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A Study on the Successful Factors for Logistics Information System in Maritime Transport Sector

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Ⅰ. Introduction

Electronic data interchange, EDI, is a powerful tool for communicating between trading partners. It is considered to be an advanced tool for modern logistics as it offers economic and strategic advantages in terms of competitiveness and allows for the provision of new and improved services [23, 28]. Two recent reports [3,6] have supported the claim that the expected tangible advantages prove to be valid : EDI indeed speeds up communications, allows for better control over information flows and quality, decreases the volume of paper, and reduces costs, thus obtaining a higher service level, followed by gains in efficiency(lower costs) and improved external aspects (held/gained clients, better relations with partners). In spite of these perceived advantages, EDI in the maritime transport sector is still in the stage of introduction, compared to the air line and airport industries. For only a small group of the advanced maritime nations in the world has EDI achieved its true

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potential.

This paper aims to describe some of the main problems and the successful factors, which are being found in the evolution of the present EDI systems for clearing import/export container cargoes, with special reference to Singapore, Korea, and Japan. Following this, leaving legal issues aside, to suggest workable guidelines for designing a new efficient EDI system for container cargo logistics. Prior to the concluding remarks in the paper, an argument is developed that although a late-comer to "EDI*sation*" may face many obstacles and resistance from its paymasters and sponsors it may be able to take full advantage of its relative backwardness, to obtain an error tested and proved EDI system, virtually off the shelf.

Ⅱ. A brief horizontal research of EDI development

EDI is applied in a growing number of sectors: retail/distribution; automotive; aerospace; defense; all transport modes; tourism; banking/finance; government; customs, and its principles are often taught and discussed in academic institutions. This section is devoted to point out some of the problems and successful factors which are being found in the process of EDI development and implementation for container cargo logistics, taking cases of MAINS in Singapore, KL-Net in Korea, and SHIPNET in Japan. This contributes to drawing workable and useful guidelines for designing a new efficient EDI system for container cargo logistics.

There is now a great deal of activity all over the world in trade facilitation services. Some value-added networks are designed to improve one particular aspect, or another, of the trade facilitation processes.

Table 1, below, contains a list of selected EDI trade and transport systems operation in the world and offers an introductory summary of the role of major EDI groups related to the maritime community. The table does not claim to cover all the developments now crowding on to the world EDI stage. It is there advisable to consult the detailed trade information provided by each group.

Table 1. Selected EDI trade and transport systems related to container cargo logistics in the world.

NAME (Start Year)	Bodies/Countries involved	Major services	Purpose
DAKOSY (1982)	Port community, Hamburg	Mail box,EDIFACT, GDCS†,DGIS††, Port-EDI, Customs clearance	Data communication systems for the transport sector
ADEMAR + (1983)	Port community, Le Havre	Mail box,EDIFACT, GDCS, DGIS, Port-EDI, Customs clearance	Exchange of information and documents for container cargoes between the operators of the Le Havre area with an inter-operator network. This systems is interfaced with SOFI system
FCPS (1984)	Maritime Cargo Processing, Plc, (MCP)	Mail box, DGIS, Inventory control, Customs clearance	To reduce clearance times for cargoes in the seaport areas. Applied in Felixstowe plus 13 locations, including ports, ICDs and an airport. Interface between FCPS and CHIEF.
INTIS (1985)	Port Community, Rotterdam	Mail box,EDIFACT, GDCS, DGIS, Port-EDI,Customs clearance	Communications network and information structure in Rotterdam.
SEAGHA (1986)	Port community, Antwerp	Mail box,EDIFACT, GDCS, DGIS, Port-EDI,Customs clearance	Belgian transport EDI system based on EDI network in the port of Antwerp.
SHIPNET (1986)	Nippon Telegraph & Telephone Corporation, Japan	Mail box	Exchange of shipping cargo transaction data using NTT mailbox facility
MAINS (1991)	Maritime Community, Singapore	Mail box,GDCS, DGIS, Port-EDI (PORTNET), Customs clearance	Maritime information system to integrate documentation in the maritime community
BHT (1993)	Bremen Harbor Telematics	Mail box, EDIFACT, GDCS, Port-EDI, Customs clearance	Integrated EDI-network of compurter systems of the transport industry, authorities and carriers.
KL-NET (1994)	Maritime community, Korea	Mail box,Port-EDI	Shipping communication system for container cargo logistics in the maritime community

† GDCS : Global Data Communication System

†† DGIS : Dangerous Goods Information System

Sources : Compiled by the authors.

It can be seen from the table above that the development of EDI systems around the world only started in the mid eighty's and then was focused on the needs of the major port communities in their endeavors for competitive advantage. The port that were involved were those ports that were entering the stage of third generation development, in other words they were the ports that realized that their future depended on creating a firm working relationship with their customers and supplying the infrastructure to facilitate this.

It was on the basis of this pioneering work, which demonstrated the advantages of integrated systems, that the major industrial and port communities, such as Rotterdam and Singapore invested in maritime information systems and brought the full power of the newest computer technology into play.

1. The Singapore case: MAINS

MAINS, which was developed in the early 90's, among others in the table above, has been one of the most recently successful cases in the maritime community, which is shown by the following factors [7,16]:

- MAINS is a system that integrates documentation in the maritime community. In a community system data are sent once, are routed to partners and are shared among them. (see Figure 1) Therefore, the user needs to provide the cargo or shipping details only 'once'. Information will be stored in the MAINS data base for use by parties who need them. In other words, MAINS promises an end to information duplication and incorporates the requirements of all parties in the maritime community into a single database. Based on a single point of reference, cargo and shipping information are built up incrementally by various parties and data that are commonly shared. MAINS streamlines and rationalizes information flow. It eliminates many commonly used paper documents and results in many benefits.
- MAINS, as a totally community system, has been initiated and designed by the maritime community to meet its own needs, being developed from processes used by the nine major members[31] representing the majority of users in the port community.
- As a result, it integrates the international maritime national inland transport organizations, importers and the port operator and consolidates shipping documentation. MAINS, together with PORTNET and TRADENET reduces the documentation process for exporting a consignment from 35 to 16 steps. The time taken for each step is also significantly

reduced, due partly to the reduction in unnecessary duplication and replication.

- Finally, the Singapore government, and the Customs organization has played a crucial role in taking measures to facilitate trade by simplifying and harmonizing formalities and procedures, and doing away with paperwork, which has been aided through EDI. In particular the co-operation and co-ordination have been made between the Trade Development Board, port authorities, and customs offices. In implementing this streamlined documentation process, total cost savings are estimated at more than US$4 million a year.

The main problem associated with this type of system is the reliance on the central computer and in a competitive business atmosphere the feeling by the individual members, or branches, that information may be withheld and not fully shared. There has to complete trust in the integrity and honesty of the system, otherwise it begins to break down.

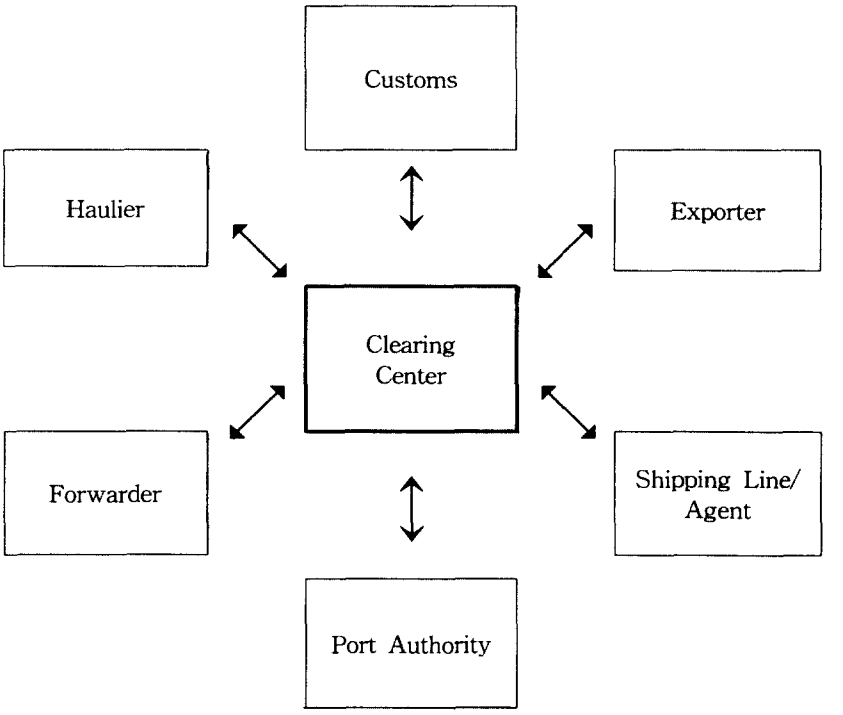

Figure 1. MAINS, EDI community system

This system has been in full operation for only three years, during which time it has been modified and adjusted to meet the developing demands of trade. New entrants to the various trade sectors are invited to join the MAINS system, and as experience is gained, the individual processed are streamlined through inter-sector consultation.

It should be noted that of the partners indicated in the Figure 1 above, the Customs authority and the port authority have to be considered as single entry and non competitive major contributors, while the other partners exhibit multiple opportunities for new firms to enter the arena and for mature firms to phase themselves out of, what they may see as a market which is developing too fast for their capabilities.

2. The Japanese case: SHIPNET

SHIPNET was established in 1986, and is a community network system which connects freight forwarders, shipping lines/agents, sworn measurers and tally firms. It aims to provide facilities to allow the optimum transfer of shipping documentation. It seems that the system is regarded as a failure case in EDI owing to the following reasons [20,30]:

- No government involvement, which has a policy of leaving such developments to the private sector.
- No support from port authorities; which in the Japanese case are many and varied
- No Customs involvement.

  All marine manifests and Customs entries are manually processed. It replicates the current manual process including all the inefficiencies associated with those manual systems. - transcriptions errors, inefficient use of staff resources, decreased speed of communications, and no reduction of data re-entry
- High user costs due to high cost of transmission lines: Costs to user are based on fixed costs associated with the speed of telecommunication lines. The combined cost per forwarding instruction through SHIPNET is ten times higher than that of FCPS in 1990.
- No communication standard message adopted:

  The unique communication standards adopted by NTT makes it difficult for foreign companies, including IBM, to connect their computers to NTT. However, local companies such as Fujitsu, Hitachi and NEC have no difficulty connection to NTT
- Lack of technical support and standard software packages for shipping lines: Each potential user, except for forwarding agents, must develop his own software, This of course is a

major drawback as the whole concept of shared EDI messages depends on the full use of compatible software and hardware systems.

An accelerating rate of attaining a critical mass of users is important for realizing the economic benefits associated with using EDI. However, in SHIPNET, there has been a considerable delay in reaching anything like the critical mass needed to achieve economies of scale or to encourage the more laggardly maritime community to join the system. This has been partly due to mismatch between the services marketed by the system suppliers and the potential users' needs and requirements, particularly where they perceive value added to current business processes and the full commercial benefits anticipated. Also in the Japanese case there are a large number of individual ports, each with different management styles and often specializing in individual trades.

Thus the adoption of the SHIPNET EDI system may be accepted in certain ports and regions, but at the same time large companies have also to deal with ports and administrations working to different models. This causes a duplication of effort and creates major difficulties in assessing the financial and operational benefits to be gained from an integrated EDI system.

Therefore, it is here emphasized that the ease of use and spread of EDI, rather than just the decision to adopt or the process of implementation, is the critical success factor in the long term and that EDI should be designed for users'-(customers'-)oriented market.

3. A Korean case: KL-NET

In Korea, for export and import shipments, as many as 350 different paper documents, including the purchase order, waybill, bill of lading, letter of credit, customs declaration, and insurance certificate, are required. The total number of documents transferred and generated for imports and exports during just one working day has been estimated at 2 million individual documents, or even higher. Indeed, the cost of trade paperwork in Korea alone is said to be US $8 billion per year. This has caused increase of logistics costs of container, and all other classes of cargo, resulting in a deteriorating international competitive edge for the Korean economy.

In these circumstance, the Korean government has been aware of the need to embrace EDI strategies in order to maintain a competitive market position with its international

trading partners. The Social Overhead Capital Investment and Co-ordination Committee, which belongs to the Presidential Office, has had initiatives to establish EDI systems since 1991. The committee decided that the Ministry of Trade and Industry would be responsible for developing EDI system for the trade and commerce sector, the Korea Maritime and Port Administration for the cargo logistics, and the Customs Administration for customs clearance.

As a direct result, in 1990, the Korea Trading Network(KT-Net)was established by the Korea Foreign Trade Association under the auspices of the Ministry of Trade and Industry. KT-Net encompasses all trading companies and trade-related organizations. Its scope covers licensing, insurance, customs clearance, use of bonded areas, duty drawback, foreign exchange, request for shipment, issuance of bills of lading and so on. After a trial period in 1994, the main system has provided full-fledged services in 1995. This system actually does not include the ports and the transport operators and thus a operators and thus a parallel system was needed to bring these important elements into the system.

The Korea Logistics Network(KL-Net) was founded in 1994 by the three major shipping companies, i.e. Hanjin, Hyundai, and Cho Yang, the Busan Container Terminal Company (BCTOC), the Korea Container Terminal Authority, shippers, forwarders, tally firms, and other professional maritime organizations. It aims to install and to exploit an EDI network for container cargo logistics which would allow exporters/importers to exchange data with the maritime community. The main system was put into operation in 1995.

Finally, the EDI system for the Customs sector is being developed for implementation by the KT-NET. Meanwhile, the Korean government has enacted the Korean Trade Automation Promotion Law, in December 1991, which legitimizes the use of EDI, fair competition between value added networks and the use of UN/EDIFACT.

Since 1992, government support of a large scale research fund has been invested in order to introduce EDI for container cargo logistics through KL-Net. In spite of this major effort, the evolution of EDI in Korea has been lamentably slow. The major problems which have arisen in the process of the introduction of logistics EDI into Korea are summarized as follows [15, 19, 24, 25, 26] :

- KL-NET has developed for inland transport and port operations without an overall blueprint for the total EDI system and without involving any pilot projects.

  The successful transition towards EDI implementation can be considerably eased by the use of a pilot project. Its objectives are : to prove the benefits of EDI: to prove the

operation of the interface between existing systems(e.g. KT-NET, PORT-MIS, BCTOC)and EDI links for both incoming and outgoing data: test the operation of the EDI clearing house and/or the carrier network; and redefine the operation cycle. The lessons drawn from a pilot project contribute to minimizing the problems of the full scale implementation of any network.

- Customs has not been included in the scope of Logistics EDI.
  Customs clearance of import and export freight involves the transfer of information about the goods from the importer, or their agent, to Customs offices. Therefore Customs administrations have a central role to play in the international movement of freight. Not only does the development of EDI give Customs the opportunity to facilitate a country's international trade by helping to remove the vast quantities of paper documentation currently required and by improving the processing of information necessary to grant Custom's clearance to goods, but also it maintains efficient and effective controls whilst creation minimum disruption to legitimate trade. Moreover, the increasing use of EDI allows traders to enjoy many economic and strategic benefits, including 'inconveniences' caused by bureaucratic and complicated procedures, in particular at Customs offices in developing countries.
- The sharing system of cargo data has not been considered in the framework of KL-NET system, unlike MAINS.
- Weak support from users, owing to big discrepancies between users' needs supported mostly by the KT-Net, and the services provided by the KL-NET.
- Low speed data processing owing to lack of network capacity of the KL-NET.
- Lack of interface services with existing EDI systems.

III. Guidelines for the design of a new efficient EDI system

If we are to succeed in establishing a new and generally applicable EDI system for container cargo logistics, there are three general prerequisites to success. Through the model we must understand more clearly:

- what the EDI is: what are its capabilities and limitations
- the transport sectors, maritime and inland, that the EDI system is to be used in : its

processes and the information that it uses.

- the broader context for the use of EDI: international standards, the law, the trading and transport process that create EDI messages and the benefits such a system can provide.

All three of these prerequisites to success will be aided by modeling tools that make us see the individual concepts behind container cargo logistics and the group concepts that, together, make EDI what it is [2, 5, 8, 11, 13, 27].

This section deals with tentative prerequisites and guidelines for a successful and efficient EDI system for container cargo logistics, based on the discussions in the previous section, the literature survey and the a series of interviews with EDI specialists[32].

- Design parameters for the system must take into account the requirements of all users, including customs, shipowners, agents, forwarders and cargo receivers and shippers.
- Because customs clearance and PORT-MIS are integral parts of container cargo logistics, it is a prerequisite to success of the system that they be included in the EDI system. Therefore, such an EDI system can provide users with the service of PORT-MIS and Customs systems through on-line and message exchanges.
- The planning design and introduction of the adapted EDI messages and the analysis of data pathways are in critical for the smooth introduction and acceptance of the new system.
- More important, to facilitate communication between trading partners and hauliers, both national and international, it is essential to adopt a standard global message standard such as UN/EDIFACT. In other words, it is necessary to adopt a reporting standard which is globally acceptable by trading partners and the transport community, while being fully accepted by local users and customers.
- The sharing system of cargo data must be integrated in the framework of EDI in order to enhance its benefits of cost saving and efficiency. The full benefits only accrue if EDI is viewed as an integral part of a complete system rather than just peripheral communications. This means that exiting procedures are reviewed and amended to take account of the EDI environment and that a bridge needs to be built between the existing processing systems and the EDI network. Such EDI can provide users with the tracking service for containers and dangerous cargo using the database, provides users with an electronic mailing service for the EDI.
- The EDI software for user must be developed and provided by EDI network operation

companies, as has been done in Europe, so that a consistent and specialized system can be maintained, rather than in dependent, in-house systems with different objectives and operating parameters.

- The EDI system for container cargoes should create value added services, and provide users with the on-line retrieval services, which are vessel schedule, container and dangerous cargo movements, ship and cargo statistics, ship status in port, and so on.
- Before starting, EDI developers should be aware of the technical problems and the organizational changes that go together with its implementation. Therefore the decision to proceed to full implementation requires that the pilot projects were successful - both in operating and financial terms.
- The most important issue is that a win-win environment should be created between EDI suppliers and users. The first steps in EDI should be taken on a very co-operative level; when this proves to run well, all the parties concerned can be expected to be convinced of the advantages of EDI, resulting in a higher eventual service level for all parties concerned.
- The EDI development should be associated with staff training and awareness courses because like with the introduction of other advanced communication technologies, the development and use of EDI can suddenly accelerate and in such a situation it can be deviated from the route it should follow, without a well prepared and understood EDI objective and strategy.
- EDI is important for the development of a country's economy in general; it helps to make administrative process more efficient. Investments in an efficient electronic communication infrastructure can be as necessary as financial investments in traditional infrastructure like ports and roads.
- As can be seen in the case of case of Singapore, with a single major port with multiple terminals catering for all categories of cargo, and a heavy concentration of industrial and trade customers operation in a relatively small geographical area, an important lesson can be pointed out that because of its independent position, government is in an excellent position to provide leadership by example to the private sector, and to act as a catalyst in the development of EDI communities.
- For further development of EDI the government should also be involved in the area of: message standardization (stimulation of the EDIFACT standards); legislation; and data communication (interconnectivity of networks). In other words, the government should

play a crucial role in coordination and stimulation in the areas of data communication, standardization and legislation.

Ⅳ. Concluding remarks

This paper has investigated the present situation of EDI with special reference to maritime transport mainly by a horizontal research approach and suggested tentative guidelines for successful design of EDI system for container cargo logistics as follows:

(a) The planning, requirement analysis and design of EDI are critical as it provides as it provides a framework for its implementation.

(b) As the data of customs clearance are an integral part of logistics EDI system, the inclusion of customs in the EDI system is essential.

(c) The sharing system of cargo data as the framework of the logistics EDI is efficient for data interchange.

(d) To facilitate communication between trading partners and transport sector, national and international, it is necessary to adopt a global message standard such as EDIFACT.

However, to carry out more valuable study on the efficient and effective EDI system, it is worthwhile to compare the present situation with the situation a few years from now.

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who are also represented by Trade Development Board; Customs and Excise; Singapore network Services, developer of the TRADENET, the National EDI network; Jurong Port; and Port of Singapore Authority.

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<국문초록>

우리나라 컨테이너 물류 정보 시스템의 성공 요인에 관한 연구

이 태 우 · 박 남 규

물류 산업 분야에서 EDI를 도입하기 위한 노력이 해양 수산부와 항만 운영회사를 중심으로 지속적으로 이루어지고 있다. 이러한 노력에도 불구하고 우리나라 물류 ED 시스템은 종이 서류를 전자 서류로 대신하는 시스템 구조를 채택하고 있기 때문에 이 문제를 극복할 수 있는 새로운 시스템의 출현이 요구된다 하겠다. 본 논문은 우리 나라에 도입되어 운영되고 있는 물류 EDI 시스템이 보다 한 차원 높게 발전하기 위해 요구되는 시스템의 성공 요인을 제시하는데 있다.

국가 또는 항만 단위의 물류 정보 시스템이 보다 효율적으로 운영되기 위해서는 단순한 전자 문서 전송방식보다는 데이터의 공동 이용 방식을 채택하는 시스템으로 전환되어야 한다. 그 이유는 항만을 중심으로 전송되는 물류 데이터는 그 특성상 약간의 수정을 거쳐 반복적으로 물류 조직 사이에 전달되기 때문이다. 본 연구를 위해 독일, 프랑스, 영국, 미국, 일본 등 발전된 물류 정보 시스템이 검토되며, 아울러 KL-Net이라 불리우는 우리나라 물류 정보 시스템의 고찰이 이루어 지고 있다. 선진화된 항만의 물류 정보 시스템으로부터 시스템의 성공 요인이 도출되며 이 시스템을 실현하는데 경험하게 될 몇 가지 어려운 점이 논의되고 있다.