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Professor **Damir Zec**, Ph. D.
Ass. prof. **Dragan Čišić**, Ph. D.
Ana Perić, B. Sc.
University of Rijeka
Faculty of Maritime Studies
Studentska 2, Rijeka

FACING UP THE CHALLENGES OF PORT OPERATIONS IN DIGITAL WORLD

SUMMARY

The authors are researching the impact of the electronic economy upon the transport value chain, and especially upon the port as a technological hub point. The electronic economy impacts on the transportation chain, as well as on logistics, outline a different view on port operations. Ports do not bind themselves to basic transit operations only, but they rather involve the sophisticated logistic operations, as well.

1. INTRODUCTION

A fundamental change in the supplier base management has been under way in the industry in recent years. Since 1991, the supplier base has been reduced significantly (by 50% or more) across all industrial sectors. Many firms have taken proactive steps towards consolidating and restructuring their supplier networks with a view to reducing costs, improving the quality, and strengthening the competitiveness. A major change has been introduced by delegating greater responsibilities to key suppliers, such as the production of major parts and components, laboratory and inspection functions, and management of lower level suppliers. The reduction in the supplier base, rather than being confined to the upper levels, appears to have permeated all layers of the industry.

Internal operations pertaining to supply chain management have been re-organized, streamlined and integrated by firms across their business units. Different forms of organizational structures for supply chain management have emerged. Many a firm

has achieved greater internal efficiency in the procurement and material management. Key efforts have been made in order to have the subcontracting cycle time reduced. Some have adopted the electronic data interchange (EDI) methods to expedite their purchasing operations. Others have started placing greater emphasis on the "best-value" subcontracting, within the constraints of the existing acquisition regulations. The widening of procurement operations into a more strategic level encompassing an integrated view of supply chain management practices has been evidenced.

A two-way communication between companies and their most important suppliers has increased substantially since 1989, serving as a platform for wider collaborative relationships. Information thus regularly provided by major suppliers to their customers have included data on production costs, statistical process control, actions taken with a view to improving production processes, longer-term business plans, proprietary financial information, and feedback to customer companies on how they can improve their purchasing and material management functions. On part of customer companies, information on their planned production schedules and requirements, cost targets, plans for supplier base restructuring, long-term business strategies, and quality of incoming parts have been regularly provided to their most important suppliers. Closer interactions also include: technical assistance to suppliers to improve their quality; joint diagnosis and solutions to manufacturing problems, joint diagnosis and reduction of inventory and scheduling problems, and a joint new product design, development and demonstration.

2. ELECTRONIC COMMERCE, SUPPLY CHAIN AND MARITIME TRANSPORT

In authors' view, logistic problems cannot be solved by applying the Internet paradigms already in use. Interactive shopping is going to introduce some changes in the transportation sector. It will make it possible for shopping to be done all over the world, and practically for each particular item to be bought from separate merchants and possibly in different countries. This will lead to smaller packages, smaller quantities of the same type of product, yet to an increasingly bigger amount of transported goods. Every package will have to be accompanied by the same amount of documentation. The increasing quantity of documentation will ask for new models of transportation logistics. The quantity of the documentation, and the need for efficiency will require strategic alliances, between the parties involved. It will be very difficult to achieve that target. Nowadays, there are more than 30 different parties involved in the international transport. They have been interchanging around 200 different types of documents among them. Interactive communications using WWW are lagging behind in this domain, because of the amount of documents and often the lack of time. The electronic data interchange paradigm is considered a possible solution to the problem.

There is no single theoretical perspective that can explain the impact of electronic commerce on interorganizational relationships; the existing approaches tend to be too narrow to successfully address the complexity of the observable phenomena. Therefore, this study has developed a multidisciplinary framework for a more comprehensive understanding of the role of the EC and related technologies. The framework is being applied in the context of a comparative case analysis of supply relationships in the transport industry. The framework acts as a foundation in examining the production network of supply relationships within the international transport.

By taking this network perspective, rather than individual dyadic relationships, one is offered a significant insight into the cost of considerable complexity. In order to be able to cope with the complexity, we have defined our organization-set as a series of focal networks comprising the document, material and cash flow. The limited space at our disposal does not allow for a presentation of the interim findings of the study, which has been still in progress. Out of a number of potentially fruitful approaches, we have pointed our attention to two major perspectives: the transaction cost analysis and the network approach. They represent two analytical dimensions that, taken together, allow us to analyse the effect of the eCommerce on the efficiency and structural aspects of transportation networks.

The latter of the problems is the natural preserve of the network approach, which provides the necessary concepts and constructions for describing and analysing the complex networks. Recently, interorganizational networks, based on co-operation and strategic alliances, have been increasingly observed. The primary contribution the network analysis has made to this study is its capacity to help conceptualizing structural variables. These are the properties of links (strength, directionality and symmetry), the position of an organisation within a network, the content of links and the properties of the network itself (connectedness, density, accessibility). The strengths of the theory represent the dynamic approach that extends the analysis to a network of interrelated firms.

Transportation is a derived demand. It is therefore a part of the economic process. The requirements of industrial processes have changed drastically during the past 10 years and they have been characterized by global competition, shorter production processes and product life-cycles and the need for cost cutting.

The concept of maritime transport includes the following three segments: the maritime, landside and port segments.

Maritime transport has recorded a phenomenal growth of containerized trade volumes and container movements in general, that have resulted in an ever expanding shipping industry, constantly exercising an increasing pressure on ports to achieve ever faster vessel turnaround times, thus increasing their profitability, quality and efficiency of service. The growth has particularly prevailed in the last three years in the container ship increased deadweight capacity up to 8000 TEU. Other analysts envisage ship capacity of 12,000 or even leviathans of 18,000 TEUs such as the one

that has been designed by researchers at TU Delft University in Holland.

The second feature of the new maritime transport trends is the tendency towards consolidation by acquisition and mergers, and according to Containerization International the first 20 carriers in the world have upgraded their capacity of the container transport from 35% in 1985 up to 76% in the year 2000.

The third feature is the globalization, present in form of global (or mega) carriers' presence on all the four world market segments (transatlantic, transpacific, Europe-Asia, North/South), in contrast to the eighties where they were only present in two segments.

After the constitution of maritime networks, the attention goes on to the ports' networks. In this very dynamic landscape, particular importance has been attached to landside ports - main ports, hubs - and platforms - dry ports. Indeed, by the decrease of transportation costs on one hand, and the search for the added value on the other, those places have become the privileged locations to generate profits along the whole transportation and logistic chain.

The eCommerce techniques are going to radically change the shipping and port industry. It is obvious how great the saving could be with the introduction of electronic commerce on a wider scale. Communication costs could be cut down virtually to a zero. Administration costs can be cut right down, with the implementation of automated systems providing the customers with availability, information and schedules to manage bookings, financial transactions, paperwork and container tracking.

Information technology (IT) is now seen as a great battleground of the next decade among not just carriers, but also forwarders, logistics based integrators and, potentially, pure technology companies who may use their system expertise to enter the industry at the expense of traditional players. The great goal for all these parties is to capture, electronically, the control over the cargo. Prosperity will be guaranteed to companies able to offer best services to cargo interests in such fields, such as the issuance of documentation, consignment tracking, electronic invoicing and payment, logistics capability and the like, will prosper. It is the party that can provide the required support and can effect a seamless integration with the shipper/importer systems, that stands to capture the traffic. If it is not the carriers who perform this task, then they risk being pushed back to a pure "ort to port"role and the one of a mere wholeseller of space, while the value added intermodal and logistic services are controlled by the party with best IT capabilities.

3. PORTS AND INFORMATION TECHNOLOGY

A completely new context for maritime business is being induced by the eCommerce by reshaping the traditional company boundaries, by making completely new functions for the maritime and transport companies, centered on information

services. It will take time to comprehend the possibilities created by new technologies and to use the new technology to create new ways of business operation.

For the purpose of analysing possible interactions between the new technologies in ports and shipping, the technologies have been grouped as:

- Ship technology:
  - Increased ship size leads to operational problems in ports by requiring appropriate infrastructure
  - Increased ship speed leads to shorter turnaround time, and to increasing demands upon the navigational support systems
  - While the container technology is heavily standardized, the Ro-Ro technology can use several types of load carriers (trailers cassettes, boxes) leading to difficulties.
- Navigational technology:
  - Different technologies for navigation and communications are available, here the systems used on board ships must correspond to the systems used in ports.
  - The development of the equipment to be used onboard must match the development of the one to be used in ports, thus utilizing the available resources and increasing the efficiency and safety.
- Communication and information systems:
  - New information and Communication Technologies (ICT) make it possible not only for the information exchange in navigation and traffic regulations, but they also provide information on precise arrival times, load plans and information on cargo concerning the supplier, contents, continued transportation means, final destination and receiver. With these pieces of information available, port operators are enabled to make better plans and preparations for cargo unloading and transhipment, thus increasing the efficiency and improving the results.
- Port container handling
  - Several attempts are currently being made to increase the port operation capacity and efficiency. One way leads to automated handling of containers either from the unloading or to the loading of ships , including the land transportation and storage .
  - Systems for the inward and outward flow of containers are being developed such as warehousing systems, rail transhipment systems, and barge container transhipment systems. These systems will increase the flow and make the loading and unloading to and from different carriers more efficient. So, for the ship, the turnaround time (terminal time) will be reduced.

Port handling is the area where any technical improvement is noticeable. The fitting of the high-tech Delta facility in Rotterdam with its heavily automated yard systems, including robotized vehicles, has moved the technology of the industry

forward. The Thamesport (UK) had been designed to be an automated terminal, and a great part of its landside operations is automated indeed, while Global Positioning Systems (GPS) are in use at Hamburg and Dubai, and under consideration in Singapore and Hong Kong amongst others.

A research carried out at the Faculty of Maritime Studies has shown how shifting from paper documents into electronic ones can make significant changes that could make a noteworthy benefit in any of the previously mentioned areas of ports and shipping technology.

The exchange of documents has always been the major link connecting all the companies within the supply chain, and especially between the companies creating the so-called port community.

The results of the research have been divided in three categories depending on the presupposition of the time required for receiving and elaborating classical (paper) documents:

- Pessimistic estimate - the documents will be received and elaborated in 30 minutes on the average
- Median estimate - the documents will be received and elaborated in 60 minutes on the average
- Optimistic estimate - the documents will be received and elaborated in 90 minutes on the average.

For electronic documents an average time of 5 minutes has been estimated as necessary for them to be received via e-mail, and elaborated, and for decision making and new document creating.

The model was decreased to fit companies in the port community (carriers, stevedores , freight-forwarders, customs, customs brokers and port warehouses), and included both the export and import side of the maritime transport supply chain.

The results are shown in Table 1 and 2:

Table 1. Total document costs within the port supply chain for one shipment in US$.

Table 2. Total document processing time within the port supply chain for one shipment in days.

Electronic documents	37,5
Classical documents pessimistic est.	219,62
Classical documents median estimate	288,022
Classical documents optimistic estimate	693,5006

The difference between this four cases , show that transfer to electronic documents in the port environment will generate additional savings:

Electronic document	0,1769
Classical document pessimistic est.	1,0812
Classic document median estimate	1,4234
Classic document optimistic estimate	3,4947

38,89% for the pessimistic case,
53,33% for the median case and
68,33% for the optimistic case.

These results could be compared to the data obtained from the port of Singapore, where before the eCommerce system was created, all documents for one import shipment had been processed in an average time of one day, and in up to 4 days where more complex shipments were involved. After having created the electronic system, the document processing time has dropped to an average of 15 minutes.

Although the model included more documents than usual, the data could be well matched, yet it should be particularly noted that the model processing time has to be divided by 2 in order to be comparable to the real world data (due to inclusion of both the export and import parts in the model).

On the ground of the findings, one can very easily obtain the data for the cost-benefit analysis. Taking into account the computer costs (1 mill $ for investment), the software costs (4200$ each computer and programs) and the labor costs (50 000 $ per annum) the result shows a saving exceeding 10 mill $ per year, for more than 50 000 shipments, for the pessimistic estimate. Indeed, for more than 5000 shipments per year, any company involved will have its investment returned within the period of less than 6 months.

4. A STEP FORWARD – VIRTUAL LOGISTICS AND PORTS

In order to take full advantage of the potential that virtual logistics would have, it would be necessary for such logistic systems to be organized and operated in a very different manner from conventional logistic systems. The major principles that would need to be applied in the design and operation of such systems would be as follows (Cooper 1992) :

(1) Treatment of assets in terms of function and availability, rather than physical objects with particular identity and form, so they can be treated like commodities.
(2) Dissociation of ownership and control of assets from their physical location, so they can be utilized remotely.
(3) Dissociation of information movements from physical movements, so that a change in ownership or change in application does not necessitate any physical movement.
(4) Dissociation of physical resources from specific operations or processes.
(5) Shared public access to the logistic resource information through the Internet applications.
(6) Computer based trading of logistic resources between suppliers and users.
(7) Integration of warehousing, transportation, and production for the purpose of maintaining the product availability and stock control.
(8) Harmonization of logistic systems and logistic resources so there can be created a greater potential to treat them like commodities and to utilize shared resources.
(9) Time phased coordination of logistics activities so that opportunities for consolidation can be maximized.

Port cooperation has to be introduced by using the afore established principles. Treatment of assets in terms of function and availability, rather than physical objects, would have a big impact on the classical port hinterland creation, because the dissociation of the control over the assets from their physical location will change the individual port corridors into a common one. For example, there should be only the Northern Adriatic corridor, instead of the Trieste-port, Portorose-port and/or Rijeka-port corridors, defining the common logistic and physical resources. The first step in cooperation should be the dissociation of the information from physical movements, represented by the common information resources system.

Port cooperation could start with information services, integrating and unifying data. The second step would be the unification of the procedures leading thus into common logistic services. The integration of information services is the primary approach to port cooperation and therefore it has to be supremely analysed.

The integration of the ports will be the step to follow, and it will be induced by the growth of the eCommerce techniques, and new business practices also generated by the eCommerce development.

5. COSTS

UNCID has estimated that the costs of data flows associated with the interna-

tional trade range between 4 and 7 % of the value of the goods, and that the complete distribution costs range up to 16% of the net value of the goods.

Provided only the data flow costs of 25% to 44% (depending on the length of the transport, and number of border crossings), the sum of all other transaction costs: search costs, decision costs, bargaining costs, control costs, handling costs, adjustment costs and execution costs has to exceed 50% of the transportation costs.

Komadina (2000) et all. have shown that only by the common standards and common information system of integrated ports a cost diminution of 40% could be obtained for all documentary costs, to be distinguished from the 20% to 31% of cost diminution for every port ownership system.

Additional cost for the implementation of the electronic commerce application, on account of integration, is 40% according to MetaGroup. This means that nearly one half of the efforts and costs for electronic commerce applications is caused by the processes of cooperation and integration among companies.

By adding this to the fact that the average influence of transportation to the GNP is about 8%, it results that the eCommerce technologies could create savings of up to 4% of the GNP. The ports alone as the hub points and natural origins of the supply chain integration could save more than 1.2% of the GNP.

6. CONCLUSION

The worldwide development process is directed towards a total logistic and supply chain management. This trend is based on the exceptional knowledge, eCommerce support, and it is extremely time sensitive.

Today's terminal has a density of 100-300 TEU per acre, productivity of 30 moves per crane-hour; container dwell time of six days; truck turnaround time of one hour; 36 feet of water depth, and an area rail service. The specifications for tomorrow's terminals are: 1,000-2,000 TEU per acre, 50 moves per crane-hour; three days dwell time, truck turnaround of less than 30 minutes, 50 feet of water depth, and on-dock rail. These results could not be effectively managed without an extensive use of the eCommerce technologies in ports.

Recent developments in logistics management services present new growth opportunities for port operations and shipping lines. Network-ports denote a group of connected and integrated logistics platforms. The link is no longer the merchandize only, the maritime line or the EDI line, but there is a unity in management, a coherent commercial policy between these places, an establishment strategy, a link through the capital, and sharing of the port computer system.

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Dragan Čišić
Damir Zec
Ana Perić

SUČELJAVANJE S IZAZOVIMA LUČKIH OPERACIJA U DIGITALNOME SVIJETU

SAŽETAK

Autori istražuju utjecaj elektroničkoga gospodarstva na prijevozni lanac vrijednosti, a posebice na luku kao tehnološko čvorište. Utjecaj elektroničkoga gospodarstva na prijevozni lanac i na logistiku omogućava i drukčije sagledavanje lučkih operacija. Luke se ne ograničavaju samo na osnovne operacije, već uključuju i suvremene logističke operacije.

ALLE PRESE CON LE SFIDE IMPOSTE ALLE OPERAZIONI PORTUALI NEL MONDO DIGITALE

SOMMARIO

Gli autori studiano l'impatto dell'economia elettronica sulla catena dei trasporti e specialmente sul porto quale nodo tecnologico.
L'impatto dell'economia elettronica sulla catena dei trasporti e sulla logistica gettano una nuova luce sulle operazioni portuali.
I porti non sono legati solamente alle fondamentali operazioni di transito, bensì includono anche sofisticate operazioni logistiche.