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PORTS IN DIGITAL WORLD

ABSTRACT

Authors investigate the impact of the electronic economy to the transport value chain, and especially the port as technological node. The electronic economy impacts on the transport chain, and on logistics outline different view on the port operations. The ports do not only bound themselves to basic transit operations only, but rather involve the sophisticated logistic operations.

Simulation has been used to define economic behaviour of the model and its entities for two generic case studies – usage of the electronic and paper documents. The results show that electronic documents can decrease the transaction costs Electronic documents diminish the time used to obtain, create the documents, and thus the costs are decreased. For one shipment (total of 103 documents) electronic documents are 39% cheaper, then paper documents and the difference between the electronic and paper documents is 295.44\$ for one set of 103 documents in one shipment.

I. INTRODUCTION

A fundamental change in 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 sectors of the industry. Many firms have taken proactive steps to consolidate and restructure their supplier networks in order to reduce cost, improve quality, and strengthen their competitiveness. A major change has been the delegation of greater responsibilities to key suppliers, such as the production of major parts and components, laboratory and inspection functions, and management of lower tier suppliers. The reduction in the supplier base, rather than being confined to the upper-tiers, appears to have permeated all layers of the industry.

Firms have re-organised, streamlined and integrated across business units their internal operations pertaining to supply chain management. Different forms of organisational structures for supply chain management have emerged. Many of the firms have achieved greater internal efficiency in procurement and material management. A key effort has been to reduce subcontracting cycle time. Some have adopted electronic data interchange (EDI) methods to expedite purchasing operations. Others have started to place greater emphasis on "best-value" subcontracting, within the constraints of existing acquisition regulations. The

widening of procurement operations into a more strategic level encompassing an integrated view of supply chain management practices is evidenced.

Two-way communication between companies and their most important suppliers has increased substantially since 1989, serving as a platform for wider collaborative relationships. Information now regularly provided by major suppliers to their customers include data on production costs, statistical process control, actions taken to improve 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 their part, customer companies regularly provide to their most important suppliers information on their planned production schedules and requirements, cost targets, plans for supplier base restructuring, long-term business strategies, and quality of incoming parts. Closer interactions also include: technical assistance to suppliers to improve their quality; joint diagnosis and resolution of manufacturing problems; joint diagnosis and reduction of inventory and scheduling problems; and joint new product design, development and demonstration.

II. ELECTRONIC COMMERCE , SUPPLY CHIN AND MARITIME TRANSPORT

Logistic problems cannot in authors view be solved by using Internet paradigms already in use. Interactive shopping will introduce some changes in transport sector. Shopping would be done all over the world, and usually every thing would be bought from separate merchant possibly in different countries. This will conduct to smaller packages; smaller quantities of the same goods, but increasingly bigger amount of transported goods. Every package has to be accompanied by the same amount of documentation. The emerging growth of documentation mass will ask for new models of transport logistics. Quantity of the documentation, and need for efficiency will demand strategic alliances, between involved parties. This will be very difficult task to achieve. Nowadays, there are more than 30 different parties involved in international transport. They are interchanging between 200 different types of document among them. Interactive communications using WWW are obsolete in this domain, because of the amount of documents and often lack of time. Possible solution of this problem is usage of the electronic data interchange paradigm.

At Rijeka College of Maritime Studies a complex research has started. There is no single theoretical perspective that explains the impact of electronic commerce on interorganizational relationships; existing approaches tend to be too narrow to address the

complexity of the observable phenomena. Therefore, this study develops a multidisciplinary framework for a more comprehensive understanding of the role of 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 to examine the production network of supply relationships for international transport.

Taking this network perspective, rather than individual dyadic relationships, offers significant insight at the cost of considerable complexity. To cope with the complexity, we defined our organisation-set as a series of focal networks comprising the document, material and cash flow. Space does not permit a presentation of the interim findings of the study, which is still in progress. Out of a number of potentially fruitful approaches we have drawn on two major perspectives: transaction cost analysis and the network approach. These establish two analytical dimensions that, taken together, allow us to analyse the effect of eCommerce on the efficiency and structural aspects of transportation networks.

This last problem is the natural preserve of the network approach, which provides the necessary concepts and constructs with which to describe and analyse complex networks. Recently, interorganizational networks, based on co-operation and strategic alliances, have been increasingly observed. The primary contribution of network analysis to this study is its ability to help conceptualise structural variables. These are properties of links (strength, directionality and symmetry), the position of an organisation in a network, the content of links and the properties of the network itself (connectedness, density, reachability). The strengths of the theory are the dynamic approach that extends the analysis to a network of interrelated firms.

Transport is a derived demand. It is therefore part of the economic process. The requirements of industrial processes have changed drastically during the past 10 years and can be characterized by global competition, shorter production processes and product-life-cycles and the need to cut costs.

The concept of transport includes three segments, maritime, terrestrial and port.

In the maritime transport the phenomenal growth of containerised trade volumes and container movements in general, that have resulted in an ever expanding shipping industry, constantly putting increasing pressure on ports to achieve ever faster vessel turnaround times, thus increasing their profitability, quality and efficiency of service. The growth had especially prevailed in last three years in increased capacity of the container ships, having d.w.t capacity up to 8000 TEU. Other analysts envisage ships 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.

Second characteristic of the new maritime transport trends is tendency towards consolidation by acquisition and merges, 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.

Third characteristic is globalization, as the global (or mega) carriers are present at all 4 world market segments(transatlantic, transpacific, Europe-Asia, North/South)., in contrast of eighties where they have been present in only 2 segments

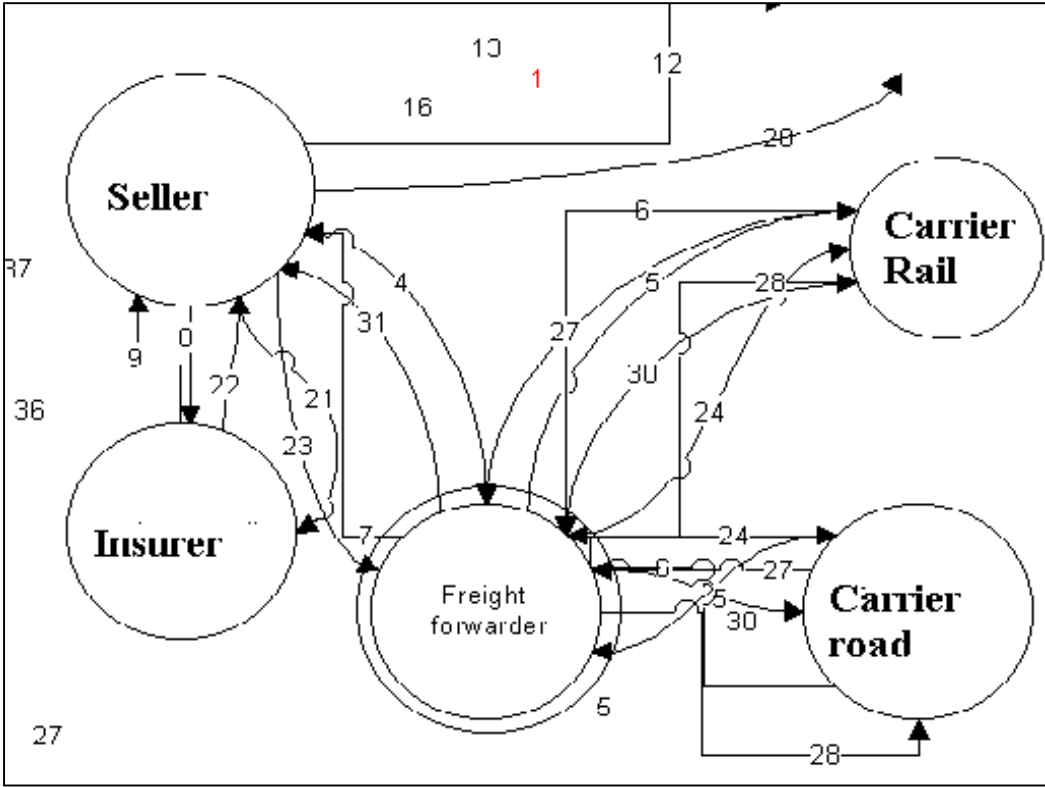
After the constitution of maritime networks, the attention goes on to the ports networks. The terrestrial ports - main ports, hubs - and platforms - dry ports - are of a particular importance in this very dynamic landscape. Indeed, by the decrease of transport costs on the one hand, by the search of value added on the other hand, these places became the privileged location to generate profits along the whole transport and logistic chain

The eCommerce techniques are going to radically change the shipping and port industry. It is obvious how much could be saved by introducing electronic commerce on a wider scale. Communication costs could be cut down to virtually nothing. Administration costs can be cut right down, if automated systems that provide the customers with availability, information and schedules to manage booking, financial transactions, paperwork and container tracking are in use.

The simulation of the supply chain network, and a port as a part of the network , shown in the next paragraph is a part of the research of the implications of the eCommerce technologies on the port as a nodal point of the transportation network..

III . SIMULATION MODEL

Simulation of economic aspects of transport logistic chain is currently under the way at Rijeka college of maritime studies. The model is very complex and is still in design. We have recognized 167 different documents and 37 different kind of firms in the international transport.



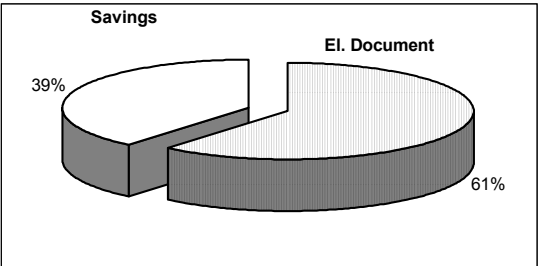
Pict.1 Part of the model

The scope is to simulate the document, goods and money flow in the international transport, to define costs of installing equipment, programs for EDI.

It is necessary to find when the shift from paper to electronic will occur. As the EDIFACT standard is inconsistent, no one could invest in building its own computer system upon it, and wait for others to do so. Why? Because, when other partners start with electronic data interchange, there is a big possibility that their messages would be different. Other view is that electronic data interchange is used on localized problems and processes. Only for big enterprises a part of their business process is big enough to convert it with EDI usage. The price for organizing and collecting parties is big enough for SME's, but is not yet defined, and

it depends on companies and their position in the transport chain, it depends on the percentage of electronic documents received and sent, and on many other factors. The scope of this research is to recognize this factors.

The results show that electronic documents can decrease the transaction costs, as shown on the picture 2 and 3 and tables 1 and 2. Electronic documents diminish the time used to obtain, create the documents, and thus the costs are decreased. For one shipment electronic documents are 39% cheaper, then paper documents.



Picture 2. Decrease of the document costs. (100% signifies the cost of the classic document)

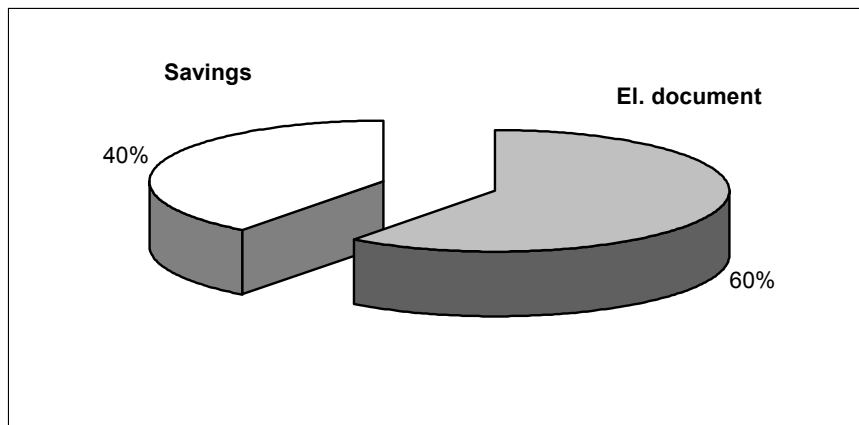
	Total time [min]	Total cost [\$]
Average	3048,47	466,24
St. Dev.	36,79	5,41
Minimum	3002,25	460,05
Maximum	3113,13	476,75

Table .1. Results for electronic documents

Observe that the results are grouped, and that the standard deviation is small. The difference between the electronic and paper documents is 295.44\$ for one set of 103 documents in one shipment. The difference in time is equal to 2001 minutes or 33 hours and 22 minutes.

	Total time [min]	Total cost [\$]
Average	5050,25	761,68
St. Dev.	15,22	2,78

Table 2 Results for paper documents

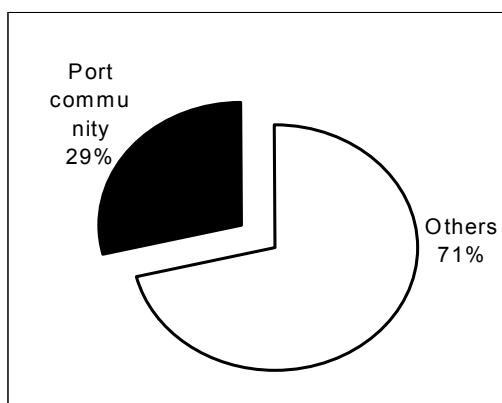


Picture 3. Decrease of the document processing time. (100% signifies the processing time of the classic document)

The simulation has been introduced for all significant generic organizations, but the succinct of this paper does not allow us to present all the results. The most attractive results are perceived from the simulation of the grouped correlated organizations.

It is interesting result that the dependence of the supply chain network on the government is minimal. The government is represented by consulate, export and import licensing, health control, chamber of commerce, export and import customs, port authority

and police. Usage of the electronic documents diminishes the importance of the government by 73%.



Picture 4. Proportion of the port community in the cost of documents

Main importance, from the research is contributed to port surrounding area – port community (agent,

stevedore, health control, export and import customs, port authority, police, customs broker, port authorities and vessel.) The results represent a total of 181,95\$ savings if all the companies situated around the port use electronic documents. The proportion of the port community in the cost of the documents is 29%.

Using this research findings one can very easily calculate the data for the cost- benefit analysis. Taking in a count the computer costs (1 mil \$ for investment), the software costs (4200\$ each computer and programs) and the labor costs (50 000 \$ per anum) the result show savings of over 10 mil.\$ per year, for more than 50 000 shipments. Indeed for more than 5000 shipments per year, any company involved will return the investment in the period which is less than 6 months.

IV. 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 logistics systems to be organized and operated in a very different manner from conventional logistics 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 as 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 utilised remotely.
- (3) Dissociation of information movements from physical movements, so that change of ownership or change of application does not necessitate physical movement.
- (4) Dissociation of physical resources from specific operations or processes.
- (5) Shared, public, access to logistics resource information through Internet applications.
- (6) Computer based trading of logistics resources between suppliers and users.
- (7) Integration of warehousing, transport, and production for the purposes of maintaining product availability and controlling stock.
- (8) Harmonisation of logistics systems and logistics resources so there is greater potential to treat them like commodities and to utilise shared resources.

(9) Time phased coordination of logistics activities so that opportunities for consolidation can be maximised.

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

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

The integration of the ports will be next step and it will be induced with the growth of the eCommerce techniques, and new business practices also generated by the eCommerce Development.

V. COSTS

UNCID has estimated that the costs of the data flows associated with international trade to be between 4 to 7 % of the value of the goods, and that the complete distribution costs are up to 16% of the net value of the goods.

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

Komadina (2000) at all have shown that using only the common standards and common information system of integrated ports could introduce cost diminution of 40% for all documentary costs, in distinction with the 20% to 31% of cost diminution for every port proprietary system.

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

Applying this to the fact that the average influence of transport to BNP is about 8%, this would signify that the eCommerce technologies could introduce the savings up to 4% of BNP. The ports as a nodal points and a natural origins of the supply chain integration could introduce alone more savings than 1.2% of the BDP.

VI. CONCLUSION

The worldwide trend is towards total logistics and supply chain management. This is something extremely knowledge-based, time sensitive and based on eCommerce support. Recent developments in logistics management services present growth opportunities for port operations and shipping lines. Network-ports mean 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 exists a unity in management, a coherence of the commercial policy between these places, an establishment strategy, a link through capital, a sharing of port computer system. The research shows that the ports as a nodal points and a natural origins of the supply chain integration could introduce alone more savings than 1.2% of the BDP.

VII. REFERENCES

- Berg, L. van den, H.A. van Klink en W. van Winden (1997), *Logistieke denkkraft als springplank naar het achterland*, Erasmus Universiteit, Rotterdam
- Berg, G.C. van den (1996), *Schuivende lading*, Erasmus Universiteit, Rotterdam
- Business Week (1996), clearing the cobwebs from the stockroom, 28-10 1996

- Cooper, J., M. Browne and M. Peeters (1992), *European Logistics - markets, management and strategy*, Oxford, Blackwell publishers
- Čišić D. Smokvina R. (1993) Edifact message mapping to and from relational data base - with examples from shipping industry The sixth international EDI conference Bled, Slovenia 1993
- Čišić D. (1994) Background of the electronic data interchange in international transport The seventh International EDI conference Bled, Slovenia 1994
- Čišić D: Mrnjavac E, Komadina P (1998) Self governing virtual supply chain 4th Intl Conference EURONAV 98, Hannover Germany pp 121-127
- Čišić D, Vranić D, Sušanj J. (1998) Horizontal, Vertical and symbiotic organizations in transport logistics factors 2nd Int. Conference on traffic science Trieste Patras 1998
- Čišić D. (1999a) Analysis of the contribution of the electronic commerce technologies to the transport logistic value chain Ph.D thesis University of Rijekas 1999
- D.Čišić, B.Kesić,D.Zec (1999b) Research Of The Power In The Supply chain – In Mufato, Pawar Editors LOGISTICS IN THE INFORMTION AGE SGEEditoriali Padova 1999 pp 119-121
- Huber, G. (1990): A theory of the effects of advanced information technology on organizational design, intelligence and decision making. In: Academy of Management Review, Vol. 15, No.1, pp. 47-71.
- IMF(1996), World Economic Outlook 1996, Washington DC
- Klein, S. (1994): Virtuelle Organisation. Virtual Organisation. In: Wirtschaftswissenschaftliches Studium, Vol. 23, pp. 309-311.
- Knight (1995), Knowledge-based Development: Policy and Planning Implications for Cities, *Urban Studies*, vol. 32, no. 2, 1995 225-260
- Lautenbacher, S./Walsh, I. (1994): Neue Technologien für virtuelle Organisationen. *New Technologies for Virtual Organisations*. In: Gablers Magazin, Nr. 6-7, pp. 28-30.
- Komadina P., Čišić D.(1997) Electronic commerce on the internet,Mipro Opatija 97
- P.Komadina, D.Čišić, E.Mrnjavac (1999) Computer Aided Logistics - An Economic Dimension -in Mufato, Pawar editors LOGISTICS IN THE INFORMTION AGE SGEEditoriali Padova 1999 pp 695-703
- KomadinaP., Cistic D., Počuća M (2000). Port cooperation and transaction costs Global logistics for the new millennium, Proceeding of the 5th International symposium on Logistics (ISL 2000) , Iwate 12-15 July 2000 , Japan Edited by Hiroshi Katayama pp. 582 – 587

- Kesić B., Komadina P, Čišić D (1998) Towards the unified theory of Port gravitational areas – Introducing the information centrality factors *2nd Int. Conference on traffic science* Trieste Patras 1998
- Kesić B, Mrnjavac E, Čišić D (1998b) Global virtual logistic organization – Transaction cost dimension factors *2nd Int. Conference on traffic science* Trieste Patras 1998
- Mertens, P. (1994): Virtuelle Unternehmen. *Virtual corporations*. In: Wirtschaftsinformatik, Vol. 36, Nr. 2, pp. 169-172.
- Mrnjavac E, Čišić D, Vranić D (1998) Self governing virtual supply chain – lessons learned from Internet *2nd Int. Conference on traffic science* Trieste Patras 1998
- Olbrich, T. (1994): Das Modell der "Virtuellen Unternehmen". *The model of the „virtual corporation“*. In: Information Management,
- Ouchi, W. G. (1980): Markets, Bureaucracies, and Clans. In: Administrative Science Quarterly, Vol. 25, pp. 129-141.
- Port of Rotterdam (1997), *Haven in cijfers 1997*
- Vranić D. Mrnjavac E. Čišić D (1998) Global virtual logistic organization – An economical Dimension *4th Intl Conference EURONAV 98, Hannover Germany* pp 128
- Worldbank (1996), Balance of payments statistics yearbook 1996, Washington DC

