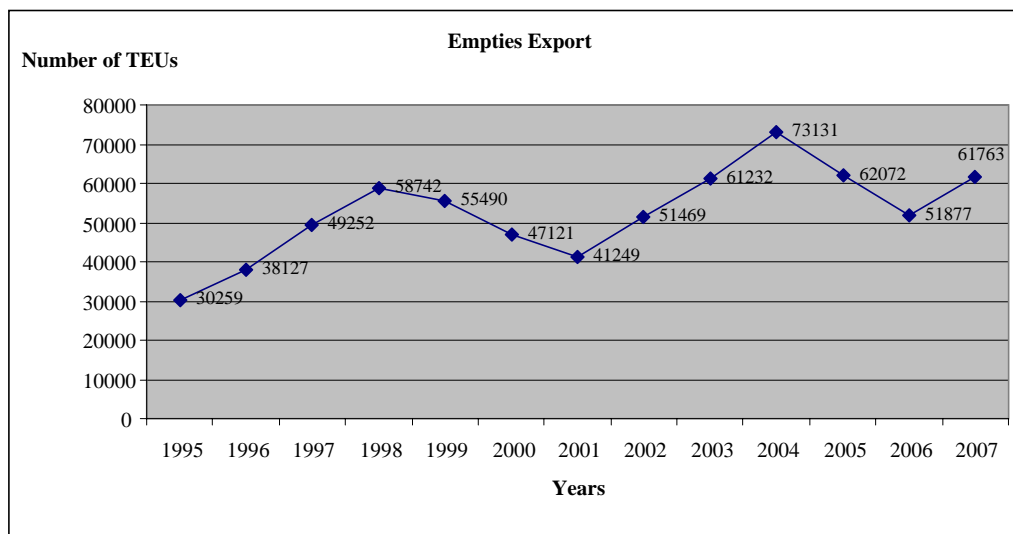
Figure 33 : Empty Container in TEUs
Source: Author ,constructed from (Transport & Abidjan, 2006)

As stated previously from 2003 to up to 2005 more than 30% of the containers
exported were empty. We can also see that during the socio-political instability more
containers exported left the port empty. The percentage of empty container from
1995 to 2002 before the war, during the war and in 2007 when all were reunified is
shown in Figure 34.
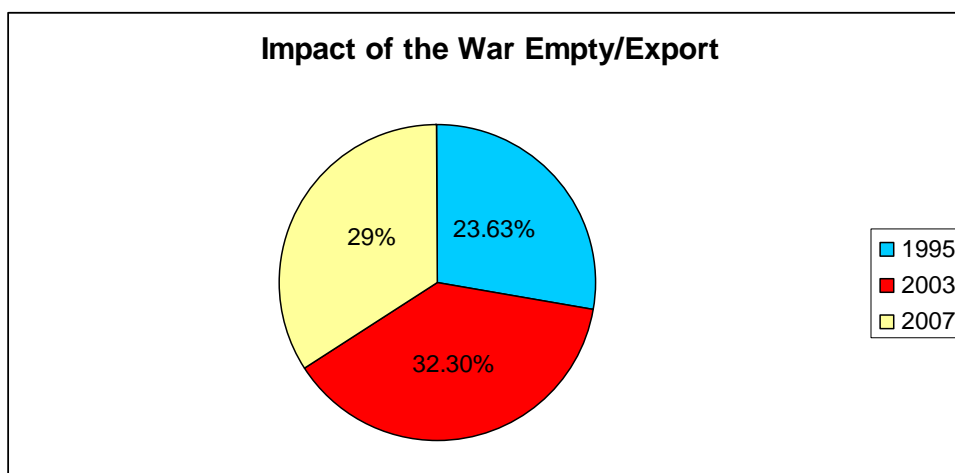
Figure 34 Impact of the War on Movement of Empties
Source: Author constructed from (Transport & Abidjan, 2006)

4 PROPOSED MEASURE FOR EMPTY CONTAINER MANAGEMENT IN IVORIAN PORTS

This section discusses the key findings (problems, challenges and prospects) identified from the empirical analyses of empty container traffic at the Port of Abidjan and production of special crops in Côte d´Ivoire and its hinterland as presented in the previous chapter.

4.1 DISCUSSION OF FINDINGS

The discussions include logical deductions from the findings and their policy implications in relation to the research objectives and within the conceptual framework presented in Chapter Two.

An overview of the Strengths, Weaknesses, Opportunities and Threats in Figure 35 of the maritime service of the study area is part of the search for an integrated transportation network for better trade and development in the corridor so as to adequately manage the empty container movements.

	Strengths	**Internal**	**Weaknesses**	

Strengths | **Internal** | **Weaknesses**

- Existence of basic transport infrastructure
- Presence of large liner companies
- Container terminal extension of île Bouley
- World's largest cocoa exporter
- Port representation in Mali & Burkina Faso
- West Africa largest coffee/cotton exporter
- Rail line Côte d′Ivoire –Burkina Faso
- Road links to all neighboring countries
- Increase in the regional GDP
- Growth in intra regional trade
- Trade agreements with Europe – USA- China – Japan - India

- 1/3 of TEU exported are empty
- Socio-political instability
- Higher liner service cost
- Loss of hinterland market
- Low levels of supply chain system
- Inadequate transport infrastructure
- Bureaucratic port formalities
- Port clearing formality takes 9-11 days
- Border formalities efficiency 39%-44%
- Control and harassment during transport leg
- Political factors (low level implementation of regional agreements, corruption)
- Customs source of countries fiscal revenue

Positive | **Opportunities** | **Threats** | **Negative**

- Increased interest in China and India (Asia) in the regional resources
- Increased international trade
- AGOA initiative
- Increase in unitize cargo
- Increase in maritime transport
- Increase in quality assurance product
- Protection of the regional environment

- Strengthening of neighboring Ports
- Increase in container movement imbalance
- Economic USA slowdown could reduce demand
- Global shortage in some staple food
- Strengthening of Euro
- High Fuel Price

External

Figure 35: SWOT Analysis
Source: Author constructed

The SWOT analysis shows that, the challenges to a quick solution of managing

empty containers with special crops is not only operational process (the physical

movement of containers) and regulations related, but also the adequacy of the capacity of the transportation network itself.

4.1.2 Transportation network

While the countries in the study area have the basic infrastructure it is not efficiently utilized (IFPRI, Diao, & Yanoma, 2003) leading to a low level of exchange. "The low level of trade is due to high transportation cost because of the scarcity of service. Limao & Venables (2001) as cited in (Coulibaly & Fontagné, 2005) suggested that transportation infrastructure quality has a major impact on transport cost and consequently on the volume of trade flows" among these countries. Investments from the technical and political point of view are not only poorly made at the national and regional level (UNCTAD, 1999), but also there is a lack of information for the users and operators of the transport system. Transport costs in Africa are 30% to 40% above that of other developing regions.

i)   Road Transport

Road transportation is the major mode used for trading. It represents more than 90% of the transportation activity in the region (UNCTAD, 2007). Côte d´Ivoire has a density of 17 km road / 100 Km square, Burkina Faso and Mali have a road density of 2.7 Km / 100 Km square. This poor connectivity is further exacerbated by the inadequate maintenance of the infrastructure leading to degradation of the network. Poor transportation infrastructure leads to poor market access, many agricultural products consequently get spoilt on the farms because they cannot reach domestic or regional markets let alone be exported. When commodities reach the regional market and are ready for export the customs border efficiency is poor, from 39% to 56 % (see Table 12 below) creating delays and increasing the total cost which is a trade impediment.

Table 12 Major Road Accessibility to some Trading partners

Border	Economic Centre	Distance Km	Road Distance Km	Border efficiency Score over 100
Cote d´Ivoire - Burkina F.	Abidjan - Ouagadougou	900	1,176	39
Cote d´Ivoire - Mali	Abidjan - Bamako	950	1,184	56
Burkina Faso - Niger	Ouagadougou - Niamey	415	537	44
Burkina Faso - Mali	Ouagadougou - Bamako	705	610	44

Source: (Coulibaly & Fontagné, 2005) p7

The road infrastructure comes under the public authorities, who are more concerned with social and political issues, than they are with economic and trade development. For instance the military road blocks and check points (e.g. Abidjan to Ouagadougou at least 15 check points) during the civil unrest in 2002-2007, were a major problem for cargo transportation creating delays and major losses. Nothing was done about it until it became politically expedient as in October 2008 there will be elections and the government will need the voters. All these check and customs points limit the road system viability. The trucking companies are poorly organized, and have a low capacity for fleet renewal; this creates disequilibrium in the service demand and supply (UNCTAD, 1999). The road infrastructure is under public care the logistics service under a private economic operator. For the port to be able to realize regionalization, as stated in Chapter two, it must play the role of initiator and facilitator between these two major stakeholders.

ii)   Rail Transport

The rail system like the other transport mode, has inadequate regulations, an obsolete infrastructure (built in 1905-1954, single track metric line) and limited capacity. The train has two departures from Côte d´Ivoire to Burkina Faso (SITARIL, 2008) and it takes 12 days to travel 1260 km (CMA CGM & OTAL, 2008). The rail is under the management Bolloré (31%) a CMA CGM partner and Maersk (8%) (WorldBank, 1999) this decision make it possible to check deterioration of the system. This

agreement gives CMACGM and Maersk priority in cargo transportation over the other liner shipping services, reducing fair competition.

iii)   Port of Abidjan

While some ports are now handling vessels of more than 10,000 TEUs, the port of Abidjan is dealing with vessels of a maximum capacity of 2,500 TEUs (Harding et al., 2007). In Sub-Sahara Africa, where these countries are located, freight costs are 5% higher (UNCTAD, 1999). The ocean freight rate between countries is almost the same, the major differences existing in costs regarding inland transport for containers (UNCTAD, 1996). The high cost of liner service is not only due to inadequate information flow, poor interconnection between the various systems, but also shallow water and space demanding quayside. The liner shipping connectivity index for the port is 15 (0-100 best) (WorldBank, 2008b), which is a very low score. The liner connection is minimal in the region, showing that containerized cargo transport is not done much on this route. The just-in-time customer behavior lets us believe that there may be some potential still untapped; a niche market needed to be discovered in the region where agricultural products are the main export. Container traffic has opened up new challenges to port operations and management leading to a new physical infrastructure, functional (service provided), and finally information (intelligence, data) demands. These new demands have led to a private concession of the port of Abidjan container terminal to world class carriers and terminal operators in March 2004. 80% of the container traffic is handled by SEVT (Society d´ Exploitation du Terminal de Vridi), which is managed by CMA CGM (60%) and APMT (40%). The terminal is spread over 27 hectares of land and is certified under ISO 9001-14001 and OSHAS 18001. The world's largest container carriers are present: Maersk line, MSC, and CMA-CGM. 80% of the total container traffic is managed in the port area; there, the containers are stripped or stuffed. In 2007 the container traffic reached 530793 TEU, out of which 153930 were exported empty. In the table below are the principal shipping liner services between northern Europe and West Africa. CMA-CGM, Grimaldi, Maersk, MSC, and Zim / China Shipping offer

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an average service of: 5 vessels / 8 days / 10 ports of call / 161671 TEUs annual 2 way capacity each.

Table 13: Principal liner services Northern Europe/ UK& West Africa using Abidjan

Carrier	service	No of ship Size/ TEU	Frequency	Annualized 2-way capacity	Itinerary	Remarks
Delmas / OTAL	Weekly Direct **09 ports**	5x 2226	Weekly	231504	Felixtowe. Antwerp, le Havre, Dakar, Abidjan, Tema, Abidjan, Dakar, Felixtowe	MOL buys space
Delmas	Nigerian Express **10 ports**	4x 1325 / 1645	Every 9 days	120000	Hamburg, Antwerp, Felixtowe, le Havre, Conakry, Abidjan, Lagos, Apapa, Abidjan, Hamburg	MOL buys space
Grimaldi	Eur/West Africa S Express **15 ports**	5x 1050 / 1500	Every 9 / 10 days	78744	Amsterdam, Hamburg, Antwerp, Le Havre, Lisbon, Dakar, Lomé, Monrovia, Luanda, Pointe Noire, Boma, Douala, Takoradi, Abidjan, San Pedro	
Maersk line / Safmarine	WAF1 **06 ports**	3x 1928	Weekly	200512	Tangier, Algeciras, Tema, Cotonou, Abidjan, Tangiers	Tangier & Algeciras Hub
Maersk line / Safmarine	WAF6 **11 ports**	7x 1800 / 1928	Weekly	195416	Antwerp, Felixtowe, Rotterdam, Le Havre, Algeciras, Abidjan, Apapa, Douala, Abidjan, Algeciras, Antwerp	Algeciras global relay point
MSC	**08 ports**	5x 1855 / 2054	Weekly	203320	Antwerp, Felixtowe, Le Havre, Las Palmas, Tema, Abidjan, Las Palmas, Antwerp	
Zim / China Shipping cont.line	NAF **08 ports**	4x 1200 1600	Every 10 days	102200	Felixtowe, Hamburg, Antwerp, Dakar, Lagos, Tema, Abidjan, Felixtowe	Hapag-Lloyd buys space

Source:(Containerisation-International, 2008)

With the project Ile Boulay container terminal, the problem of terminal capacity has been addressed, but the rising environmental, social (about 10000 people to be relocated, (Côte d´Ivoire Planning Ministry 2008)), and political instability issues have resulted in a major delay in bringing new capacity into the market and a reduction in the container traffic.

4.1.2 Cargo Movement: Port – Hinterland relationship

A factor having a major impact on the port dynamic is socio-political issues, simply local constraints. Port –hinterland interaction has an impact on the development of the port. This was clearly demonstrated during the period of the socio-political crisis when the hinterland traffic was lost. The port traffic went from 16310000 tons in 2002 to 15520000 tons in 2003. Port performance is linked to its inland network, which provides access to the inland and hinterland cargoes as shown in the figure below.
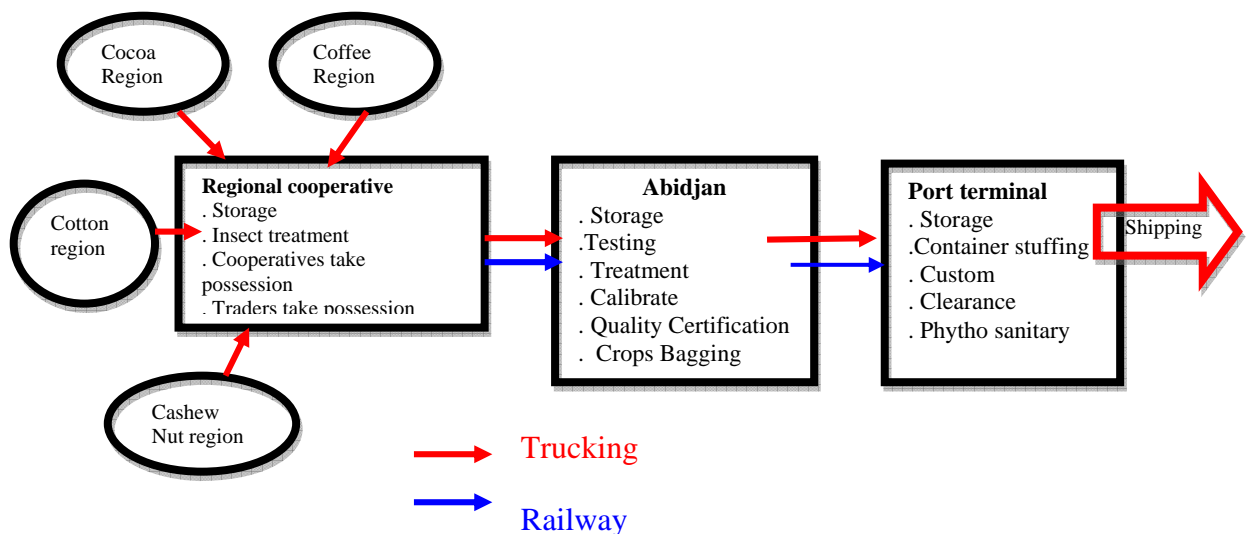
Figure 36: Farm to Port Cargo Handling and Storage system
Source: Author constructed, adapted from (Foster, 2006) p4

i)   Cargo export movement

Freight transport has become the most volatile and costly component of the area's agricultural product exporters. They have to deal with delays in the transport system, the rising oil price and complex security issues. These are compounded by bureaucratic constraints. The number of documents required to be an exporter in

Côte d´Ivoire is 10 and it takes 23 days to complete the procedure; 9 in Mali and 44 days, 11documents in Burkina Faso and 45 days to acquire them (WorldBank, 2008a). The cargoes are transported by the farmers mostly in smaller quantities as shown in the figures below. They are usually delivered in the cooperative receival sites. Where the crops are weighted and bagged. The transport in container will help take care not only of the small volume movement but also help in the identity preservation, the quality of the crop.

Figure 37: Cocoa transport to the main receival site in Côte d´Ivoire
Source: Atlas on regional integration, SWAC / OECD initiative 2006

Figure 38: Burkina Faso smaller farmer's cotton transportation
Source: Atlas on regional integration, SWAC / OECD initiative 2006

Two types of cooperative are functioning in the area:

- Simple Cooperative
- Cooperative exporter

The simple cooperative usually sells its products to the crop traders in the country directly, while cooperative exporters will take care of the crops up to the shipping point and sell them on the international market. From the cooperatives receival sites the crops are moved to the testing calibrate warehouse. There the crops are fumigated and bagged and the quality assured.

<u>Cargo movement Pricing</u>

The average cost of container export in Côte d´Ivoire is US$1653 per TEU, in Burkina Faso US$ 2096 per TEU and Mali US$ 1752 per TEU (WorldBank, 2008b). These costs are shared as follows:

- 51% port cargo handling charges
- 40% transport from inland to port
- 9% documentation

At the port, depending on the choice of export mode, the cargo handling cost is portioned as shown in Figures 40 and 41.
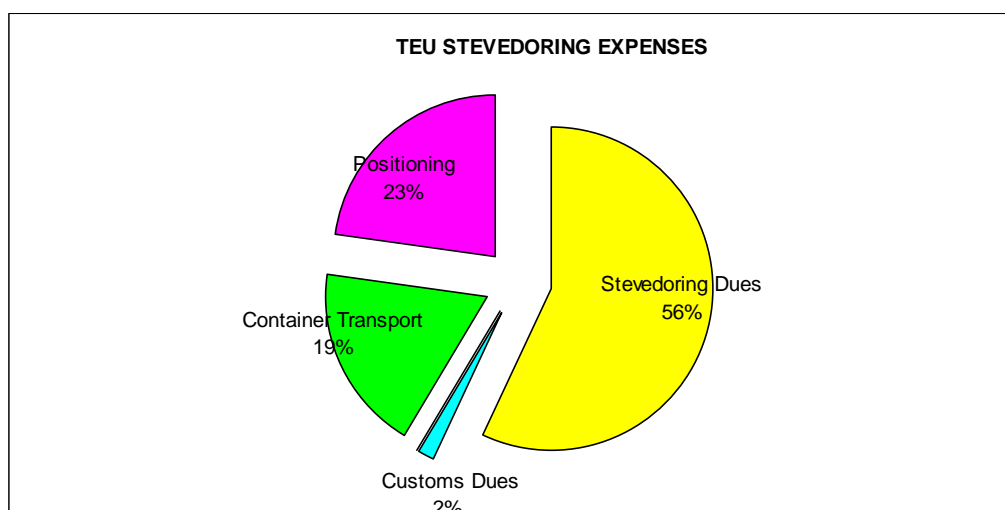
Figure 39: Transportation share of total terminal container handling cost
Source: Author constructed adapted from Stevedoring companies survey, 2008

BULK CARGO STEVEDORING EXPENSES
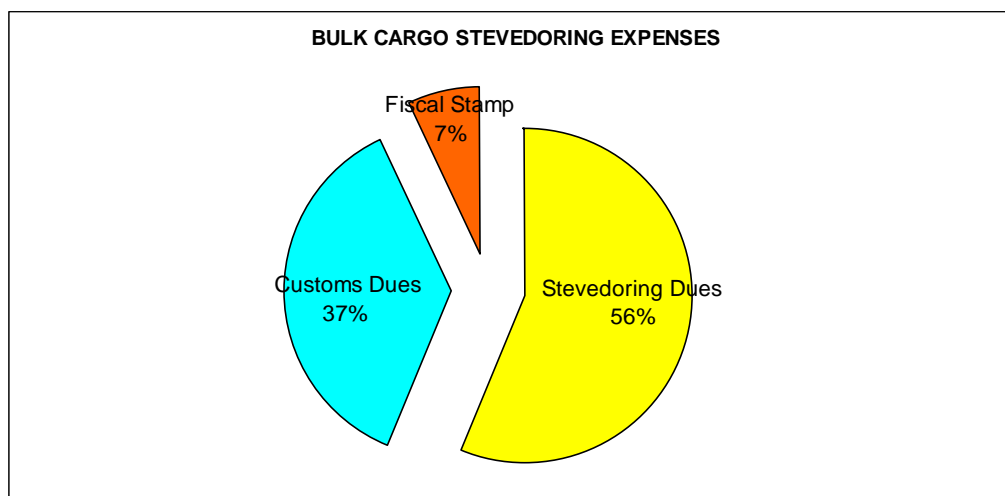
Figure 40: Transportation share of total bulk cargo handling cost
Source: Author constructed adapted from Stevedoring companies survey, 2008

The cargo handling cost also depends on the commodities exported as shown in the
Table below.

Table 14: Cargo Handling Costs in Euro

	Cost TEU per Ton	**Cost of Bulk per Ton**
Cocoa	71.03	55.38
Coffee	71.03	55.38
Cashew Nuts	75.55	59.9
Shear Nuts	70.84	55.19
Cotton Fiber	69.09	53.46
Cotton Seeds	71.44	55.79
Log Teak	72.54	56.89
Sawn Timber	72.14	54.87

Source: Author constructed from Stevedoring companies survey, 2008

The movement of cargo in the area is not only impaired by the transport costs but
also by the transportation length. Moving cargo from the Port of Abidjan to Bamako
(Mali) by road will take 9 days, from the Port of Abidjan to Ouagadougou (Burkina
Faso) by rail takes 12 days and from the Port of Abidjan to Bobodioulasso (Burkina
Faso) by rail takes 11 days. The inefficiency of the network is obvious; the distance
from Abidjan to Bamako is 1184 km, the truck therefore travels 8.22km / hour
(removing the 08 hours / day of sleep). These delays increase the risk of the cargo
being damage. Liner shipping and port managers have to deal more and more with

cargo transport causalities; therefore logistics reliability and capacity have become the most critical elements in handling total cost issues. These developments undermine the very essence of containerization forcing the Ivorian port market player and government to rethink the way in which containers flow and the associated logistic infrastructure is managed in the port of Abidjan.

4.2 PROPOSAL FOR OPTIMAL USE OF EMPTY CONTAINERS

Port regionalization expands Burkina Faso and Mali economic operators reach of the port, linking it more closely to inland freight distribution centre. The regionalization concept is used to improve the efficiency of the geographical connectivity of the gateway through a more flexible intermodal function as stated in Chapter two. The area productions are distributed all over the region; cocoa, coffee, and timber in the southern part, cotton, shear nuts and cashew nuts in the northern part making the production area fragmented. The Port regionalization system creates a distribution network that fits the fragmented production to better optimize the use of empty containers.

4.2.1 Existing situation: Empty Container Movements

Figure 41 shows the movement of empties in the port today. 80% of the containers remain in the port area, where they are stripped or stuffed, which saturation decreases the port productivity. 10% of the containers remain in the city of Abidjan where the liner service can better control their movement. The remaining 9% are transported via rail to Burkina Faso, where SITARAIL takes care of the equipment which remains on their site. There is today no proper linkage between exporter, cargoes, and crop owner / producers and the liner logistic network system.
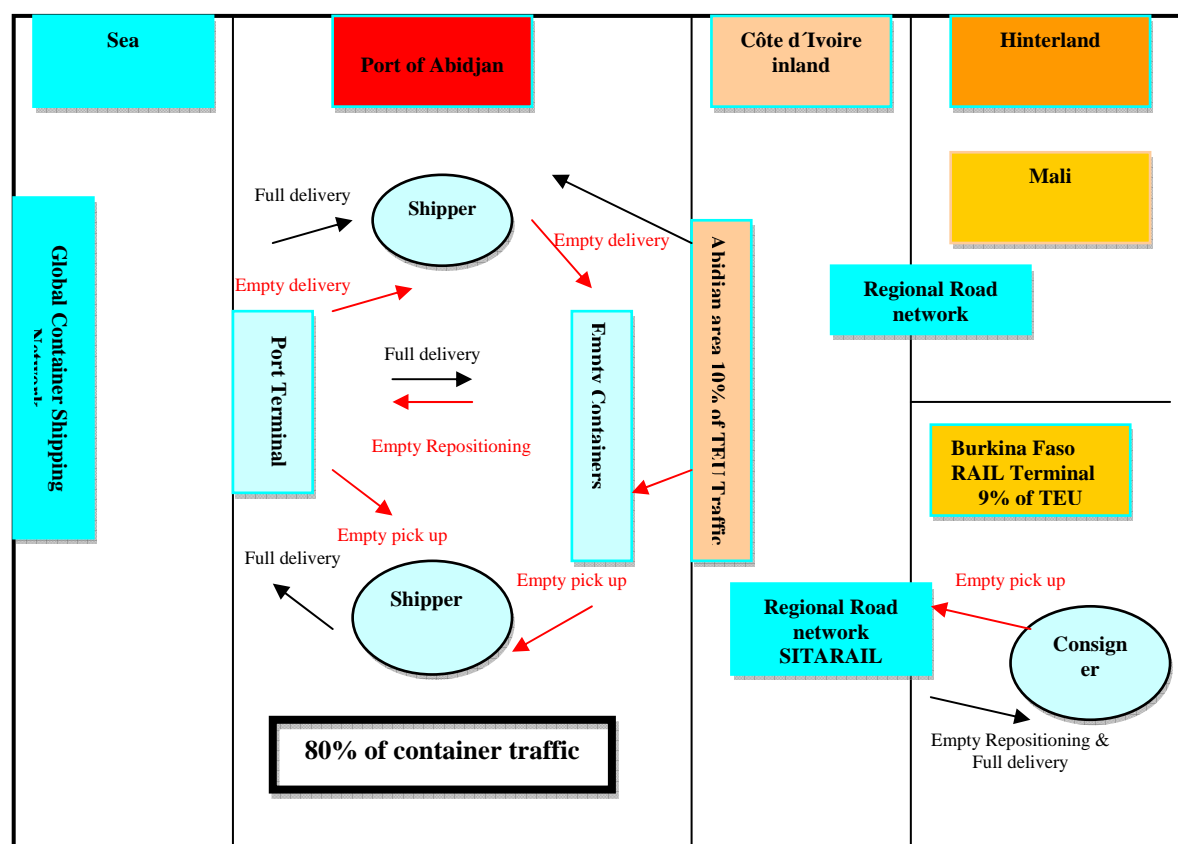
Figure 41: Empty Container Movement Port of Abidjan Existing Situation
Source: Author constructed from field data, 2008

The table below shows the cost distribution of the cargo transported from farms to the port on trucks for shipment in bulk or in containers. The highest cost is cargo loaded in bulk from the farm and stuffed in the port area in containers ready for shipping.

Table 15: Cost of cargo movement from farm to port

	Bulk Cargo Loading	Cargo Port TEU Loading
Côte d´Ivoire	84.94 Euro / ton	100.08 Euro / ton
Burkina Faso	147.70 Euro / ton	162.84 Euro / ton
Mali	152.87 Euro / ton	167.87 Euro / ton

Source: Author constructed from field data, 2008

Port loading in containers is more expensive making the bulk shipping of special

crops the preferred mode of agricultural products export in the area. To be able to monitor their equipment properly, the container manager prefers port loading where they have total control over the network.

4.2.2 Proposal for optimal use of export container

Regionalization provides an answer to the importance of the inland distribution network of the supply chain. It can improve its efficiency by integrating the logistics system, therefore reducing the total cost. Its goal is to reduce congestion by having access to inland and hinterland cargoes mainly through inland agricultural load centre accessible through the rail and major road networks. It is not only physically accessing the inland and hinterland, but also making sure that local and regional producers and producing clusters have the port capacity to support their export activities. This action for liner service is an opportunity to secure return freight to fill the emptied equipment. The regionalization process can be done progressively; firstly as presented in this study with a medium-term plan proposal with 4 logistics poles, and later a long term plan proposal with more logistics poles, adding other such as the port of San Pedro and Harper in Liberia for example, and Guinea cotton producing area.

i)   Medium term proposal 2008-2012

By adopting the port regionalization concept and the development of logistic poles, the port of Abidjan is getting closer to its fragmented customers and efficiently using the logistics competence of its various stakeholders, and more importantly, stuffing the empty containers with special crops for export.

Figure 42 shows the optimization of empties with the use of a logistics site, secondary logistics zone and logistics pole.

Logistics site: Local trucking companies and agricultural cooperatives are ready to collect the special crops and transport them to the secondary logistics zones.

Secondary logistics zone: There are regional capitals, where all the crops are from the region are transported, stored, treated, tested, quality certified,

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bagged, and stuffed in containers. Here the crop

processing and logistic centre is located.

First logistics zone: The port of Abidjan, main container terminal, export centre.

The containers are scanned and all documents are ready and checked.

Logistics pole: is formed by all the closest logistic site, and zone.

Abidjan Logistic pole: (Daloa 2[nd] zone + Yamoussoukro 2[nd] zone +

Bouake 2[nd] zone)

SKBO Logistic pole :(sikasso 2[nd] zone + Korhogo 2[nd] zone +

Ferkésedougou 2[nd] zone + Bobodioulasso 2[nd] zone)

Bamako Logistic pole: Bamako area logistics site

Ouagadougou Logistic pole: Ouagadougou area logistics site.

Crop exporters, when planning to ship their cargo in bulk at the port to be able to get an appropriate vessel calling at the port, should at least secure 3000 tons of freight. This will take 49 days in the planning horizon from farm to vessel loading. On the other hand port container loading, which is the other option given nowadays without a container deposit, has a double cargo handling process; first bulk from farm to port, then from port to export destination in container, which makes the total logistic very high. The cost ratio of bulk loading to port TEU loading is 1: 1.20.

The role of the port will then be to finding ways to mitigate between the stakeholders and satisfied their needs. For example solutions where the logistics carriers are assured of cargo availability and equipment safety and crop producers and exporters find an affordable transport cost and guaranteed cargo identity and quantity preservation. Source loading in TEU to the port will therefore be the proposed alternative. As shown in the Table below the cost ratio, source TEU loading to Port TEU loading, is 1:1.5.

Table 16**: Cost of cargo movement on truck logistic site source TEU loading**

	Bulk Cargo Loading	**Cargo TEU Source Loading**	**Cargo Port TEU Loading**
Côte d´Ivoire	84.94 Euro / ton	79.01 Euro / ton	100.08 Euro / ton
Burkina Faso	147.70 Euro / ton	106.11 Euro / ton	162.84 Euro / ton
Mali	152.87 Euro / ton	111.87 Euro / ton	167.87 Euro / ton

Source: Authors constructed Field data 2008
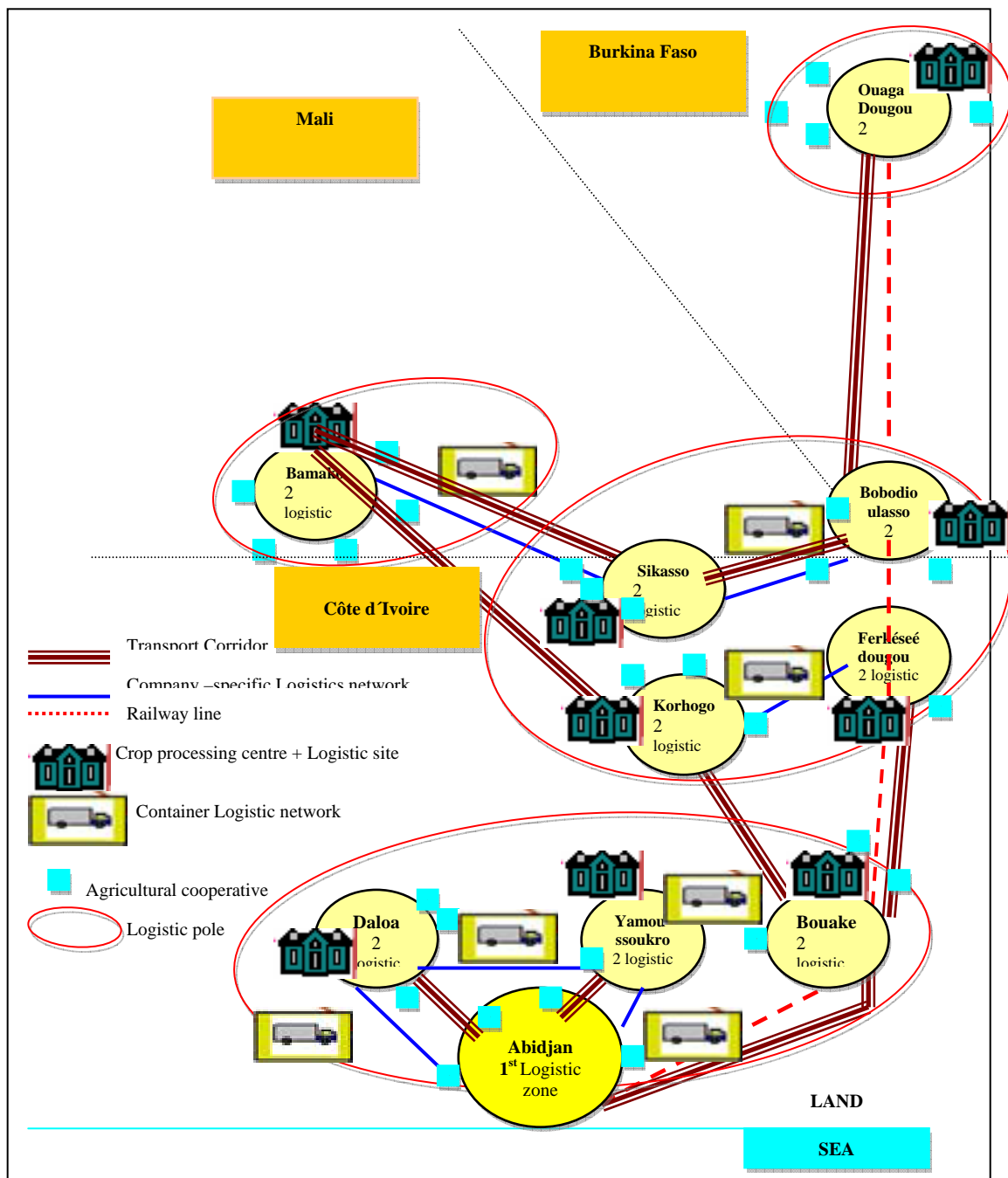
Figure 42: Proposal for empty containers management
Source: Author constructed adapted from (Notteboom & Rodrigue, 2008, p. 169)

Table 17 shows the time saved by using the containerized mode instead of bulk transport.

Table 17: Planning horizon for bulk and container handling of the cotton zone.

Bulk Handling System For export at least 3000 tons (150 trucks)	Days	Container System Port export at. least 1000 tons (84 TEUs)	Days
Site loading	10	Site loading + Quality Assurance	9
warehousing	22	Container terminal + Final customs	5
Quality Assurance + Final customs	10		
Bulk shipment	7	Container shipment	2
Total	**49**		**16**

Source: Author constructed field data, 2008

Container shipping is the most reliable and feasible way to meet today's customer just-in-time demand. According to the Table above, whereas containerized cotton can be shipped from its receiving site and leave the port in 16 days (about 2 weeks), the bulk system is much more time intensive being almost 7 weeks. Liner services, because of their policy of reduced transit time help to reduce the cost inventory and preserve the cargo integrity. With the advent of the Information Technology system small exporters and buyers can make full use of containers with direct shipment. These new strategies make it desirable for trade developments to use special crops such as cocoa, coffee, cotton, cashew nuts, shear nuts and timber and transport them in those empty containers ready for export, because it is a way to reach the new markets of various tonnage and increase profits.

- Abidjan Logistic pole: (Daloa 2nd zone + Yamoussoukro 2nd zone Bouake 2nd zone) is in the cocoa, coffee and timber zone.

- SKBO Logistic pole :(sikasso 2nd zone + Korhogo 2nd zone + Ferkésedougou 2nd zone + Bobodioulasso 2nd zone) is in the cotton cashew nut zone.

- Bamako Logistic pole: Bamako area logistics site is in the south west Malian cotton zone.

- Ouagadougou Logistic pole: Ouagadougou area logistics site is in the shear nuts zone.

Table 18 shows the population size in the logistic pole, its average production of special crops, and the cargo availability for Liner Company back haulage.

Table 18: Area Special Crop Production

	Population	Average production	Production yearly growth rate
Abidjan logistic pole	4.9 million	1.6 million tons / year	2
SKBO logistic pole	1.01 million	1.0 million tons	1.7
Bamako logistics pole	1.3 million	600000 tons / year	1.7
Ouagadougou logistic pole	1.2 million	400000 tons / year	1.7

Source: Authors constructed from field data (FAO, 2005-2006), (Transport & Abidjan, 2006)

The port cargo volume available and the amount of empty containers needed to satisfy the demand is shown in the Table 19.

Table 19: Crop Production and Empty Optimization

	Port market share	Port market share in tons	TEU needed (12 tons / TEU)
Abidjan logistic pole	61%	976000	81334
SKBO logistic pole	50%	500000	41666
Bamako logistics pole	20%	120000	10000
Ouagadougou logistic pole	50%	160000	13334
Total		**1756000**	**146334**

Source: Authors constructed from field data (FAO, 2005-2006),and (Transport & Abidjan, 2006)

This production is taking care of 146334 empty containers knowing that the port export is 153930 every year. Proper coordination between liner shipping and the agricultural producer can reduce the number of empty containers transported to 7596 TEUs.

Forecasting the 2012 demand at the end of the medium planning was done with some assumptions:

- The port is able as planned to get the hinterland traffic back to what it was before the socio-political instability

- The average production growth rate remains the same as 2006
- The port container handling capacity has increased

The empty container management through special crops is as shown in Table 20.

Table 20 : Crop Production and Empty Management 2012 estimate

	Production in 20012	Port market share	Port market share in tons	TEU needed (12 tons / TEU)
Abidjan logistic pole	1728000	67%	1157760	96480
SKBO logistic pole	1068000	60%	640800	32040
Bamako logistics pole	610200	42%	256284	21357
Ouagadougou logistic pole	400680	70%	280476	23373
Total			**2335320**	**194610**

Source: Authors constructed from field data (FAO, 2005-2006), (Transport & Abidjan, 2006)

Making the logistic part of the transport network as the port corporate strategies, will help stuff 194610 TEUs with special crops by 2012.

The Port's aim is to become the logistics provider and facilitator of the special crops producer and other exporters. It will then become a reliable deliverer of goods and services within a minimal uncertainty of time by finding a balance between the inventory carrying cost and the order cost of its various customers.

4.3 RECOMMENDATIONS

The port of Abidjan cannot be isolated from the international trade and shipping trend. So far, where liner services are concerned, it has not been able to integrate very well in the trends by increasing its container throughput and accommodating bigger vessels; yet current challenges may be turned into opportunities. Based on the key findings that emerged from this study the following recommendations have been made for consideration to improve the management of empty containers in the port of Abidjan. The prospect of more and larger vessels calling at the port, with the dredging and new container terminal Ile Boulay plan, offers an opportunity to reduce shipping costs, provided that necessary maritime transport, land transport and port reforms are undertaken.

The medium and long term container management plan aimed at developing a logistic quality service with focus on the transportation network system. Its intended result is a port as a logistic provider for a better container logistic management network which will facilitate the flow of container traffic while still protecting the competitive aspects of the area's special crops from the adverse effects of an unreliable transport network system. In order to adopt the port regionalization approach, consideration would have to be given to the following important aspects of the problem.

4.3.1 Strengthening the stakeholders structure in the area

i)   <u>Port of Abidjan</u>

1.   Increase transparency and good governance in port activities.
2.   Create a standard approach to detail data source management between the various stakeholders. Data concerning container movements, container availability, container velocity, special crops production, stocks, total export by port and mode (bulk, container), railway and trucking company capacity etc.
3.   Improve the port commercial relationship with first its hinterland and coastal partners, then the transport logistics providers and the various shippers councils, because non- performance of any of the fraction has a costly impact on the total industry.
4.   Act as the main logistic provider in the supply chain.

i)   <u>Logistics Providers</u>

1.   Integrate through a standardized system, the management of container movement especially the use of empty container filled with special crops as a back haulage for liner shipping. At a cost which is covering the liner companies' variable cost of operation with the cooperation of all the players.
2.   Give a special incentive (cost reduction for respecting term of contract) to the special crops provider so as to encourage the use of container logistics.

iii) <u>Special Crops Producers</u>

1. Increase transparency and good governance in special crop financial institutions.

2. Improve transparency and decentralization in the management of the special crops sectors.

3. Reform the special crop sector to respond to the international trade demands, of organic, quality preserved and assured production.

4. Build the capacity of the farming community through training, refreshing courses, commodity market, understanding their various specializations.

4.3.2 Strengthening harmony between the various governments

i) <u>Transportation Infrastructure and Policy</u>

1. The Ivorian government should promote trade friendly regulations and procedures by abolishing the regulatory framework that uses the port as the main source of the country's fiscal revenue (port customs contribute to 60% of the country's budget). This acts as a disincentive to its efficiency and forces the customer to look for alternative courses of action.

2. The various governments should invest in road infrastructure to improve access to the port for better efficiency.

3. Encourage transport integration policies, improve infrastructure as a means of keeping ahead of cargo demand, because there is an untapped potential calling for transport logistics improvement.

ii) <u>Trade policy</u>

1. Facilitate trade and land transport outside the port along the main trade corridors.

2. Increase private participation not only in maritime infrastructure buildings but also in human resource building and management, especially in container terminals and depot management in the area.

3. Increase competition among liner shipping services.

iii)   <u>Socio-political environment</u>

1.   Increase transparency and good governance in decision making institutions.

2.   Increase grass root conflict management among the community groups in the area.

3.   Sustainable conflict management among the Ivorian political parties.

4.   Strengthen the relationship among the various governments.

The figure below shows the sustainable Participation Framework for Efficient Empty container and special crops export management in the area if all the parties wish to increase their trade volume.

PROCESS

Global container Traffic

OUTPUT

Special crops farmers

Trucking Companies

Export of Special Crops in containers

Special crops dealers / traders

Liner Shipping Logistics

International Commodities Market Demand

Special crops processors

SITARAIL Railway

Container Terminal Operator

Liner shipping companies

Empty Container Management

Special Crops Quantity & Quality Preserved

Special Crops Market accessibility

Increase in Port container Throughput

REQUIREMENTS

Government of Burkina Faso

Port of Abidjan

Burkina Faso Farmers / Shipper's council

Government of Mali

Regionalization Port Community

Mali Farmers / Shipper's council

Government of Côte d′Ivoire

Area transport & Logistics providers'

Côte d′Ivoire Farmers / Shipper's

Figure 43: Participation Framework for Optimization of Empty container and special crops export
Source: Authors constructed 2008

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Following the implementation of these measures it is anticipated that the area will become a more efficient container logistics provider where the players' total costs are fairly reduced.

4.4 CONCLUSION

This study, has pinpointed some critical factors in the view of better management of empty containers through the use of special crops. The question that needed to be answer was how to manage empty container movement. Therefore, with the Port of Abidjan as a case study, the study sought to:

- Assess the circumstance that gives rise to the container traffic directional imbalance.
- Identify the various strategies in place for managing empty containers.
- Asses the state of liner shipping container traffic and cargo movement in the study area
- Explore possibility of using special crops as a means to optimize the use of containers and curb the empty container traffic.

The outcome of the study has shown that liner service as a logistic provider is not properly developed in the area. The door to door service that adds value to the movement of container is none existent. This is due to a number of problems and challenges which include:

- Port Authority and liner companies' inadequate policies and regulations
- The inefficiency of the transportation network
- The High cost of moving cargo in the area.

Despite these problems and challenges, the study revealed a number of issues that serve as prospects to the optimal use of empty containers.

- The availability of special crops for containerization
- The accessibility to the hinterland market
- The return to socio-political stability in the area
- The political will to develop the port as an efficient hub.

- The presence of the biggest liner shipping company in the port community.

The port of Abidjan has to catch up with the new changes in the industry, because the transportation system has now become part of the production.

It should be a logistics platform, which not only does the cargo handling but also its transformation and distribution towards and out of the landside and hinterland. These functions will therefore add value to the logistics chain and reduce the export of empty containers outside the country.

The best way for the liner service to secured return freight for empties is to multiply their inland service network. They must co-exist with the agriculture network so as to create logistics pole. The management of empty containers with special crops through port regionalization promotes the sustainable production and transportation of special crops. This concept permits to identify and address transportation problems so as to increase the port efficiency, but importantly in a country which has been in socio-political turmoil it strengthens the cohesion of the community which is in total agreement with the findings of (Notteboom & Rodrigue, 2008) and (Quorum Cooperation, 2005-2006).

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APPENDICES

Appendix 1: Port traffic data

Port total traffic in tons

years	Import	Export	Total
1985	5368090	3886662	9254752
1986	5723731	3747572	9471303
1987	5959472	3581758	9541230
1988	5973719	3462653	9436372
1989	6273077	3857626	10130703
1990	5774657	4063281	9837938
1991	6047509	3995400	10042909
1992	6178182	3984204	10162386
1993	6165632	4045406	10211038
1994	6275197	3793593	10068790
1995	7399429	4173441	11572870
1996	7895403	5465823	13361226
1997	8714289	5039679	13753968
1998	9971722	5101868	15073590
1999	9463259	5490270	14953529
2000	8631660	5589033	14220693

Port Traffic Per continent Import in tons

	1995	1996	1997	1998	1999	2000
Africa	3929629	3792037	3772543	4053554	3938694	3957663
America	555579	859568	758789	859951	735416	550916
Asia	624343	522870	705696	1564508	1970718	1921140
Europe	2288982	2720927	3473963	3449109	2818431	2196474
Total	7399429	7895403	8714289	9971722	9463259	8631660

Port Traffic per Continent Export in tons

	1995	1996	1997	1998	1999	2000
Africa	1718008	1967944	1773208	2147942	1947656	1974691
America	342422	910095	938601	706485	874291	1024694
Asia	305292	365105	374518	338442	544415	544642
Europe	1807719	2222672	1935816	1908890	2123908	2019157
Total	4173441	5465823	5039679	5101868	5490270	5589033

Total traffic per continent in tons

	1995	1996	1997	1998	1999	2000
Africa	5647637	5759981	5545751	6201496	5886350	5932353
America	898001	1769663	1697390	1566436	1609707	1575610
Asia	929635	887975	1080214	1902950	2515133	2465782
Europe	4096701	4943599	5409779	5357999	4942339	4215630

years	Port Throughput (000) of tons	General Cargo Export (000) of tons	Container cargo (T) (000) of tons
2001	17179	7043	4399
2002	16310	6198	3409
2003	15520	5898	3244
2004	17770	6655	5380
2005	18662	7511	4891
2006	18857	7818	4272
2007	19894.6	8491	4670

	Total	Total container
1985	9254752	
1986	9471303	
1987	9541230	
1988	9436372	
1989	10130703	
1990	9837938	
1991	10042909	
1992	10162386	
1993	10211038	
1994	10068790	
1995	11572870	2973478
1996	13361226	3622398
1997	13753968	4872641
1998	15073590	5632376
1999	14953529	4244731
2000	14220693	5482205
2001	17179000	6665452
2002	16310000	5056100
2003	15520000	3788010
2004	17770000	5377914
2005	18662000	4889844
2006	18857000	4269203

Appendix 2: Hinterland export traffic

Burkina Faso Export Traffic in tons

	1995	1996	1997	1998	1999	2000	2001	2002
Shear nut	2398	6155	3651	20778	17361	10722	13044	1839
Cotton seeds	1348	107	1178	4315	24	12071	4184	808
Cotton fiber	62254	58851	82116	118098	106625	89613	77722	78861
% of Total								
Total	**83062**	**78555**	**103591**	**161099**	**155363**	**132191**	**116728**	**111785**

	2004	2005	2006	2007
Shear nut	1412	6309	8320	
Cotton seeds	1589	7098	7098	
Cotton fiber	14650	65461	88586	
% of Total				
Total	**23534**	**105158**	**138673**	

Mali Export Traffic in tons

	1995	1996	1997	1998	1999	2000	2001	2002
Shear nut	2172	4731	2966	7822	7864	7339	10526	581
Cotton seeds	1400	5635	12800	7203	93	5026	3034	0
Cotton fiber	98706	114004	125428	135667	148015	155161	83083	153544
% of Total								
Total	**103675**	**126760**	**147815**	**155951**	**162185**	**173275**	**101043**	**173793**

	2004	2005	2006	2007
Shear nut	2687	3399	5070	
Cotton seeds	2488	3147	4694	
Cotton fiber	44585	56396	84120	
% of Total				
Total	**53505**	**67680**	**100951**	

PAA HINTERLAND MARKET SHARE

Countries		2001	2002	2003	2004	2005	2006
Burkina Faso	Tons	380152	396977	13255	117670	420634	495259
	%	64.52	56.42	1.73	11.84	42.9	50.5
Mali	Tons	1038201	1044630	277571	267521	338400	504754
	%	66.08	54.62	14.34	13.82	17.7	26.4

	2001	2002	2003	2004	2005	2006
Burkina Faso	64.52	56.42	1.73	11.84	42.9	50.5
Mali	66.08	54.62	14.34	13.82	17.7	26.4

Year	B. Faso	Mali
1995	83062	103675
1996	78555	126760
1997	103591	147815
1998	161099	155951
1999	155363	162185
2000	132191	173275
2001	116728	101043
2002	111785	173793
2003	2187	61022
2004	23534	53505
2005	105158	67680
2006	138673	100951

Appendix 3: Containers traffic

	Container traffic without Transhipment			
years	Total Traffic	Total Export	Empties Export	Empty/Export
1995	261324	128052	30259	23.63%
1996	308558	154457	38127	24.70%
1997	416111	206066	49252	24.00%
1998	468727	232475	58742	25.27%
1999	354389	172340	55490	32%
2000	377514	190496	47121	24.75%
2001	329991	164995	41249	24%

	Container traffic without Transhipment				
years	Total Traffic	Total Export	Empties Export	Empty/Export	Total Traffic
2002	370602	183819	51469	28%	579065
2003	384531	189574	61232	32.30%	600829
2004	428612	212733	73131	34.40%	669843
2005	397929	197187	62072	31.45%	571674
2006	366629	180939	51877	29%	507119
2007	432000	212976	61763	29%	621000

Container traffic without Transhipment in TEU		
years	Total Traffic	Empties Export
1995	261324	30259
1996	308558	38127
1997	416111	49252
1998	468727	58742
1999	354389	55490
2000	377514	47121
2001	329991	41249
2002	370602	51469
2003	384531	61232
2004	428612	73131
2005	397929	62072
2006	366629	51877
2007	432000	61763

years	Empties Export	Empty/Export
1995	30259	23.63%
2003	61232	32.30%
2007	61763	29%

Appendix 4: Cargo handling cost

Coffee TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	2.30 euro / T
DTM	1.52 euro / T
Port Community Dues.	0.03 euro / T
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	2.56 euro / T
TOTAL	**71. 03 euro / T**

Cocoa TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	2.30 euro / T
DTM	1.52 euro / T
Port Community Dues.	0.03 euro / T
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	2.56 euro / T
TOTAL	**71. 03 euro / T**

Cashew Nuts TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	7.01 euro / T
DTM	1.52 euro / T
Port Community Dues.	0.03 euro / T
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	2.37 euro / T
TOTAL	**75. 55 euro / T**

Shear Nuts TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	2.30 euro / T
DTM	1.52 euro / T
Port Community Dues.	0.03 euro / T
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	2.37 euro / T
TOTAL	**70. 84 euro / T**

Cotton Seeds TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	2.90 euro / T
DTM	1.52 euro / T
Port Community Dues.	0.03 euro / T
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	2.37 euro / T
TOTAL	**71. 44 euro / T**

Cotton Fiber TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	1.22 euro / T
DTM	1.52 euro / T
Port Community Dues.	0.03 euro / T
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	1.72 euro / T
TOTAL	**69. 09 euro / T**

Teak Log TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	2.60 euro / m 3
DTM	1.52 euro / m 3
Port Community Dues.	0.03 euro / m 3
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	1.72 euro / T
TOTAL	**72.54 euro / T**

0.74 m^3 = 1 ton   1.35 T = 1 m^3

Stevedoring Expenses in Euro /TEU	
Stevedoring Dues	125.77
Customs Dues	4
Fiscal Stamp	0
Container Transport	41.16
Positioning	50.31

Sawn Teak TEU handling cost	
Consignment	
B/L Delivery	38.11 euro / B/L
Port Expenses	
Port Dues	2.30 euro / m 3
DTM	1.52 euro / m 3
Port Community Dues.	0.03 euro / m 3
Stevedoring Expenses	
Stevedoring Dues	125.77 euro / TEU
Customs Dues	4.00 euro /declaration
Fiscal Stamp	0.76 euro / dossier
Container Transport	41.16 euro / TEU
Positioning	50.31 euro / TEU
Health Certificate	
Forwarding Expenses	
Customs Forwarding Dues	1.72 euro / T
TOTAL	**72.14 euro / T**

$0.74 \text{ m}^3 = 1 \text{ ton}$ $1.35 \text{ T} = 1 \text{ m}^3$

Appendix 5: Côte d´ Ivoire ministry of commerce data

EXPORTATIONS ANNUELLES IVOIRIENNES (en valeur, poids)

Version 2007 provisoire / En millions de francs CFA / Poids en tonne	2002 Valeur	2002 Poids	2003 Valeur	2003 Poids	2004 Valeur	2004 Poids	2005 Valeur	2005 Poids	2006 Valeur	2006 Poids	2007 Valeur	2007 Poids
AGRICULTURE, ELEVAGE, P	146 443	710 414	27 259	99 483	43 084	163 551	59 018	188 797	2 574	5 037	58 021	263 323
Céréales	13 328	53 314	9	57	145	497	397	1 550	2	4	189	1 048
Féculents	9 236	598 411	205	827	781	2 616	422	1 600	148	669	353	1 483
Elevage et chasse	512	14	34	4	23	3	6	1	6	1	1	0
Pêche	123 297	12 216	2 472	1 934	2 226	2 440	2 364	3 777	1 368	1 076	7 603	9 710
Autres fruits	70	46 458	24 539	96 660	39 910	157 994	55 829	181 869	1 049	3 287	49 875	251 082
AGRICULTURE INDUSTRIEL	27 963	2 085 711	1 240 984	1 795 162	1 107 761	1 924 957	940 106	2 068 358	111 886	266 388	180 738	624 950
Café vert	2 322	2	45 863	121 600	49 184	146 546	36 688	94 669	5 494	8 701	6 211	26 388
Cacao fèves	7 058	8 507	1 007 604	947 858	850 113	1 060 641	777 859	990 956	38 083	46 924	3 626	2 194
Cola	3 499	1 027	325	8 740	915	14 616	834	13 520	30	224	629	9 932
Ananas frais	1,3	2 857	28 966	173 518	28 230	158 736	24 953	132 077	10 516	56 140	18 527	96 558
Banane	0	148 587	50 974	242 280	53 570	252 281	49 681	234 267	26 554	123 833	60 446	288 456
Coton en masse	180	8	9 882	3 352	1 277	3 169	124	111	493	863	46 829	79 605
Oléagineux	51	1 253 957	402	110	1 536	622	1 253	300	81	33	5 114	18 668
Graines d'oléagineux	1 085	25 796	5 728	106 437	6 493	97 109	6 787	102 599	12	54	1 057	389
Caoutchouc	964	10	72 613	132 313	87 781	141 251	105	62	29 039	26 755	34 374	35 609
Sucre	2 692	605 194	12 738	41 709	9 062	26 055	8 046	27 764	487	1 480	55	47
Tabac	9 502	13 756	1 701	468	13 928	2 112	28 142	449 704	0	0	1 229	47 093
Autres	608	26 009	4 106	16 778	5 671	21 819	5 636	22 328	1 095	1 381	2 640	20 010
BOIS	36	7 536	156 217	499 253	160 559	428 597	3 121	7 053	10 598	27 578	33 181	274 148
Bois en grumes	10	316	19 259	126 703	160 559	428 597	2 955	3 582	3	21	16 590	137 074
Bois transformé	26	7 220	136 958	372 550	0	0	166	3 472	10 595	27 557	16 590	137 074
CONSERVES ET PREPARATIO	59 038	3 132 254	525 464	426 271	449 973	486 143	430 684	518 849	124 366	110 441	814 496	980 074
Cacao transformé	1	214	364 937	255 166	296 664	276 451	309 493	315 053	83 511	80 528	687 519	803 886
Café transformé	15 214	61 276	36 623	9 037	19 475	5 160	22 406	19 422	0	0	554	839
Conserves de thon	864	615 993	79 050	45 583	81 138	50 478	51 065	29 369	39 193	25 491	1	0
Conserves d'ananas	4 230	172 917	19	35	10	20	3	3	204	242	10 877	33 717
Jus d'ananas	1 392	14 386	662	1 662	3	8	972	2 160	0	0	196	233
Poisson fumé	349	2 388	391	643	601	374	840	261	395	114	110	95
Sucreries	497	2 196 722	8 947	13 352	7 510	10 615	3 830	3 009	0	1	36	79
Huile de palme	291	3 058	30 463	78 200	37 187	109 162	36 216	121 985	571	2 649	570	1 217
Huile de palmiste	6 602	62 411	31	132	62	239	35	142	84	312	35 450	89 381
Autres conserves et préparations	29 599	2 888	4 342	22 461	7 324	33 637	5 825	27 447	408	1 105	79 183	50 628
AUTRES PRODUITS	1 665 577	4 822 564	1 067 103	2 602 788	1 210 436	2 665 393	1 603 881	3 005 117	524 847	608 421	2 769 802	4 487 137
Dont :												
Engrais	20 541	44 488	12 205	64 107	21 605	102 987	7 376	8 810	0	0	1 617	165
Huiles essentielles	2 036	1	52 425	34 729	64 899	42 997	27 521	72 729	792	268	5 670	7 102
Prod. Chim. Divers	25 266	366	9 319	12 309	13 222	13 589	26 430	29 719	35	10	11	1
Plastiques	71	1	33 205	46 922	30 576	40 845	108 239	159 181	188	89	7 352	8 978
Produits pétroliers	37 807	575 596	126 686	789 560	16 675	139 333	3 170	9 132	10	9 344	494 916	2 073 533
Ciment	7 370	54 143	6 101	120 161	26 678	458 426	1 908	12 954	0	0	18 559	2 881
Papiers et cartons	8	52	33 108	43 612	842	221	73 708	129 304	9 163	16 725	132	2 701
Divers	1 572 477	4 147 917	794 053	1 491 387	1 035 938	1 866 994	1 355 529	2 583 288	514 659	581 984	2 241 544	2 391 776
TOTAL EXPORTATION	1 899 057	10 758 479	3 016 946	5 422 957	2 971 814	5 668 640	3 036 811	5 788 173	774 270	1 017 864	3 856 238	6 629 632

Source : Statistiques douanières / MC - DISD

IMPORTATIONS ANNUELLES DE LA COTE D'IVOIRE (valeur, poids)

Version 2007 provisoire / En millions de francs CFA / Poids en tonnes	2002 Valeur	2002 Poids	2003 Valeur	2003 Poids	2004 Valeur	2004 Poids	2005 Valeur	2005 Poids	2006 Valeur	2006 Poids	2007 Valeur	2007 Poids
PRODUITS ALIMENTAIRES	414 440	1 691 757	448 847	1 799 895	431 174	1 626 263	454 808	1 807 253	529 098	1 925 183	501 358	1 692 334
Produits laitiers	20 937	20 597	27 676	31 224	23 448	23 989	28 266	27 323	29 163	25 366	24 759	20 384
Fruits et légumes frais	12 737	56 909	16 450	76 924	13 780	67 395	17 246	99 618	19 100	73 473	17 132	65 625
Viande, poissons en conserves	2 046	1 792	2 903	2 735	2 648	2 475	3 208	2 986	3 714	2 710	10 565	12 634
Poissons	123 646	255 360	115 159	271 396	98 560	245 108	105 433	266 740	119 319	261 813	130 950	278 559
Riz semi-blanchi	90 625	701 459	90 680	730 888	111 864	703 437	133 919	808 204	152 292	903 214	43 147	270 559
Blé tendre	37 340	304 779	30 244	265 969	33 886	249 229	28 578	251 660	34 032	292 417	2 583	2 211
Autres céréales	4 420	33 271	1 633	11 667	1 889	14 188	3 956	33 405	835	5 745	155 502	805 779
Sucre	15 412	62 454	9 692	40 861	3 735	15 506	2 203	5 267	3 311	9 078	3 017	2 340
Boissons	-15 214	37 195	18 180	40 990	16 568	35 184	17 008	35 318	21 869	42 524	8 818	5 013
Tabac	21 128	3 701	24 142	1 960	33 409	4 771	27 324	3 948	37 541	4 943	20 857	11 883
Autres prdts alimentaires	70 935	214 239	112 087	325 282	91 386	264 982	87 666	272 784	107 922	303 901	84 028	217 347
AUTRES BIENS DE CONSOM	471 514	698 690	553 683	699 058	872 133	647 278	943 699	647 183	481 179	611 420	806 073	1 916 403
Vêtements	1 684	801	3 496	1 220	1 526	646	2 834	1 646	3 534	1 339	1 395	1 460
Prdts pharmaceutiques	68 035	6 027	70 228	5 321	79 866	6 090	76 335	5 756	79 112	5 981	12 344	23 444
Librairie	15 749	3 012	9	13	11 341	2 011	9 461	1 698	12 128	1 901	46	47
Plastiques	80 423	137 401	79 263	135 032	69 962	98 096	78 308	102 153	98 116	114 311	545	277
Caoutchouc	25 266	34 788	20 723	16 238	22 700	24 056	22 789	25 563	25 709	23 957	1 400	618
Automobiles	40 461	24 316	9 679	94	386 370	58 563	390 774	41 566	77 587	19 647	213 451	46 118
Effets personnels	4 648	1 402	2 696	1 112	6 423	1 691	2 668	1 116	2 623	1 274	3 426	1 679
Autres biens de consommation	235 249	490 943	367 589	540 028	293 945	456 125	360 530	467 685	182 370	443 011	573 467	1 842 759
BIENS INTERMEDIAIRES	713 759	5 079 246	531 640	3 971 053	834 242	5 543 589	1 162 811	5 663 455	1 280 837	5 434 969	1 266 339	4 643 490
Pétrole brut	290 925	2 375 246	311 174	2 599 271	546 610	3 668 356	836 648	3 941 539	919 238	3 631 327	5 227	94 163
Produits pétroliers	79 908	529 265	25 712	131 658	6 395	15 880	6 423	34 427	10 039	30 418	9 343	195 268
Produits chimiques	55 289	103 367	47 056	93 789	37 448	82 481	42 664	90 987	53 933	111 396	916 611	3 975 111
Coton	7 811	6 975	2 613	15 306	4 008	2 313	7 901	5 868	5 357	3 642	14 855	2 931
Autres fibres textiles	21 736	37 798	16 258	11 526	11 076	16 419	16 161	24 217	17 745	24 132	52 968	72 187
Fer, fonte, acier et ouvrages en	81 002	198 252	28 823	22 859	92 098	214 142	109 573	172 211	112 296	186 014	17 613	102 780
Prdts métalliques	12 540	4 842	25	4	10 047	4 442	10 234	4 327	10 691	3 924	54 218	31 773
Céram., verre, pierre	4 911	26 600	5 387	10 713	7 211	46 033	8 137	50 301	8 441	56 907	390	397
Engrais	38 935	345 830	29 092	238 065	32 036	257 091	34 351	226 252	38 911	263 752	19 595	80 617
Clinker	29 656	1 201 539	17 176	719 653	29 745	1 035 994	33 468	926 333	37 239	941 667	23 453	41 601
Autres matx de construction	6 424	133 973	6 510	117 433	7 803	148 137	7 858	139 101	7 687	125 141	33 641	4 643
Papiers et cartons	52 835	106 533	11 358	1 820	22 809	43 540	22 795	40 040	26 111	47 486	12	5
Autres biens interm.	31 787	9 025	30 458	8 957	26 955	8 761	26 599	7 853	33 149	9 163	118 413	42 014
BIENS D'EQUIPEMENT	214 438	167 328	476 634	68 361	270 567	48 214	480 282	43 522	670 806	110 835	624 345	151 768
Machines	63 003	17 853	1 672	371	100 920	21 656	129 862	22 237	156 063	33 602	128 592	46 118
Mat. électrique	511	207	40 646	13 234	1 786	453	3 244	1 364	149 708	30 210	15 290	3 085
Mat. de transp. routier	1 105	9	100 791	11 230	28 058	64	74 513	195	274 849	43 800	121 179	24 612
Autre Mat. de transport	107 034	133 793	13 992	1 386	72 390	5 703	216 483	3 179	61 857	253	105 708	29 012
Instr. de précision	350	181	44	9	458	209	560	139	24 452	1 736	245 210	43 395
Autres biens d'équip.	42 436	15 285	319 488	42 132	66 956	20 128	55 619	16 407	3 877	1 234	8 365	5 546
TOTAL IMPORTATION	1 814 151	7 637 020	2 010 803	6 538 367	2 408 116	7 865 342	3 041 600	8 161 413	2 961 921	8 082 407	3 198 115	8 403 994

Source : Statistiques douanières / MC - DISD

Appendix 6: Transport logistic quote from field survey

Cost of cargo movement on truck logistic site source TEU loading Côte d´ Ivoire

	Bulk Cargo Loading	Cargo TEU Source Loading	Cargo Port TEU Loading
Truck loading cost	2.87		2.87
Container stuffing cost		2.30	2.30
Transport farm to port cost	20.00		20.00
Warehousing cost	0.2		0.20
Transport Warehouse to quay cost	3.00		3.00
Container logistics / stevedoring cost		76.71	71.71
Bulk loading cost	58.87		
Total cost	**84.94 / euro / ton**	**79.01 / Euro / ton**	**100.08 / Euro / ton**
Planning horizon (Time period for process)	**49 days**	**16 days**	**14 days**

Cost of cargo movement on truck logistic site source TEU loading Côte d´ Ivoire

	Bulk Cargo Loading	Cargo TEU Source Loading	Cargo Port TEU Loading
Truck loading cost	1.80		1.80
Container stuffing cost		2.30	2.30
Transport farm to port cost	64.03		64.03
Warehousing cost	20.00		20.00
Transport Warehouse to quay cost	3.00		3.00
Container logistics / stevedoring cost		103.81	71.71
Bulk loading cost	58.87		
Total cost	**147.70 / Euro /ton**	**106.11 / Euro / Ton**	**162.84 / Euro / ton**
Planning horizon (Time period for process)	**56 days**	**23 days**	**21 days**

Cost of cargo movement on truck logistic site source TEU loading Côte d´ Ivoire

	Bulk Cargo Loading	Cargo Port TEU Loading
Truck loading cost	2.20	2.20
Container stuffing cost		2.30
Transport farm to port cost	68.60	68.60
Warehousing cost	20.00	20.00
Transport Warehouse to quay cost	3.00	3.00
Container logistics / stevedoring cost		71.71
Bulk loading cost	58.87	
Total cost	**152.87 / Euro / ton**	**167.87 / Euro / ton**
Planning horizon (Time period for process)	**58 days**	**23 days**