Intermodal technology implementation: the key for the functioning of port a system

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Abstract

Transferring freight transport from road to rail is one of the objectives of transport policy in Europe and a main concern in national and European policy. According to the White Paper on the Future of the Common Transport Policy, the development of Combined Transport should be encouraged as a cheaper and more financially attractive mode of transportation that will result in the transfer of freight haulage from road to the more environmentally responsible rail and water transport modes.

The aim of this work is to analyse the development and integration of new technologies for the improvement of intermodal transport operations on intermodal ports and terminals. Innovative transhipment techniques and the impact on interoperability for transport means and equipment will be the priority area. Results of this paper link with the project ITIP of the European Committee. The objectives of this report are:

- the survey and collection of data and technical information about different loading units adopted by the market and analysis of the problems related to their utilisation within innovative techniques (selection and adaptation).

Using intermodal information technologies should also help intermodal ports and terminals in maintaining or attracting additional traffic, since the competition for business is as fierce among ports and terminals as it is among carriers and enterprises. This research will provide a better understanding of how intermodal information technologies relate to the port industry.
Keywords: port system, intermodal transport, intermodal technologies, cargo flow, port access.

1 Introduction

Ports represent the gateway for goods and people to flow into cities and countries. They are the interchange between the land and the sea transport and are used for assembling and unassembling commodities moved in bulk or in containers. Maritime transport has become a faster and more reliable transportation mode. In order to reduce pollution and congestion on the roads, EU transport policy aims to stimulate the shift of traffic to short sea shipping. To meet this demand, seaports must increase their terminal capacity (demand for space) and to increase their productivity with new generations of cranes, that will be capable of handling goods (containers) in both directions automatically. The first shift to new technologies occurred in the 1950s with the introduction of container ships. The need for efficient handling of containers stimulated development of new equipment, such as straddle carriers, gantry cranes, and special tractors. Recent technical developments in intermodal technologies will lower personnel requirements and operating costs, increase control and speed the flow of goods through ports for attractive door to door services.

2 Port – interface of the land and water traffic

A port is a natural or man made harbour on the sea, river, canal or lake, where ships find shelter from waves, currents, tides, and ice; shelter from hostile action or attacks; a place providing bunkering, fresh water and provisions; a place for repairs on the hull, engines and gear, or for cleaning all the parts thereof; a place for safe and fast discharge, loading or re-loading of cargo and passengers; and a place allowing the crew to rest and relax [1]. Ports are a component of freight distribution as they offer a maritime / land interface for export and import activities. They represent points of convergence of inland and coastal transportation systems, - port's hinterland. This function can be direct and indirect. It is direct when freight reaches port directly through roads, or it could be indirect when freight reaches a port through a freight distribution center or through traffic being consolidated at a regional port and shipped by costal transportation. Every port provides services to ships with docks, berths, navigation channels and repairs (occasionally), and services with cranes, warehousing and access to inland distribution systems.

Seaports create unique challenges in establishing a policy framework. Traffic in European seaports is growing at about 4 % per year. For container traffic, annual increases between 7 and 15 % are estimated in the next few years. If no investments are made European trade will come to a standstill.

Today container traffic reaches approximately 60 million TEU per year. From 1997 to 2002, container traffic in the northern European ports increased from 14 to 20.6 million TEU per year and in western ports from 6 to 10 million TEU per year. Efficient port operations require good connections with the port's hinterland, which entail roads and a modern rail network with inland waterways.

The port has acquired its standing within the intermodal transport system by constituting a nodal point between two transport modes. The nodal linkage

between two different modes of transport should be functional, permitting efficient and secure movement of cargo [2].

Table 1: Traffic at Europe's largest container ports.

TEU	Rotterdam	Hamburg	Antwerp	Bremerhaven	Zeebruge	Total
1997	5,495,000	3,338,000	2,969,000	1,703,000	648,153	14,153,153
1998	6,032,000	3,546,900	3,265,750	1,811,014	776,357	15,432,021
1999	6,343,000	3,738,300	3,674,246	2,181,000	850,164	16,726,710
2000	6,275,000	4,248,247	4,082,334	2,751,793	965,345	18,322,719
2001	6,096,142	4,688,669	4,218,178	2,972,882	875,926	18,851,797
2002	6,515,449	5,373,999	4,777,152	3,031,587	958,942	20,657,129

2.1 Intermodal functions of port system

The intermodal function of ports must have some conditions and subjects that represent the basic function of ports. The services in a port depend on the type of the goods, the market area, consignee's requests and the ability and qualification of the staff adding new value to the goods. Additional elements important for intermodal functioning are; palletization, packing, storage, automatic invoicing, inspection and etc. The notion of intermodal function in ports contains new strategies of cooperation. The nature and dynamics of business demand from a number of suppliers and buyers, freight forwarders, agent, ship owners, carriers, banks, insurance companies to participate in a cooperating way in the strategy of advancement of the intermodal function. This is displayed in operational management, execution of transportation and defining the pricing policy. The main activity is control and tracing the flow of goods by a system of information and communication.

3 Innovative intermodal handling technologies

The train loader is not a transhipment device in the narrowest sense as the transhipment is done during the transit time. The storage area is re-organised and the trains are reloaded on the way. These trains can then in the port leave the ship immediately without further transhipment. The train loader concept only works in point to point networks as there are special facilities needed to allow the train boarding and leaving the ship. Thamesport – Automatic Guided Vehicles - is not a transhipment facility as such but a whole transhipment terminal listed here for its use of innovative transhipment devices, namely the AGV (automated guided vehicle). Transhipment operations within the Thamesport terminal are all carried out automatically, which means that human resources are necessary for the supervision of certain processes and for the transhipment from ship to shore. Use of the AGVs and their integration in the terminal procedures proves an overall successful method though the equipment is rather costly to start with [3]. At the

Maasvlakte terminal, use of AGV did not prove successful. Cranes with other transhipment vehicles were proved to function better than AGV. As the purchasing and maintenance cost was too high the fact that only about 32 units in contrast to 40 by standard transhipment could be handled per hour was an additional factor. Transfer of units within the terminal is again carried out by Multi-Trailer-Systems. The CPT Container Palled Transfer System is yet only a concept. The main purpose for its development was the time reduction of a vessel in port. Turn-around time means the time needed until the total transhipment off and onto a ship, train etc. is completed and it can leave the terminal again. With CPT the increase is quite large and the investment foreseen for the installation of such a system so far proves to be such a decisive failure factor that not even a prototype has been built yet. Also the system will need the installation of the same technology at the other end, i.e. it can only be used in point-to-point transport. For good implementation the transport between only two ports will need at least 3 of the mega-pallets that are 'transfer platform' for the containers, both factors accounting for higher cost. The River-Sea Push Barge system is also a concept that would lead to time and cost savings (time for the entire chain can be reduced by only having to change the 'motor' and not having to tranship the containers between river and short sea). In the whole system there is a loss of time when the change of motor unit takes too long. The dimensions for the new vessel type are largely determined by legal regulations for river barges but also by the stability conditions that are necessary for sea transport [3].

4 What?/how? model of intermodal port concept

In defining the what?how? model it is necessary to review methodologies of research to measure the level of acceptance of intermodal technologies and detail measures to increase acceptance and identification for future research needs. The impact of new intermodal technologies on the port system is the subject of this paper. Modelling of functional requirements of intermodal technologies has precisely defined benefits of developing innovative technologies in ports: the investment will generate benefits in the sphere of access, reliability and customer satisfaction.

The optimal approach and concept that allow research and improvement of the functioning of intermodal technologies is the user-driven development process supported by a clear explanation of needs, objectives, capabilities and effects. The user driven approach as a conceptual methodology can significantly improve the effectiveness of intermodal planning and is based on the mechanism of the What?How? cycle with two basic models: needs and solutions model.

The needs model supports the “what?” half of the cycle and it captures what the user wants initially and finally in a concise structured manner. It also accommodates changes and modifications, enables a flexible approach and co-operation between user and developer. The main components of the needs model are: initial needs, problems; intermodal technologies vision and objective statements; intermodal user services. The solutions model represents the other

half of the cycle and it contains the solution of how users needs can be satisfied by combining intermodal technologies together into a structured framework supporting the required interaction between components. The model contains enough detail to insure that needs would be satisfied in a manner that ensures a balanced resource investment, but also the model has enough level of abstraction to make subsequent changes to the proposed solution.

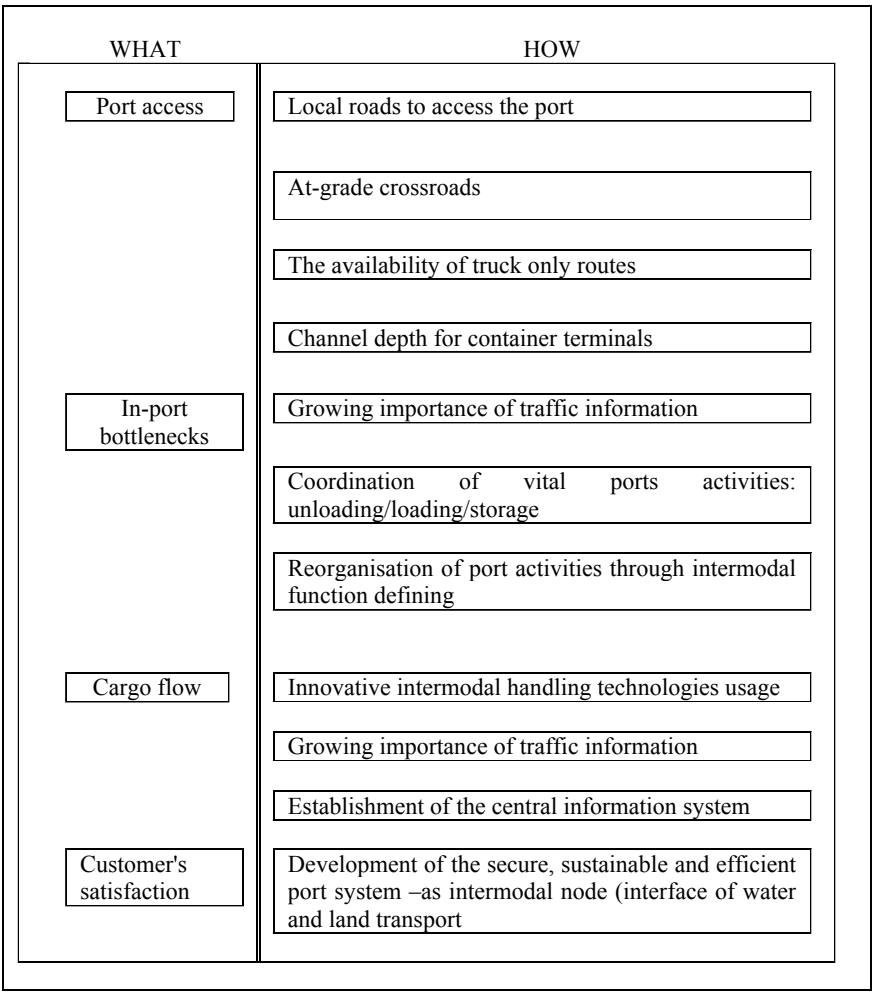

Figure 1: What?/How? model of the intermodal port concept.

5 Conclusion

This paper presents the importance of Intermodal technologies, according to properties and their active role in a transport system. The system complexity

based on the integration of innovative intermodal technologies of port components through fulfilling the functional requirements of intermodal technologies allows the establishment of the synergy relationship of all transport participants. Technological innovation must be specified in order to answer to a fundamental need in relation to customer's satisfaction, time and space and environment. To ensure interoperability of the innovations great care must be given to the system so as to avoid bottlenecks and to allow future modifications.

To be improved as regards intermodal quality and accessibility, a function will be improved/optimised through a particular technological development: this improvement will guarantee a certain level of particular quality criteria, at the 'output' of the function. Technological innovations are a way to increase quality and accessibility of a particular function, acting as a tool allowing efficient system integration.

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