

PortNet Impact Evaluation

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Tekijät (toimielimestä: toimielimen nimi, puheenjohtaja, sihteeri) Raine Hautala, Pekka Leviäkangas, Risto Kulmala Seppo Auvinen, Robin Berglund VTT Rakennus- ja yhdyskuntatekniikka, Oy EDI Management Finland Ltd, VTT Tietotekniikka		Julkaisun laji	
		Toimeksiantaja Liikenne- ja viestintäministeriö	
		Toimielimen asettamispäivämäärä	
Julkaisun nimi PortNet Impact Evaluation.			
Tiivistelmä Tiivistelmä <p>PortNet on kansallinen merenkulun tavaraliikenteen eri osapuolia palveleva tietoverkko. Järjestelmän ydin muodostuu Merenkulkulaitokselle, Tullille ja satamalaitoksille välitettävistä tiedoista ja vastaavasti näiden organisaatioiden tarjoamista meriliikenteen tietopalveluista. PortNet-yhteisöön kuuluu em. organisaatioiden lisäksi yksityisiä yrityksiä. PortNetin palveluilla on nykyään noin 1300 käyttäjää.</p> <p>Tässä työssä arvioitiin PortNetin vaikuttavuutta ja miten sitä tulisi edelleen kehittää. Lisäksi arvioitiin liikennetelematiikkahankkeiden arviointiohjeiden soveltuvuutta tähän arviointityöhön.</p> <p>PortNet edistää selvästi liikenne- ja tietoyhteiskuntapoliittisten tavoitteiden saavuttamista. PortNet on myös yhteiskuntataloudellisesti kannattava. Sen hyöty-kustannussuhde on vähintään 2, vaikka laskelmiin otettiin mukaan vain PortNetin hyödyt sen pääkäyttäjien hallinnollisissa toiminnoissa. Näin laskettujen suorien taloudellisten vaikutusten lisäksi PortNet tuottaa myös paljon laadullisia hyötyjä kuten:</p> <ul style="list-style-type: none"> – yksityisen ja julkisen sektorin välinen edistyksellinen toimintamalli tehostaa eri osapuolten toimintatapoja ja yhteistyötä sekä ulkomaankaupan toimintaedellytyksiä – välilliset hyödyt logististen prosessien tehostumiseen – tiedon oikeellisuuden ja laadun sekä työmukavuuden paraneminen. <p>PortNetin toimintamalli on kansainvälisestäikin hyvä esimerkki yksityisen ja julkisen sektorin toimivasta yhteistyömallista ja sillä on selvää vientipotentiaalia. PortNetin hyödyt kasvavat tulevaisuudessa edelleen sähköisen asioinnin lisääntyessä sekä integroitaessa uusia toimintoja ja järjestelmiä PortNetiin. PortNet tehostaa eri toimijoiden operatiivista toimintaa ja logistisia prosesseja. PortNetin vaikuttavuutta voidaan parantaa järjestelmän teknisten toimenpiteiden kehittämisen lisäksi toteuttamalla meriliikenteen järjestelmäarkkitehtuuri, laatimalla PortNetille liiketoimintasuunnitelma, edistämällä PortNetin toimintamallin vientiä sekä järjestämällä vuosittainen tiedonvaihto- ja yhteistyöfoorumi PortNetin osapuolten kesken kehittämistarpeiden kohdistamiseksi. Käyttäjätarpeiden selvittäminen ja huomioon ottaminen on tärkeää.</p> <p>Liikennetelematiikkahankkeiden arviointiohje antoi toimivan kehikon PortNetin vaikuttavuuden arvioinnille. Ohjeissa käytetty Du Pont -malli sopii paremmin yritystasoiseen arviointiin kuin PortNetin kaltaisen laajan, toimialatasoisen järjestelmän taloudellisten vaikutusten arviointiin. Arviointeja tehtäessä tuleekin muistaa, että ohjeet on tarkoitettu käytettäväksi soveltaen muun hankearvioinnin ohjeistuksen ohella.</p>			
Avainsanat (asiasanat) Meriliikenteen tietojärjestelmät, PortNet, telematiikka, vaikutusten arviointi, sähköinen asiointi			
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Abstract <p>The PortNet is a national information network serving the different parties of maritime cargo transport. The kernel of the system consists of the data submitted to the Finnish Maritime Administration, Finnish Customs and port authorities and the information services provided by them. In addition to these authorities the PortNet community also includes private companies. Currently the PortNet services have about 1300 users.</p> <p>This study evaluated the impact of PortNet and how it should be further developed. The applicability of the guidelines for the evaluation of ITS projects in this study was also assessed.</p> <p>PortNet clearly advances the achievement of transport and information socio-political objectives. Port Net is also viable socio-economically. The benefit-cost ratio was estimated as more than 2 even though only the gains for the administrative functions of the main operators of PortNet were taken into account. In addition to these direct economical effects PortNet also produces a lot of qualitative benefits:</p> <ul style="list-style-type: none"> – the progressive operations model between the private and public sectors intensifies the operation modes and co-operation of different parties and the operational preconditions of foreign trade – the indirect benefits to the logistic processes – the improvement of data validity and quality, and ease of work. <p>The operations model of PortNet is even internationally a good example of a functional co-operation model between private and public sectors and it has clear export potential. The benefits of PortNet will increase further as electronic business expands and when new functions and systems are integrated into PortNet. PortNet advances the operation and logistic processes of the parties. The impact of PortNet can be enhanced in addition to developing the technical procedures also by implementing the maritime system architecture, drawing up a business plan for PortNet, promoting the export of the PortNet operation model and organising annual information exchange and co-operation fora of the PortNet parties in order to focus the development needs. It is important to identify and take into account user needs.</p> <p>The guidelines for the evaluation of ITS projects created a usable framework for the impact evaluation of PortNet. The Du Pont -model used in the guidelines is better suited for business level evaluations than for a broad sector wide economic impact evaluation like PortNet. In the evaluations, one should always remember that the guidelines are to be used in addition to other project evaluation instructions.</p>			
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FOREWORD

Evaluation of the impact of PortNet was performed within the Project Area 2 of the Finnish Research and Development Programme on ITS Infrastructures and Services, established by the Ministry of Transport and Communications. The objective of the Project Area 2 is determination of the commercial, economic, and other important impacts of transport telematics systems, solutions, and services. An additional objective is the identification of transport telematics services required by users.

In the beginning of 1990-s, the PortNet community began to develop a common activity pattern and a national maritime transport information system. The objective was to rationalise the use of basic declarations submitted to different levels of authority, as well as to make the activities of those participating in maritime freight transport more efficient. Currently PortNet system offers information on practically all ships that visit Finnish ports, as well as on their cargo. Approximately 1300 customers use the information system and new services have been developed on its basis. Attention on the international level is mainly being paid to the functioning model of co-operation between private and public sectors.

In summer 2002, management group of the FITS Programme Project Area 2 and the PortNet community commenced evaluation of PortNet's impact. The respective task group includes Rolf Bäckström (Chairman) and Antti Arkima from the Maritime Administration, Olli Tuomisto from the Customs, Reijo Toivonen from the Turku port, Tauno Sieranoja from the Helsinki port, and Osmo Moisio from the Ministry of Transport and Communications. This report has been composed by Raine Hautala, Pekka Leviäkangas and Risto Kulmala from VTT Building and Transport, Seppo Auvinen from Oy EDI Management Finland Ltd, and Robin Berglund from VTT Information Technology. Jorma Rytönen from VTT Products and Production participated in the evaluation as an additional expert.

On behalf of the FITS programme, Helena Vänskä from the Ministry of Transport and Communications and Jani Granqvist ensured quality of the report from the VTT Construction and Community Technics.

Helsinki, February 2003

Rolf Bäckström

Deputy Director

Finnish Maritime Administration

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List of Abbreviations

AirPortNet	Air transport information system. From the viewpoint of the Customs, in case of air traffic the freight treatment processes should be accelerated and electrical communication procedures developed (an information system similar to PortNet is required). First stage of the pilot project concentrates on activities associated with export-related customs procedures.
AIS	Automatic ship Identification System – positioning and identification of ships in connection with maritime transport and the related data interchange, primarily between ships, but also between the VTS-centre and ships.
APEC	Asia Pacific Economic Cooperation. A co-operation forum promoting economy, trade, and investment activities in the Asian-Pacific Ocean region.
BOPCom	Baltic Open Port Communications. An EU project established in order to create an IT system utilising the EDI and Internet connections intended for transfer of maritime traffic messages and the related information.
ECDIS	Electronic Chart Display and Information System; electronic sea chart system
EDI	EDI (electronic data interchange) means data interchange between organisations (in Finland, abbreviation OVT is used). EDI refers to transferring of accordingly formatted information from one data system to another by electronic means, using mainly the EDIFACT format standard.
EDIFACT	EDIFACT (Electronic Data Interchange For Administration, Commerce and Transport) is an international ISO standard that defines the content and submission form of data transferred by electronic means. The standard is developed by UN/CEFACT.
Electronic Customs	EU development programme, intended for development of customs-related electronic business procedures in order to promote trade and improve data safety.
ENC	Electronic Navigational Chart – official numeric chart database for ECDIS systems.
ETA	Estimated time of arrival; estimated time of vessel arrival.
FAL-directive	Directive 2002/6/EC of the European Parliament and of the Council on reporting formalities for ships arriving in and/or departing from ports of the Member States of the Community is imported from the viewpoint of ETA. The purpose of this Directive is to facilitate maritime traffic by way of standardising the respective reporting formalities.
FITS	Finnish R&D programme on ITS Infrastructures and Services, 2001-2004.
HELCOM	The Helsinki Commission – a co-operative body striving for protection of Baltic marine environment.
IBNet	Management of icebreaking activities. The system supports decision-making in planning and supervision of icebreaking activities and ensures that the data entered in icebreaker database is transferred through the centre to other parties involved (icebreakers, co-ordinating transport department, VTS-centres). IBNet also functions as a connection link in co-ordination of the activities of Finnish and Swedish icebreaker fleets. The basic content includes ships, their locations, and schedules.

IBPlott	IBNet's graphic user interface allowing to represent the state of winter traffic on chart or satellite image basis.
Intermodal Portal (IP)	EU programme intended for better integration of ports into intermodal transport chains by way of utilising the existing systems and developing Internet-based telematics services for maritime traffic.
ITU	Integrated customs declaration system. In co-operation with the customers, Finnish Customs develops a declaration system that uses EDI-messages in data interchange between the Customs and the customers to the widest extent possible.
Navi	A programme for collection and updating of data concerning sea fairway areas and navigation channels, safety equipment and water depths in the fairway area.
NeLoc	Networking Logistics Centres in the Baltic Sea Region to promote networking of planned and existing logistics centres.
PCS	Port Community System. An in-port system (unlike PortNet, which is a system intended for communication between ports and authorities).
PilotNet	A system for the administration of piloting activities and composition of reports on pilot work time supervision and charging for piloting services. Basic content: port-specific vessel lists, schedules, vessels, and pilot allocation.
PortNet	Maritime traffic information system covering both in-port activities and activities/services associated with administration, supervision, and piloting of vessels. The system also provides information on the cargo transported by the vessels, especially on dangerous substances included in the cargo.
Port State Control	The Paris MOU on Port State Control is the official document in which the 19 participating Maritime Authorities agree to implement a harmonized system of Port State Control
PUUVIPRO	A multilateral project established by woodworking industry enterprises. It deals with electronic exchange of logistics-related data between different parties, especially in case of export operations.
RailTrace	RailTrace is a freight and railcar supervision system developed and marketed by VR.
SafeSeaNet	A project developed by the European Commission, the objective of which is to implement the requirements set by EU directives in the field of collecting navigation-related information from the Member States. The actual system is a reference database that indicates the location of the requested information and retrieves the information.
SHIP	Basic register of the Maritime Administration, containing information on the ships that have visited Finland. SHIP functions as a basic database of several systems, such as VTS, PortNet, IBNet, and PilotNet.
Single Window	The Single Window Concept. A co-operation concept that enables enterprises and associations to submit legally prescribed and other declarations in the most rational manner, to several instances at once. The declarations are usually submitted electronically, using commonly agreed interfaces.
TARKKI	Cargo traffic telematics architecture

TEDIM	International forum for the development of foreign trade logistics and delivery management in the Baltic Sea region
TelemArk	National system architecture of passenger traffic telematics
TERMIS	Electronic delivery of declaration data by terminals in case of container traffic. TERMIS project of the FITS programme develops a high-tech network of data interchange between Finnish container terminals, their customers, and the Customs.
VIPRO	A co-operative system intended for management of logistics-related processes and information associated with export activities in the chemical timber industry.
VTMIS	Vessel Traffic Management and Information System, a concept that describes the totality of several different maritime traffic systems (VTS, AIS, ...), which, however, is not an actual system. VTMIS may also include commercial components.
VTS	Vessel Traffic Service, vessel supervision and support services in maritime traffic, as well as transmission of the related information between the VTS centre and the vessels.
XML	Extensive Markup Language (XML) is a formatted data submission standard based on SGML ISO 8879, which describes logic structure of the data, mainly in order to allow utilisation of Internet-based solutions. Especially popular in case of data exchange between different systems.

1 INTRODUCTION

The Ministry of Transport and Communications requires from traffic boards the vision, strategy, and activity programme necessary for development and utilisation of transport telematics in their own operation. In addition to development of the application of telematics in the activity of each specific traffic board, the objectives also include unification of the principles of operation and promotion of the transport telematics services throughout the country. These are necessary, for example, from the viewpoint of establishing information systems covering all forms of transportation and realisation of the information exchange between them.

The maritime transport telematics strategy report issued in the beginning of the year 2003 offered an initial vision, strategy, and operation programme for the years 2003-2006, concerning utilisation of telematics in maritime traffic administration (Leviäkangas et al. 2002). Evaluation of the impact of maritime transport telematics services was identified as one of the most urgent tasks.

Maritime traffic clearly covers most part of foreign trade turnover – approximately $\frac{3}{4}$ in both volume and value. This requires increased utilisation of IT means by the Customs in order to cope efficiently with the customs procedures associated with vessels and their cargo. In addition to said procedures, the Customs Board supervises payment of fairway fees by the vessels and transportation of dangerous substances. The ports strive towards utilisation of IT means for optimisation of port services, as well as for charging and statistics. The Maritime Administration utilises information technology in supervision of vessel traffic, vessel port control activities, composition of maritime traffic statistics, and keeping of basic maritime registers.

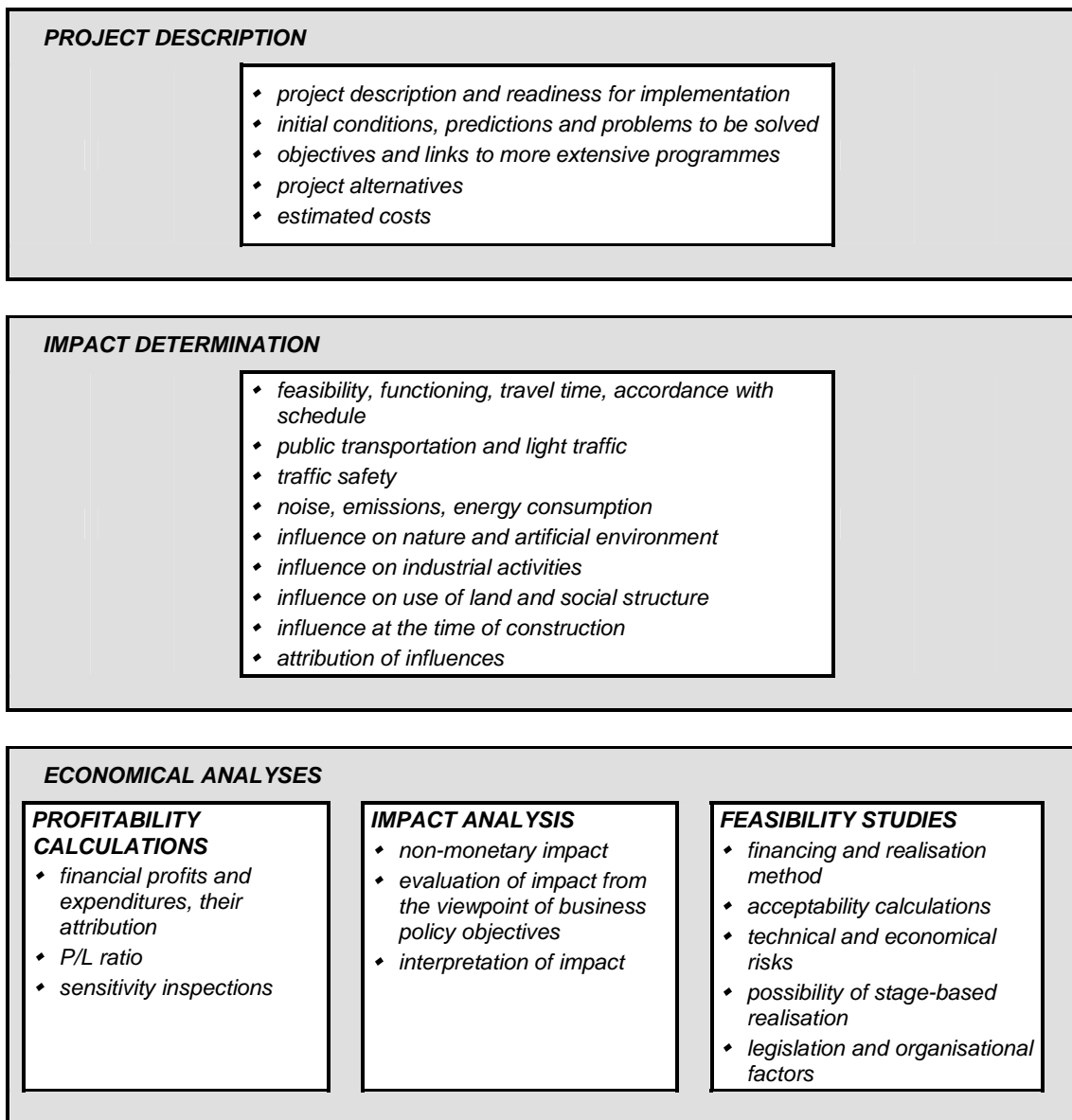
In the beginning of 1990-s, Finland's largest ports, the Customs, and the Maritime Administration commenced development of activity methods and co-operation models applicable by different instances participating in maritime transport, as well as development of a national maritime traffic information system. PortNet community commenced its activity in 1992 and the information system's first version was based on centralised architecture. PortNet's modern information system based on the Internet was created in 1998-2000. Currently PortNet covers maritime traffic in the whole country and constitutes a significant part of the maritime traffic telematics information infrastructure. Both the public and the private sector have created new transport telematics and other services on its basis. The PortNet concept is progressive even on the international level

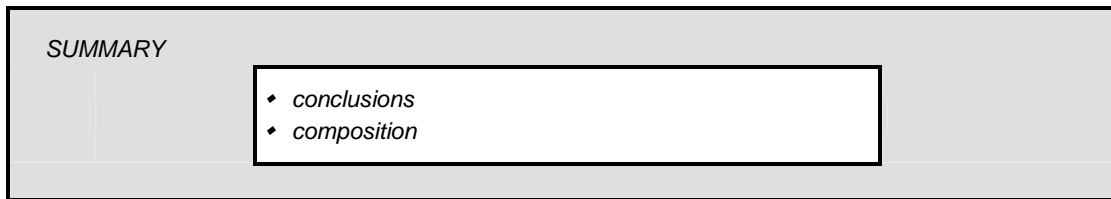
Applicability of the PortNet system for support of active operation is becoming more important. This concerns the entire logistics chain. In case of forest industry logistics, for example, preplanning has been found to be extremely important.

The objective of this study is to identify the impact and socio-economical influence of the PortNet system, as well as to determine how these can be developed further. Impact evaluation concentrated on principal users of PortNet. In addition to that, the indirect and potential influence of PortNet was evaluated. Applicability of the guidelines for the evaluation of ITS projects for this end was examined as well.

2 IMPLEMENTATION OF EVALUATION

The impact of PortNet was evaluated with the help of the framework model provided in guidelines for the evaluation of ITS projects (Kulmala et al. 2002) (Picture 1).





Picture 1. General framework model for project evaluation (Ministry of Transport 2000).

Evaluation process included the following stages:

1. **Description of PortNet.** Description of PortNet and currently existing services created on the basis of the system, as well as PortNet development plans and interconnections with other projects.
2. **Impact determination.** The impact of PortNet services was evaluated, concentrating on PortNet's direct influence on its principal users today. PortNet's indirect impact was evaluated as well.
3. **Profitability calculations.** The profits and expenditures associated with PortNet and the related services were evaluated. The respective calculations were based on benefits and results allowing rough quantitative analysis. The calculations also dealt with principal users of PortNet and the system's direct economic impact on their activities. PortNet's influence on the efficiency of logistics processes, for example, was analysed separately, using more specific methods of guiding nature (see section 6).
4. **Evaluation of impact from the viewpoint of business policy objectives and information society.** Evaluation of PortNet's impact from the viewpoint of business policy and information society.
5. **Evaluation of implementation.** Evaluation of the implementation of PortNet and the associated services from the viewpoint of user visions, organisation, pricing, technical realisation, efficiency of the system, and user interface.
6. **Potential impacts.** Main potential impacts were evaluated whether by rough calculations or verbal assessment. Evaluation of potential impacts was considered important due to the fact that the profitability calculations under section 3 cannot include all possible impacts, because of either insufficient initial data or the complexity of calculations.
7. **Conclusions.** Based on results of stages 2-6, conclusions were made concerning the impact of PortNet and applicability of guidelines for the evaluation of ITS projects for performance of the related evaluation tasks.

8. **Future recommendations.** Future recommendations were made based on the evaluation of PortNet's impact and the identified needs for development.
9. **Reporting.** The report was composed on the basis of previous sections and in accordance with the FITS Publications publishing instructions issued by the Ministry of Transport and Communications.

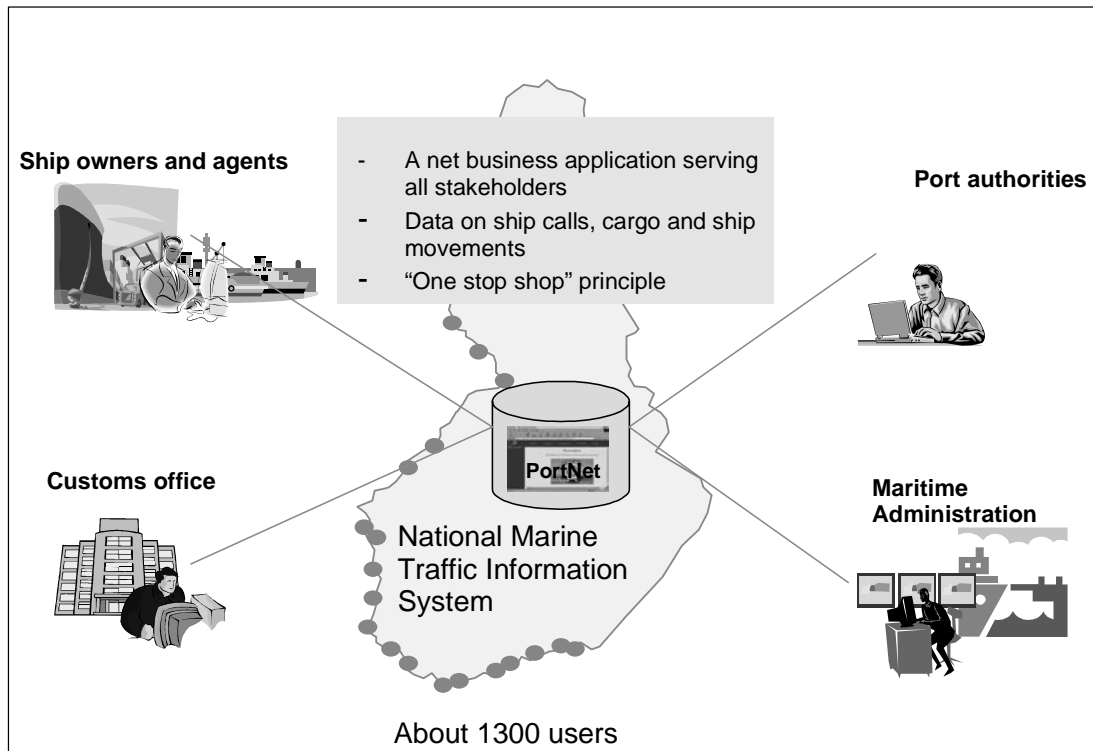
3 DESCRIPTION OF PORTNET

Background

The reason for the creation of PortNet in the beginning of 1990-s was that several different forms of similar content had to be filled in and delivered to various authorities each time a ship arrived or departed. This required much effort, for which reason the principal actors in the field decided to establish a new centralised national maritime traffic information system utilising electronic data transfer. After that, a common project was composed, describing the functionality of the future system, and the participants began to develop the related services.

The objective of the PortNet system was creation of a national information network providing services for groups involved in maritime traffic. The core of the system was to consist of maritime traffic-related information transferred to ports and authorities, respective maritime traffic information services offered by these organisations, and the possibility for improvement of the related operations offered by the system itself.

Currently PortNet is a wide community involving numerous users, in which a national maritime traffic co-operation model has been created for processing and distribution of administrative data (Picture 2). The system presently has approximately 1300 users.



Picture 2. Basic concept of PortNet services (Maritime Administration and Oy Edi Management Finland Ltd 2003).

PortNet Community

From the very beginning of its existence, the PortNet community has been a contract-based (mutual contracts) community without official legal structure. Member organisations of the PortNet community are the Maritime Administration (present host organisation), Customs Board, and 20 ports (Hamina, Kotka, Loviisa, Porvoo, Helsinki, Inkoo, Hanko, Naantali, Turku, Uusikaupunki, Rauma, Pori, Kristiinankaupunki, Kaskinen, Pietarsaari, Vaasa, Kokkola, Oulu, Kemi, and Tornio).

Other associated groups of primary importance are:

- Ministry of Transport and Communications (chairmanship of PortNet management team)
- Finnish Shipbrokers' Association
- Finnish Port Association
- freight agencies
- other levels (IT suppliers, experts)

Development work has been managed by the PortNet management team, which has discussed financing of different projects, new activities, maintenance of the system, and other similar subjects.

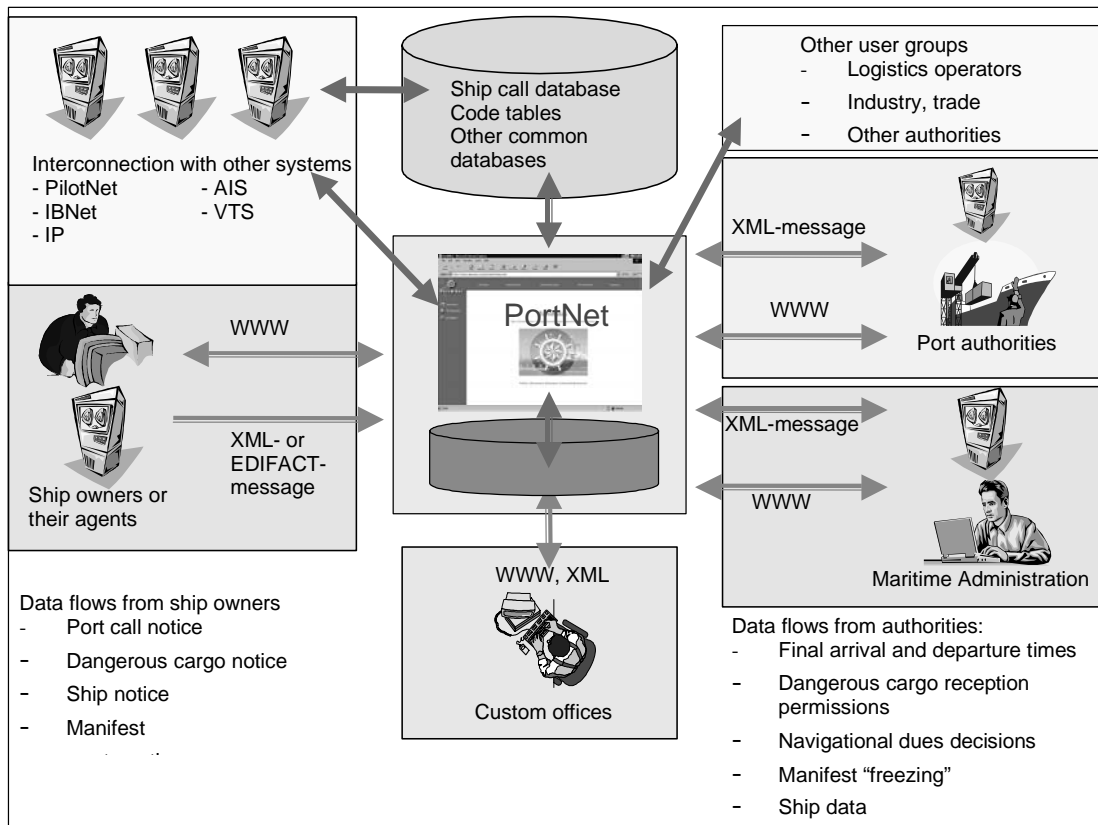
The development of PortNet can be divided into following phases:

- Phase 0: Theoretical development phase in the beginning of 1990-s, when support to the idea was sought and connections between main participants (ports, the Customs, Maritime Administration, Ministry of Transport and Communications) being established.
- Phase 1: Ensuring of the practical applicability of the model by implementation of the project's first stage, which was based on centralised architecture ("learning" of the new model, technological challenges, ensuring of the implementation of the first stage by various measures). Main emphasis was laid on administrative information.
- Phase 2: Strengthening of the activities of PortNet community, creation of a new generation solution with the help of the Internet, and fast growth of the community in the end of the 1990-s and in the first years of the new century. The need to update the organisation. PortNet's influence on operative activities increases.
- Phase 3: Improved integration into other services and associated international use. The importance of preliminary information and planning in freight traffic increases, partly because of the new safety requirements. EU instruments and projects influence PortNet's development plans.

3.3 Activities and Exchange of Information

The PortNet community has agreed on how freight agencies or their representatives, port authorities, the Customs, and the Maritime Administration input information on ship arrival, port calls, and departure. If entitled to specific user rights, members of the community have the right to acquire information from common database and to utilise it in their own interest in different reports or inquiries. Information can be transferred directly via the Internet or in the form of XML and EDI messages (Picture 3).

In order to function, the service requires from community members compliance with agreed processes and schedules upon input of information and verification of the correctness of data.



Picture 3. PortNet's current functions.

3.4 PortNet Expenditures

PortNet's investment and upkeep expenditures are presented in Table 1. Investment expenditures include costs under PortNet's development history since the year 1990. Investments have been calculated on general level in nominal value, and the exchange rate alterations in 1990-2002 have not been taken into account. Upkeep expenditures are as of year 2002.

Table 1. PortNet's investment and upkeep expenditures, in Mill. €

Actor / level	Investments 1990–2002	Upkeep expenditures in 2002
Companies (shipping companies, brokers, other)	0.00	0.00
Ports	0.70	0.07
Customs	0.49	0.04
Finnish Maritime Administration	0.35	0.04
Sum total	1.54	0.14

The shares of investment and upkeep expenditure compensation in the PortNet community have always remained the same: ports 50 %, Maritime Administration and the Customs both 25 %. Relatively larger share of the Customs indicated in Table 1 is mainly caused by investment of 135 000 € in the maritime traffic charging module (Tuomisto 2002b). The Maritime Administration has invested approximately 15 million € in AIS, VTS, IBNet, PilotNet and SHIP systems, but these investments have not been included in the PortNet investment calculations, since these systems also function independently and primarily service other activities of the Maritime Administration.

The ports have additionally supported the introduction of PortNet with the help of tariff policy means in the sum of 4 Million €, but this has not been accounted for in table 1, since it cannot be considered as direct investment into the system itself.

PortNet upkeep expenditures include

- upkeep and support costs of the solution and base system (Oracle)
- data traffic costs
- labour expenses associated with upkeep of PortNet and paid by the community.

Investments include

- establishment of the system
- development of the existing system and adding of new features.

Support offered by the Ministry of Transport and Communications for the establishment of PortNet was not considered separately – this financial support received by the sponsors of PortNet community (Maritime Administration, the Customs, and ports) was interpreted as transfer of income within the public sector. The said support constituted half of PortNet's establishment expenditures. The other half was distributed within the PortNet community in accordance with the percentages indicated above (ports 50 %, Maritime Administration 25 %, the Customs 25 %). Investments made by companies and their

share in compensation of the upkeep costs were considered extremely small, hence the value 0.

a. PortNet Development Plans, Links to PortNet

Development of and integration into PortNet was considered from the following viewpoints:

- development of common PortNet service,
- links to PortNet for development of own services (e-services) by various user groups,
- utilisation of PortNet's information in other services; and
- electronic business and logistics combined.

i. Development of Common PortNet Service

PortNet service is being developed within the framework of the budget approved by PortNet community. Currently the main areas and plans of development are as follows:

- Creation of cell phone services for mobile users. A pilot project implemented in Spring 2002 included provision of two cell phone services: port schedule inquiries for WAP telephones and submission of vessel declarations via Nokia 9210 Communicator (Auvinen J. 2002). Services that are more versatile shall be created based on this pilot system.
- Development of the quality of statistics. The objective is to develop the common statistics of PortNet so that different participants could acquire from the system information important for them in the form of complete reports concerning the transportation of dangerous substances and freight traffic by type of cargo and vessel (increased transparency).
- Creation of international connections, at least in the Baltic Sea region (between different systems). In 2002, Intermodal Portal system was connected with PortNet (Aspelin 2002), allowing to transmit maritime traffic messages between different systems. PortNet community strives towards the introduction of PortNet-type solutions in all countries around the Baltic Sea.
- Compliance with implementation of the so-called FAL directive on the maritime traffic reporting formalities, which entered into force in 2002 (the Customs).

- Compliance with EU guidelines and development projects (e.g. maritime traffic databases and SafeSeaNet programme, and the Single Window concept and Electronic Customs programme of the Customs).
- Compliance with the systems used by other modes of transport, for the purpose of developing intermodal traffic information services.
- Connection to the AIS, PilotNet, IBNet and VTS systems of the Maritime Administration, VTS systems of ports, and other Finnish systems.
- Compliance with the TERMIS project, for the purpose of developing electronic delivery of declaration data by terminals in case of container traffic.

Upkeep and development of the PortNet system still requires significant contributions. The responsibility for upkeep and development will transfer more clearly to the Maritime Administration in connection with the PortNet community administration reform and the Maritime Administration's organisational reform implemented in the first half of the year 2003.

ii. Links to Development Work Performed by User Groups

This section discusses the development plans and requirements of individual parties, in connection with which the information of the PortNet system could be made use of.

From the viewpoint of Finnish Maritime Administration, PortNet is a central service with links to several other solutions and systems utilised within the Administration, such as the automatic identification system (AIS), vessel traffic service (VTS), piloting service (PilotNet), and supervision of ice-breaking activities (IBNet). The Maritime Administration's own MARTINA solution programme also utilises PortNet's information in analysis of maritime traffic statistics (monitoring of freight traffic according to cargo type).

The Customs Board is currently creating an information system that would cover, by mode of transportation, all declarations and basic notices submitted concerning imported or exported cargo. In case of this project, it is also important to consider the links to e.g. PortNet, Intermodal Portal, and VR Cargo RailTrace services, as well as to pay attention to other developments taking place in Finland (e.g. AirPortNet and TERMIS). Furthermore, the Customs and its clients are currently developing an integrated customs system (ITU) for improvement of customs control procedures.

Disregarding some exceptions (Turku, Helsinki), the ports have commenced to develop its own PortNet-based invoicing, statistics, and activity control systems only after the latest version of PortNet was launched. Only a few ports offer their own Internet-based

services to their customers and the related groups. In case of these services, it is often necessary to decide which services should be provided by the ports themselves, and which could be offered utilising the PortNet system or other existing systems. Such port-specific additional services and requirements include (Turku Port 2002):

- location and status information on units present in the port area
- electronic invoicing
- IMO data transfer and balance information
- transit traffic
- statistics
- electronic ordering of port procedures
- general marketing of the port.

In several industry-related projects, such as VIPRO of the forest industry and PUUVIPRO of the woodworking industry, the specific need for development of electronic business between the ports, port operators, shipping companies, and end customers (trade, industry) has been acknowledged. One of the main issues to be dealt with in the future is the identification of needs that can be satisfied with the help of a common PortNet-type service, and of the needs subject to individual development work performed separately by different parties.

iii. Electronic Business and Logistics

The objective of electronic business and logistics is the improvement of competitive ability, as well as creation of economic and quality-related surplus value for enterprise shareholders, customers, and the entire society. The most important characteristic feature of electronic business and logistics is the sharing of information in a co-operative network. Activities and transport chains become transparent, since relevant and updated information is simultaneously available for the entire co-operative network. High-quality information allows more efficient planning of and supervision over activities. Information sharing methods are as follows:

- Real-time or nearly real-time information transfer methods between different systems. Co-operation partners agree on exchange of information, procedure of the exchange, and quality of the information. Access to the co-operative network requires at least a bilateral agreement.
- Common databases and different portals for accessing these databases. Access to databases is granted through common or tailored user interfaces; all entered data

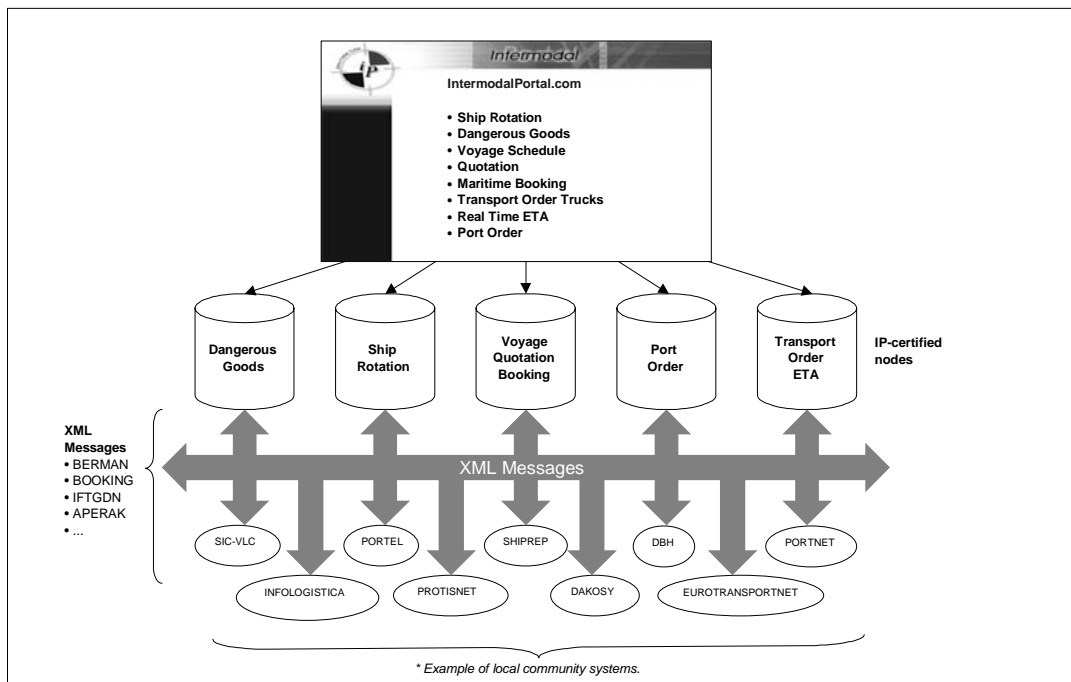
are available to the entire co-operation network. Accession to the co-operation network is technically simple.

PortNet represents the latter solution. Another feature characteristic to the solution is that different functions and surplus value services can be created on the basis of common databases and portals.

From the viewpoint of electronic business and the efficiency of information exchange between the systems created by individual participants, common system architecture and standard interfaces are of crucial importance. Activity processes commonly defined and data exchange interfaces co-ordinated between individual actors allow exchange of information between organisations, in which case the producers of the information transfer it to those in need of it in the same, commonly agreed format (Hautala et al. 2001).

iv. International Application

In case of several EU and other projects, it has become evident that there is a need for automatic vessel and cargo information exchange between the systems of different countries and different operators. Today, the same information is still handled manually in different ports and between different operators, via fax or, in some cases, by way of electronic communication. Functions similar to those of PortNet have been implemented in the largest and most important European ports, often as a component of a respective extended Port Community System (PCS) (picture 4). There are many such systems, but unlike the national PortNet, these are port-specific.



Picture 4. Example of a Port Community System environment (Intermodal Portal 2001 – 2002).

In many countries, message communication is arranged with the help of PCS systems maintained by different port associations and using specific format (EDIFACT, XML); the systems also involve application services created for common use. Such PCS services are usually provided by companies operating on commercial basis and under the control of the owners. Naturally, the difference of Central European solutions is partly caused by the fact that Finnish ports are much smaller in comparison to major European ports.

In Summer 2002, an expert from the APEC visited Finland in order to discuss the state of affairs in the APEC countries. In connection with the explanation provided, the following basic problems associated with development of a respective common service in the APEC countries were discussed: (Miranda A. 2002)

- conflict of interests between the Customs and enterprises
- no uniform message standards
- intense competition between ports and nations
- lack of strategic vision (on state and port levels)
- corruption present in some of the countries

- lack of legal framework adjusting electronic business
- poor technological development level of some regions
- lack of general harmonization and process standardisation.

In case of Finland's PortNet activity model, the aforementioned problems have mostly been solved, and thus it can be considered suitable for export.

4. ECONOMIC AND QUALITY-RELATED IMPACT OF PORTNET

4.1. Procedure

In order to identify the impact of PortNet, information was gathered from members of the management group (discussions, e-mail messages, and other source materials) and interviews were conducted with the following actors:

- Finnlines (Aspelin 2002b.)
- Finnish Port Association (Aura and Tarnanen 2002)
- Viking Line (Vaarama 2002)
- Transfennica (Laurila 2002)
- Unifeeder (Ahlgren and Eriksson 2002)
- Wallenius Wilhelmsen Lines (Westerholm 2002).

In addition to that, a workshop was arranged by the Finnish Maritime Administration, in which the following experts from the Maritime Administration participated: Antti Arkima (vessel statistics), Rolf Bäckström (traffic administration, transport telematics), Ove Hagerlund (vessel inspection), Kari Kosonen (VTS, piloting), Ulf-Peter Lindström (vessel inspection), and Åke Tötterström (icebreaking, IBNet).

The influence field and activity analysis provided in Annex 1 was utilised in evaluation of the attribution of PortNet's impact. Quantitative impact was calculated in connection with PortNet's principal users, i.e. the Maritime Administration and the Customs, as well as brokers and shipping companies. The impact has been evaluated based on the conditions existing by the beginning of the year, and no future development activities or their influence has been taken into consideration.

4.2 Attribution of Impact

4.2.1 Finnish Maritime Administration

The Maritime Administration acquires from PortNet basic statistical information for its own information systems, without the need to re-enter the acquired data. Owing to this,

entry of data and statistical procedures are performed faster and the quality of the data is improved. The Maritime Administration has the possibility to use updated information from maritime traffic charging decisions, as well as other statistical and basic information required for planning and realisation of operative actions. The updated and reliable information acquired with the help of PortNet also improves maritime safety and limits the environmental risks associated with maritime transport.

The following benefits were acknowledged in case of Finnish Maritime Administration and included in the evaluation (Arkima and Bäckström 2002):

- Collecting of statistical information, maritime traffic statistics. Data processing becomes simpler: before PortNet, the Statistical Office processed manually about 50 000 arrival/departure declarations per year. The volume of employee work time associated with processing and archiving of declarations has decreased by approx, 1/3 (from three to two years of employee work time).

The following quality-related and economic impacts were acknowledged, but not taken into account (Arkima and Bäckström 2002):

- Improvement of the quality of information and information processing, acceleration of information acquisition. Increased efficiency and improved quality of information processes is beneficial for statistics and registration of maritime traffic fees, which also allows improved precision of economic planning. Before PortNet, the distribution of maritime traffic fees transferred to the Finnish Maritime Administration on the basis of different vessel types, nationalities, and ice class was determined according to traffic statistics, which resulted in high error risk. Information concerning maritime traffic fees is acquired with a 3-week delay, and the allocation of maritime traffic fees can be confirmed with the help of data acquired from PortNet.
- Owing to PortNet, there exists a database concerning vessels that have visited Finland, which is updated on operative basis. PortNet's basic data has been linked to the Maritime Administration's SHIP database. PortNet's new and modified basic data are transferred to the Maritime Administration's SHIP database for verification. The Maritime Administration's vessel registry verifies the modification information acquired from PortNet and confirms modifications in the SHIP database. Confirmed SHIP data are sent back to PortNet's vessel registry, allowing maritime traffic supervisors and navigation managers to receive updated information on vessels visiting Finland. Maritime traffic supervisors can decide on which vessels are to be inspected (Port State Control inspections) by browsing the SHIP database and the list of arriving ships.

- PortNet vessel database is linked to the Finnish Maritime Administration's ice class certificate registry. With the help of that link, the Customs, maritime traffic supervisors, and other parties concerned are able to acquire updated ice class registry information on vessels they are interested in.
- Information on all dangerous cargoes arriving to Finland and departing from Finland is transmitted to the National Vessel Traffic Emergency Centre, the Turku Radio. Before PortNet, thousands of respective declarations were faxed to the Turku Radio every year. Such declarations can nowadays be acquired directly from PortNet.
- Incorporation of the AIS and VTS systems into PortNet (i.e. integration of vessel location and schedule information) since the beginning of the year 2003 improves safety at sea, as well as the possibilities to cope with environmental hazards.
- Incorporation of PilotNet and IBNet into PortNet since the beginning of 2003 allows more efficient planning and control of icebreaking activities. Resources are now being used more efficiently.

4.2.2. The Customs

The Customs benefits from uniform activity procedure and electronic business documents by faster and more efficient administrative work (statistics, archiving). Owing to electronic declarations, administrative functions are less dependent on time and place, and this releases resources that can be used for other purposes. This promotes general efficiency of administration and fluency of foreign trade in accordance with the objectives specified for the Customs (Tuomisto 2002).

The following benefits were acknowledged in case of the Customs and included in the evaluation (Tuomisto 2002):

- Labour timesavings owing to automation of vessel declarations processing and fees calculation. Estimated timesavings amount to approx. 1.5 employee work years.

The following quality-related and economic impacts were acknowledged, but not taken into account (Tuomisto 2002):

- Timesavings as a result of the automatic processing of customs declaration-related consignment-level cargo declarations.

- Influence of electronic preliminary information. Electronic preliminary information concerning the goods imported to and exported from Finland accelerates the transit procedure. The Customs can acquire the necessary additional information and make the decisions concerning cargo inspection without unnecessary decision-making related delays in the course of freight transportation process. PortNet's Internet-based database also allows performing of the related tasks independent of location and with efficient utilisation of resources. Moreover, electronic preliminary information improves the quality of work (no unnecessary haste) and improves the efficiency of resource allocation. For example, the use of inspection resources can be pre-planned, in which case the need for resources is less intensive, and the personnel will be able to use their time more efficiently. Composition of various risk analyses will become easier as well (which cargo requires inspection).

4.2.3 Ports

The ports benefit from electronic business by improved efficiency of their activity, mainly through decrease in the volume of manual paperwork, which further leads to decrease in the number of errors and substantial timesavings. PortNet also allows ports to increase their turnover, due to the fact that acquisition of invoicing and statistics master data is accelerated and the invoicing procedure is sped up, thus developing business activities and improving profitability. Information on vessel calls and service requests, as well as cargoes in general and dangerous goods in particular is acquired via PortNet from the ports' own information systems, in default format and by term agreed. Owing to common development of the system, statistics services can be provided for small ports with the same quality as in case of large ones.

The following benefits were acknowledged in case of ports and included in the evaluation (Toivonen 2002):

- Lowering of port fees in order to increase the use of PortNet. In the very beginning, PortNet was used by a few brokers only, since there was no way to force brokers/shipping companies to submit vessel declarations and manifests through PortNet. This type of support was established in 1995 and terminated by the end of the year 2002. In all, price reductions (2% of tariff payments) were granted in the amount of approx. 4 million €. Of this, the share of the ports of Helsinki and Turku amounted to approx. 3 million €.
- Saving of the work time required for archiving and processing of vessel and cargo declarations because of automation. Estimated timesavings amount to approx. 0.5

- 1.0 employee work years in case of larger ports. In all, this amounts to approx. 3
- 6 employee work years.

The following quality-related and economic impacts were acknowledged, but not taken into account (Toivonen 2002, Tuomisto 2002)

- All parties producing information provide information in default format and by term agreed, leading to improvement of the quality and efficiency of processes. For example, electronic business in ports – PortNet, ITU, and TERMIS (in future also the export ITU) – accelerates the time of goods transit through ports, thus limiting the need for warehouses, fields, administrative buildings and the like, as well as makes the use of work time more efficient.
- Preliminary information concerning both vessel calls and cargoes in general and dangerous goods in particular is acquired through the system. The Customs stores preliminary information on dangerous goods in PortNet, unless if the declarant delivers it to PortNet directly.
- Ports acquire from PortNet cargo manifests verified by the Customs for invoicing and statistics purposes. A precondition to this is that the brokers and shipping companies submit their declaration on PortNet's manifest level.
- A common database for ports, the Customs, and Finnish Maritime Administration. For example, basic data verified by the customs are also available for ports, e.g. for invoicing (deadweight, nationality, ice fee class, etc.).
- Different levels of authority develop the system together, which simplifies achievement of objectives important from the viewpoint of individual ports.
- High-quality statistics are available for both small and large ports.
- Information providers also participate in the development. Such a solution ensures that the actual applicability of development projects is determined in the course of development, and that the information providers benefit from the use of the system as well.

4.2.4. Shipping Companies and Brokers

Evaluation of PortNet's influence on the activities of shipping companies and brokers presented in this section is based on summary memorandum (Auvinen S. 2002) and interviews conducted in connection with this study (see section 4.1, pg. 26).

Shipping companies and brokers derive direct economic benefit from automation of document processing, due to work timesavings, improvement of the reliability of data, and decrease in the number of errors. In PortNet, former paper forms have been replaced with electronic declarations. Before PortNet, up to nine different forms had to be filled in at ports. Viking Line, for example, used to process 11 000 documents a year before PortNet was introduced; by now, the number has decreased to about 400. Common activity procedure at ports and entry of data into the system only once also improves labour convenience.

The following benefits have been acknowledged and included in the evaluation:

- In case of administrative tasks, the estimated timesavings in case of each vessel call amounts to 0.5...1.0 hours.
- Granted port fee benefits were taken into account as decrease in variable expenditures.

The following quality-related and economic impacts were acknowledged, but not taken into account:

- PortNet's uniform structure and activity procedure improve the quality of the entire business process.
- Business is easier, since submission of official declarations no longer depends on time and place.
- The possibility to enter data only once, automatic transferring of the data to the Customs (it is no longer necessary to enter data several times, print it out and submit to the customs), and the related simplification of administrative tasks.
- Electronic preliminary information speeds up cargo-related procedures throughout the entire official system.
- If intentions of the Customs are known, it is possible to influence the planning of cargo unloading. In case of transportation within the EU, the influence is modest.
- Brokers no longer have to compose special statistics declarations.

4.2.5 Other Parties

In addition to direct, user-specific economic and quality-related impact, PortNet also exerts indirect economic and secondary influence on the various parties participating in the logistics process. This influence was not taken into consideration, since collection of

the required source materials and making of the necessary calculations would have required too much work under the framework of this evaluation project.

As the logistics process becomes more efficient, trade and industry enterprises benefit from increased turnover and active use of operating assets. Profitability of trade and manufacture operations increases due to shorter capital/stock turnover cycles. Through improved preliminary information and planning, PortNet directly speeds up the realisation process of stored and transported goods. The entire logistics process becomes more efficient because of preliminary information and more efficient activities.

Producers of storage and transport services will benefit from improved timing and administration of activities. This directly influences both fixed and variable expenditures. Forwarders will also be able to improve their customer service in many ways owing to PortNet's updated and high-quality information. Forwarders will save work time through using of PortNet's electronic document functions.

Road and railroad transport service providers, stevedores and port operators, as well as providers of port services will benefit from improved preliminary information. Planning of the application of personnel resources and equipment is easier and more precise, which will influence directly the expenditures of service providers and utilisation of capital.

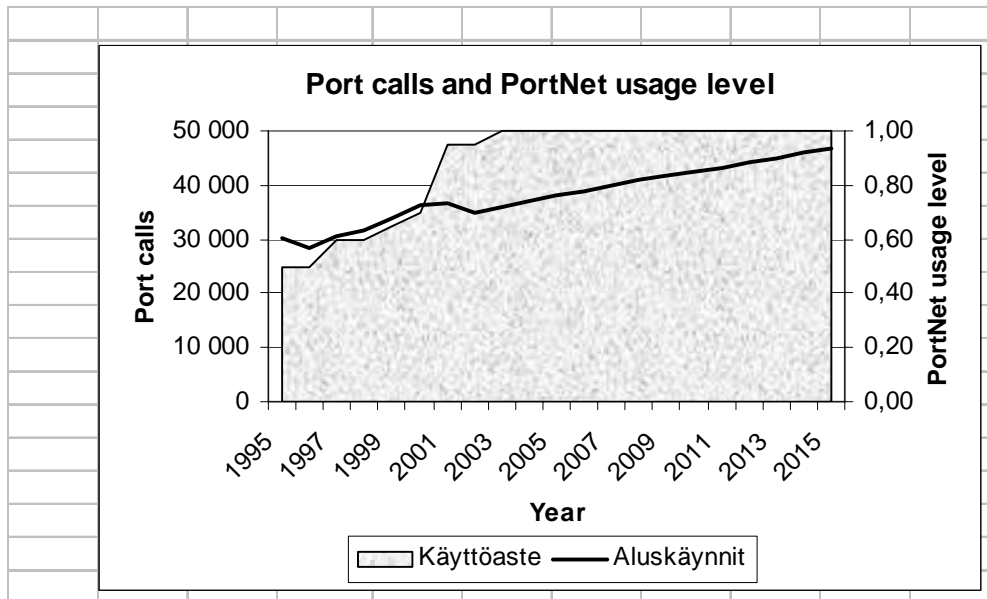
4.3 Analysis of Impact

Direct and indirect economic influence exerted on PortNet's current principal users was analysed. The Du Pont source information form recommended by guidelines for the evaluation of ITS projects (Kulmala et al. 2002) was simplified by combining the activity report and balance sheet sections. More detailed overview of PortNet's economic and quality-related impact is provided in Annex 1.

Profitability calculations were made for four periods of time:

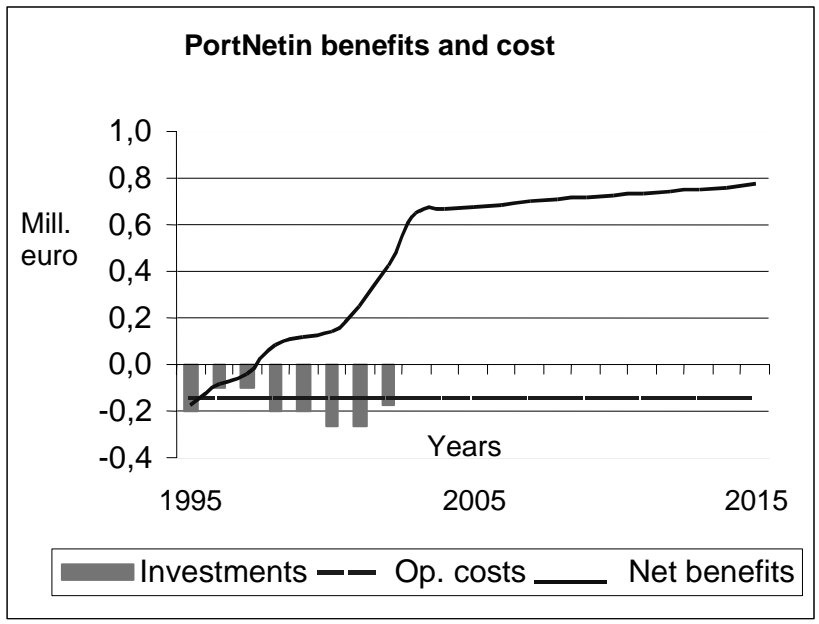
- 1) The entire history of PortNet, i.e. from 1992 to 2015. The development, investment, and upkeep costs of the years 1992-1995 were roughly summarized and transferred into the year 1995; therefore, time series analyses always started with the year 1995. This simplification exerts no practical influence on calculation results.
- 2) The entire history of PortNet's arc of development, but until the year 2010, i.e. 1992-2010.
- 3) PortNet's latest development phase, 1998 – 2015
- 4) PortNet's latest development phase, but until the year 2010, i.e. 1998–2010.

In the course of consideration, the time division of annual data presented in table 5 was specified. For example, port fee benefits were cancelled since 2003, and timesavings were considered to depend on PortNet’s usage level and the number of vessel calls. Usage level was defined as relative share of vessel calls in which case brokers used PortNet. It was presumed that the usage level has been rising evenly since the year 1995 (50%) until the year 2003 (100%) and stabilizes at 100% after the year 2003 (Picture 5). In 2001, usage level was already 95%.



Picture 5. Vessel calls trend estimate and development of usage level (basis for calculations). Usage level indicates the share of vessel calls registered in PortNet for all foreign traffic vessels visiting Finnish ports.

The calculations were made regarding PortNet’s principal users: the Finnish Maritime Administration, the Customs, ports, and shipping companies/brokers. It was assumed that one call results in timesavings for only one broker or shipping company (Auvinen S. 2002). PortNet-related expenditures and benefits calculated according to these principles are described in picture 6. Net benefits have increased in pace with rising of the usage level. From the viewpoint of benefits, investment and upkeep expenditures are modest.



Picture 6. PortNet's net benefits rise in pace with the development of usage level. The figures are nominal (no inflation corrections).

5 PROFITABILITY CALCULATION

5.1 Calculation Method

Profitability calculations were based on the year 2002, using 5% discount rate. The following were selected as the indicators of profitability:

- Net present value (NPV), indicating total profit and acquired by way of subtracting present cost value from present profit value.
- Internal rate of return (IRR), indicating the internal profit rate of net cash flow.
- Benefit-cost ratio (B/C), ratio of discounted benefits and costs.

Indicators were calculated both for specific actors (ports, the Customs, Finnish Maritime Administration, enterprises) and in total. Calculation of internal profit, for example, was sometimes impossible. If cash flows were negative only, the internal rate is $-\infty$. “e” marks the cases when the indicator could not be calculated.

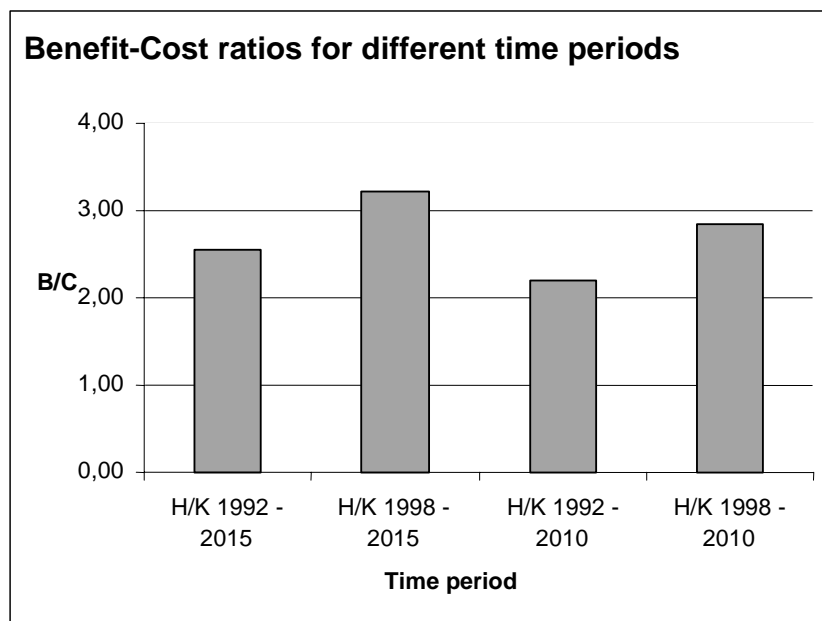
5.2 Results

In this section, we present the main results of PortNet profitability calculation. More detailed overview is presented in Annex 1.

When considering the indicators, there is ample reason to state that PortNet has been a profitable investment, irrespective of the period under consideration, inclusion of the investments and costs of the past, or estimated profits in the future (table 5 and picture 6). PortNet has been a profitable investment, even more so because of the fact that only a part of the benefits has been included in the calculation. PortNet’s benefit-profit ratio during different periods under consideration is at least 2.

Table 5. Indicators of the profitability of PortNet. Direct economic influence on principal users has been taken into account.

Indicator	Periods considered			
	1992–2015	1998–2015	1992–2010	1998–2010
IRR, %	44 %	e	44 %	e
NPV, Mill. €	6.90	7.34	4.92	5.36
B/C	2.55	3.23	2.20	2.84

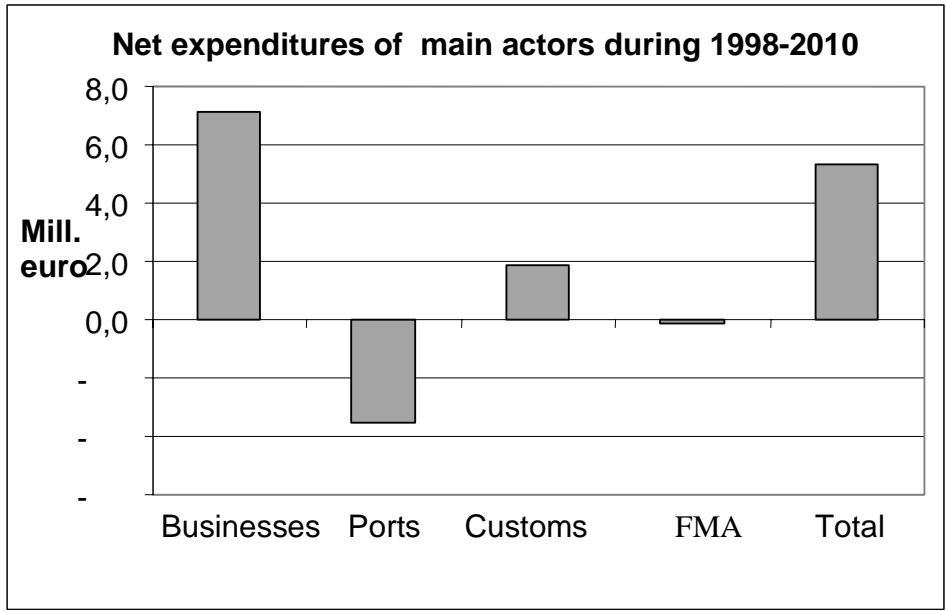


Picture 7. PortNet's benefit-cost ratio during different periods under consideration is at least 2.

Picture 8 shows that above all, enterprises (shipping companies and brokers) and the Customs have derived most benefit from PortNet. The benefits have mainly accumulated through work timesavings. The time saved by Finnish Maritime Administration, mostly in connection with statistics activities, does not always compensate for the investments made and upkeep costs paid by the Administration. The ports have acted as net payers, due to the port fee benefits granted to enterprises using PortNet.

These differences were somewhat equalised after full cancelling of port fee benefits at the end of the year 2002 (fees are transferred to enterprises). On the other hand, relieving of the enterprises using PortNet from the service fees charged by the Customs is currently under consideration. This is based on Regulation No. 1129/2002 of the Ministry of Finance on chargeability of Customs operations (Ministry of Finance 2002). Cancelling of service fees is to enter into force in the beginning of the year 2004, which means decrease in the economic benefits derived from PortNet by the Customs, and a respective increase in the benefits derived by enterprises (cancelling of the port fee benefits is thus compensated to enterprises). These changes equalize the benefits and costs of the bodies financing PortNet.

According to a rough future prognosis, the enterprises are most likely to benefit the most from PortNet, but the same goes for administrative circles, and there will no longer be distinct "net payers".



Picture 8. Net expenditures of the principal users of PortNet, 1998 - 2010.

6 TRANSPORT POLICY OBJECTIVES AND INFORMATION SOCIETY

In addition to the above-stated economic, quality-related, and indirect economic influences, the impact of PortNet was also evaluated from the viewpoint of transport policy objectives and development of information society (Ministry of Transport and Communications, 2000). The outcome is presented in table 6.

Table 6. Concentration of PortNet's primary effects in the objective fields of information society and transport policy.

Primary effects and their concentration in the fields of transport and information society policy	Information society	Transport system service level and costs	Safety and health	Social viability	Regional and community development	Environmental risks
Increase in electronic business	😊					
More efficient use of registers and systems	😊	😊				
More efficient supervision over the transport of dangerous goods			😊			😊
More efficient supervision over vessel traffic		😊	😊			😊
More efficient operation of ports		😊			😊	
Improvement of logistics-related processes		😊				

PortNet is most beneficial from the viewpoint of achieving objectives associated with transport system service level and expenditures. In addition to that, PortNet has positive effect in case of objectives associated with the development of information society, improvement of safety and health, development of regions and communities, and

elimination of dangers to nature. PortNet has no negative effect in case of any of the objectives.

7 EVALUATION OF IMPLEMENTATION AND DEVELOPMENT REQUIREMENTS

7.1 Method

The implementation and development requirements of PortNet were evaluated on the basis of observations made in the course of work, interviews conducted with shipping companies and brokers (Auvinen S. 2002), and description of the technical realisation (Annex 2, Berglund 2002). Not many persons were interviewed (see section 4.1), and thus this study was not a wide-scale PortNet user survey.

7.2 User Perspective

Users consider the PortNet activity model and technical solution concept rather successful. The service is generally regarded as convenient and handy, although some users are not satisfied with some of its features. Users identified several alternative application solutions and functions that could include utilisation of the information acquired from PortNet (e.g. piloting activities, icebreaking, logistics, etc.).

On the other hand, users expressed the opinion that reliable and convenient, customer-oriented application of the services presently offered by PortNet is more important than implementation of extensive additional functions and services.

The following development objectives and requests were put forward:

- Automatic transmission of manifest information to the port authorities and Customs of the destination country (in case of both export and import)
- Development of PortNet mobile services
- Transfer of PortNet schedule information to all PortNet's own browsing monitors and other systems
- Development of PortNet's reporting features and continuous improvement of the quality of data. The users are of opinion that it is necessary to develop a reporting tool allowing them to compose their own statistics and reports in compliance with various criteria
- Development of the PortNet portal so that it would also include the Intermodal Portal solution, PilotNet, and IBNet

- Checking of cargo information with the help of information concerning the associated parties (sender/receiver), using company codes
- Integration of the TERMIS project into PortNet (starting with electronic notice in the html format)
- Amendment manifests to the cargo manifests
- Standardisation of the manifest message and statistics within the EU (Common Customs Codex defines manifest).
- The PortNet concept should be offered to other countries as well, emphasizing the Finnish co-operation model and “best practices”-functions developed in the course of actual work.
- Selling of the PortNet system itself abroad may turn out to be difficult and require great effort. Nevertheless, it is important that similar systems compatible with PortNet be implemented in other countries (especially in the Baltic Sea region and other significant co-operation territories).
- As concerns promotion of the use of PortNet, inclusion of the Intermodal Portal services may prove to be very important.
- Development of schedule services
 - Schedule tracking might cover the entire Europe (status image). This can be achieved via the SafeSeaNet project.
 - NeLoc project foresees a pilot programme in the Baltic Sea region.
 - In case of the Baltic Sea Digital Motorways project currently under development, an ETA-model covering the entire Baltic Sea Region is one of the implementation solutions subject to discussion.
 - Forest industry is in great need of reliable information (mainly concerning irregular traffic).
- Service request activation. Acquisition of receipt/confirmation with the help of various technical means (e-mail, SMS, etc.).

User criticism is mainly directed towards technical features of the system. The situation was declared to have taken a turn for the worse in autumn 2002 (e.g. slowness of the service, language changes during the declaration fill-in process, frequent system crashes). Latest amendments made the service even less convenient to use, since the opinions of

users have not been taken into account (for example, filling in of vessel arrival and departure times is too tedious). System crashes outside of working hours is a clear deficiency. For example, if the system crashes after 4 PM on Friday, it is restored only by Monday noon.

7.3 Organisation

From the viewpoint of the service users, the organisation model of PortNet community has been sufficiently flexible, but lack of clear rules concerning the service's host organisation, the responsibilities associated with upkeep and development of the service, as well as other legal issues, has been somewhat problematic. However, the new administration order introduced in the beginning of the year 2003 clarifies the rules and seems to be a positive solution from the viewpoint of PortNet's activity, for as long as PortNet services remain non-commercial.

From the viewpoint of export and international expansion of the PortNet activity model, lack of participants having clear commercial interest in PortNet and willing to invest into the export of the activity model and the related solution components is an obvious deficiency. On the other hand, PortNet's primary objective is to provide basic services free of charge/at favourable cost, thereby supporting the activities of domestic actors and promoting foreign trade. Possible export of PortNet and provision of commercial surplus value services are of secondary importance.

Development objectives identified:

- It would be favourable to compose a business plan for PortNet, which would deal, inter alia, with service provision principles, strategies, activity programme, marketing, earning logics, etc., as well as outline the basic services, commercial surplus value services, and service pricing principles. Accomplishment of such a task would probably also generate new ideas concerning the development and activity of PortNet, since the standpoint would be different. For example – what new services should be created, what services should be offered for pay, and how should their provision be organised (basic services, surplus value services offered by officials, and surplus value services offered by enterprises). Composition of the business plan would also result in more precise comprehension of PortNet's role, significant functions, and links to other systems and services.
- "PortNet User Forum", through which the various participants could discuss the development needs of PortNet together and to receive information concerning e.g. EU plans and guidelines and their possible influence on the related fields and the development of PortNet.

Development objectives; promotion of the export of PortNet:

- Commercial export should be entrusted to an actor having clear responsibility and commercial motivation.
- International network is required for the export of PortNet and distribution of the concept. The possible tools include EU programmes and projects, direct co-operation between organisations (e.g. Customs Boards), and TEDIM co-operation in the Baltic Sea region. For example, the TEDIM development forum is currently preparing a project called "Baltic Sea Digital Motorways", and the distribution of a PortNet-type solution is one of the subjects for discussion.
- We need a Finnish development strategy, to which all of the primary participants would be devoted: KTM, LVM, Tekes, PortNet community/users, system introducer (sales, commercial motive), and expert levels (motive for project-oriented activity)
- The PortNet export project should include the following stages:
 - 1) Development of true common initiative in different countries, accompanied by sufficiently high-level political influence on different authorities (ministries, Customs boards, maritime administrations, etc.) and strong arguments (e.g. EU guidelines and individual benefits – on the basis of this evaluation report, for example).
 - 2) Agreement upon common processes and messages. Mainly includes practices that already exist – these practices, however, should be reviewed, taking into consideration the local conditions, and amended so that all the parties agree to follow them
 - 3) Synchronized implementation in different countries based on PortNet, IP, or other technical solutions. The actual problem that has hindered progress in several Baltic Sea region countries is that the stages 1) and 2) have not been properly completed, and attention has been paid to technical realisation only.

Opinions concerning surplus value services:

- From the viewpoint of officials, production of commercial services and commercial export of the system should be accomplished by commercial enterprises. The overlapping areas of PortNet's basic services and commercial surplus value services should be identified.
- PortNet could function in the present manner and offer basic services, while the Intermodal portal could be utilised as the basis for commercial surplus value services.

7.4 Pricing of Services

User opinions (shipping companies and brokers)

The current principle, i.e. free service, is beneficial from the viewpoint of users who only provide information for the officials (currently the main objective). Such practice is expected to continue. If surplus functions were to be included in the service, the participants are ready to pay for them. The most important requirement, however, is that basic services must comply with the needs of the users, from the viewpoint of both the content and applicability.

Rules concerning transport telematics products and services (Airaksinen et al. 2003)

The existing legislation on charging of the services offered by state officials, Act on the Charge Criteria of the State, does not provide unambiguous answers to the questions concerning charging of said services. According to the laws currently in force, decisions on charging of the services can be made rather freely.

When charging the services offered by state officials under the jurisdiction of the Ministry of Transport and Communications, special attention should be paid to transport policy objectives. The pricing of documentation produced by state officials must support establishment and development of transport telematics services. Under such circumstances, the services should be free of charge or charged below their net cost, covering only the direct intermediation and data transmission expenses. Application of this principle gathers momentum within the entire European Union. If the information is delivered free of charge or at low cost utilising a suitable undercharging principle, budgetary financing of the activity must be ensured.

Opinions on the charging of PortNet services

- The development of PortNet services and charging for the services should be analysed based on the relation between basic services and commercial surplus value services. The service development strategy should indicate whether only the basic services (services based on information required by officials) of PortNet will be developed in the future, or will the development also include the use of PortNet as a foundation platform of surplus value services provision (surplus value services by both officials and commercial enterprises).
- PortNet is a component of the information transmission structure built and maintained with the help of public means (partly derived from state taxes), and the use of PortNet's basic services should be free of charge at least for the levels that utilise it for submission of official applications and at the same time generate information for

PortNet. The use of PortNet's non-commercial services by other actors might be free of charge as well, because this will allow enhancing of the positive influence of PortNet on the achievement of objectives associated with state economy, transport policy, and information society. If other than PortNet's financiers are charged for the use of its basic services, the price should be low (data acquisition costs at the most). Information producers should be able to use the service for free or for very low price.

- Principles of charging the surplus value services possibly created on the basis of PortNet in the future should be defined separately in the PortNet services development strategy.
- Separation of different types of services should be performed before implementation of such new services that require definition of the service type and financing. The following service types are suitable for application within the present PortNet and the futures PortNet services:
 1. basic public services made available for everyone by the authorities free of charge
 2. public net budget-based services made available by the authorities for everyone or specific contract partners only at prime cost or data acquisition cost
 3. market-price surplus value services made available by private or public commercial enterprises at market price for everyone or specific contract partners only.

a. Technical Realisation of the System

The current Internet-based system has made it possible to develop the PortNet service into a true "single window business station" (see EU Single Window concept). PortNet's architecture allows easy expansion of the user base and installation of solution-specific programmes in user machines is not necessary. If the number of users should increase, efficiency of the server can be improved, or several servers used together with a load-distributing router. Addition of functions can be implemented whether by expansion of the existing PortNet solution or by realisation of functions with the help of new applications suitable for use in the application server. Common PortNet database will be the uniting factor.

The Intermodal Portal interface enables development of information transmission between foreign ports and shipping company executives, as well as utilisation of PortNet in prior and successive transport operations. Nationwide schedule function will support

the companies using Integrated Custom Declaration System (ITU) and the Intermodal Portal transport offer solution will enable to create a common Internet-based information system for small and medium-sized transport enterprises in order to improve the efficiency of their operation (transport orders, bills of lading, and freight bills).

Development objectives identified:

- Upon establishment of the interfaces of PortNet and other systems, it is necessary to ensure the possibilities for prospective integration of external systems and sufficient flexibility, since the use of PortNet through direct message communication (EDL or XML messages) is certain to increase.
- Integration of PortNet into the systems of Finnish Maritime Administration has advanced significantly. After the integration, it will be necessary to ensure the applicability and reliability of the outcome, as well as to provide sufficient supervision tools in order to resolve problem situations (information entered once must be transferred correctly and in time into other systems).
- Upon development of the system, it is necessary to identify the needs of all PortNet participants and to support small-scale pilot projects in order to find ideas that work.
- Upon development of the Intermodal Portal (incl. definition of interfaces), it is necessary to account for the needs of foreign co-operation partners and features of their systems, as well as to follow international standardisation, in order to ensure that the information interchange with foreign actors will be resolved in the most simple and efficient manner.

b. Applicability of the System, User Interface

The system is considered easy-to-use and logical, although in autumn 2002 some problems did emerge (e.g. slowness of the service, language changes during the declaration fill-in process, frequent system crashes), caused most likely by the increase in the number of users and “traffic jams” in the beginning and at the end of workweeks. Functional disorders caused by technical faults of the system have caused most harm at weekends, since functionality of the system has sometimes been restored only by Monday noon. The problems mentioned above are likely to be eliminated in 2003, after physical transfer of the PortNet service to the facilities of the Helsinki VTS centre, and supervision over the PortNet service on 24-hour basis instead of only during the work-hours.

The interviewed shipping company and broker representatives mentioned the following specific problems:

- correct transfer of information if an attempt has been made to update the manifest information before assignment of a departure/arrival code by the Customs
- filling in of the basic declaration is time-taking (e.g. it is impossible to copy and paste information from an earlier version and simply update the changes)
- after submission of basic information, it is necessary to wait for a long time (1 h) before it is possible to send the manifest information.

In opinion of the interviewed shipping company and broker representatives, the user interface is basically good and simple. Improvements were desired mainly in addition of logical control functions (times, work procedure in correct order, etc.).

Development objectives identified:

- Ease of use could be improved by e.g. generation of pre-filled forms on the basis of personalised and protected passwords (company name and other information of the kind), as well as by creating of the possibility to update previous declarations.
- The architecture of PortNet enables technical improvement of applicability, e.g. by using dual application servers and establishment of fault recovery service for elimination of technical faults (shorter response times and improved reliability). By supervision of the present system's operation, it is possible to evaluate system reliability and the need for measures improving response time, but also resulting in increased expenses. Response times are often influenced by capacity fluctuations within the public data communication system or router faults possibly causing the delays that annoy users – in such cases, improvement of the server system does not result in shorter response times. Systematic registration of data traffic, allowing to distinguish between the delays caused by the data communication system and the delays caused by the server's own treatment delay, is very important.
- Since the system is used by a large number of users (about 1300), conducting of an Internet-based questionnaire survey and interviewing of the principal user groups would allow to get a better notion of PortNet's usability.
- In addition to the aforementioned, regular identification of user needs with the help of e.g. "PortNet User Forum" and service-related feedback functions (collecting of user comments and development proposals) is recommendable. This would ensure compliance of the features developed and amendments made with actual user needs.

8 POSSIBLE FUTURE IMPACT

8.1 Saving Opportunities for the Current Users of PortNet

The Customs

A great saving potential is associated with maritime traffic fees, since introduction of the automatic invoicing system in the near future will allow to save approx. 0.5 years of employee work time. Planned electronic delivery of invoices to the customers will allow to save additional 0.5 years of employee work time. The processing and calculation of declarations can be automated altogether, in which case the savings will annually amount to 2 years of employee work time. It is also necessary to take into account that the percentage of electronic declarations submission has been subject to continuous increase – such declarations currently constitute about 80 % of all maritime traffic fee declarations (basic declarations). For the time being, permission from the Customs Board is required for submission of maritime traffic fee declarations, as well as consignment-specific cargo declarations.

On average, of the customs declaration-related obligatory consignment-level cargo declarations, every fourth was submitted to the Customs electronically in 1990-2002. This number has been increasing constantly and is currently approx. 50 %. This usage level is likely to rise in the future as well, resulting in actual savings.

Savings associated with reporting are difficult to estimate, since PortNet has so far not been used as a reporting tool. Possible influence is of extremely large scale, approx. 5 years of employee work time for the entire Finnish Customs. Nationwide reporting instructions have not been composed yet. Development of reporting requires additional investments into PortNet.

Ports

If all ports were to utilise information acquired from PortNet on more extensive basis, e.g. for automation of invoicing, statistics, and reporting, the resulting work timesavings would be significant. On the other hand, small ports might have a problem with investing into the software required, but in that case, common system architecture would prove helpful.

Maritime Administration

Use of PortNet's information in other systems allows improved preliminary co-ordination of different functions and more efficient utilisation of the resources available. For example, integration of the AIS, VTS, PilotNet, and IBNet systems into PortNet in 2003 rationalises the use of Maritime Administration's resources, but the resulting cost savings have not been defined in this study.

Shipping Companies and Brokers

Work timesavings of shipping companies and brokers resulting from the use of PortNet were calculated according to minimum savings estimates provided in the interviews conducted. Maximum estimate was twice as high (0.5...1.0 h per vessel call).

8.2 Improvement of the Efficiency of Logistics Processes

The calculations did not cover the improvement of the efficiency of the logistics processes resulting from better, timelier, and more accurate preliminary information acquired due to PortNet. It is most likely that these benefits are substantial, and their realisation does not require large investments. Even if only a few minutes are saved per each separate cargo transportation event due to more efficient application of transport equipment, the total timesavings will bring significant benefits. For example, take the timesaving arguments used in case of road building operations: hundreds of millions are sometimes invested only in order to allow each separate vehicle to reach its destination a few seconds earlier.

The influence of systems similar to PortNet on improvement of the efficiency of logistics process should be evaluated under a separate project. Even the results of a single evaluation project can be used for evaluation of other systems of the same type with sufficient accuracy, and the tedious evaluation procedures need not be performed in case of each individual system. Such evaluation requires modelling of the logistics process in case of different links of the delivery chain or utilisation of an existing model, as well as sufficient amount of empirical information, which can be generalised with the help of statistics.

The class of said benefits can be roughly estimated as follows, for example:

- extensive use of PortNet grants 1/2 h timesavings per one cargo transport operation (a transport operation = the entire transport chain per one unit of cargo)
- sum of annual foreign trade turnover, export, and import; composed of all cargo transport operations

- accordingly, the volume of annual foreign trade turnover forms a cargo flow, the efficiency of which will increase by 1/2 h, and for this value a benefit from the resulting increase in the rate of capital turnover can be calculated, which is:

$$\text{cargo flow value} \times \text{capital interest} \times 1 \text{ y} / 365 \text{ d} / 24 \text{ h} / 2 = \text{benefit}$$

- provided that the capital interest is 5% and cargo flow value (in accordance with statistics of 2001) 35 600 + 47 700 million €, the capital interest savings achieved owing to timesavings amount to $(35\,600 + 47\,700) \text{ million } \text{€} \times 0.05 \times 1 / 365 / 24 / 2 = 0.24 \text{ million } \text{€}$ per year. At 10-year discount and 5% interest rate, 0.24 million € amounts to approximately 1.8 million €.

If better preliminary information would also allow limiting e.g. truck idle time at terminals, much more substantial financial benefits are to be expected. For example, under the framework of the HELSAT project (Rautiainen et al. 1991), on the basis of information concerning the Helsinki port, it was estimated that each minute of trailer or container idle time saved results in savings in the amount of approx. 0.34 million € per year for transport companies (due to reduction in driver wages and transport equipment-related expenses).

Although the calculations described above are of speculative nature, they still provide an overview of the cost-reduction potential of systems similar to PortNet in connection with improvement of the efficiency of logistics processes.

8.3 Benefits from Common Architecture

A common architecture for telematics systems is still lacking in maritime transport and logistics. PortNet's architecture could still be utilised by integration of other systems into it and use of common information. Such benefits will be granted e.g. in case of linking the PilotNet system to PortNet, in which case piloting operations can be fulfilled with the help of preliminary information acquired from PortNet. PortNet's user interface could be enhanced by inclusion of various data exchange and service requests, allowing to perform several functions in a centralised manner through the interface. Linking to other systems is accomplished by definition of processes, common areas, and messages transmitted into the systems.

The benefits derived from the use of common architecture have been evaluated in connection with European architecture projects and surveys. For example, the benefit/cost ratios of transport telematics systems can be multiplied if common architecture and information infrastructure are used instead of tailored solutions (Perrett

& Stevens 1996). The benefit/cost ratios of PortNet and the services integrated may well increase up to 2-3 times in comparison with the present level.

8.4 Risks of Automation

Creation of complicated systems and linking of other systems into an interdependent network also generates costs and risks, which in principle require calculation of cost impact. Such costs and risks include:

- Increase in system upkeep and updating costs in the future. In case of complicated systems, updating of a component may result in the need for updating or replacing of other components. This risk can be somewhat reduced by way of using an architecture, in case of which certain modularity is characteristic to the systems involved, and updating is therefore more efficient and simple. Several systems of the Maritime Administration function independently as well, which reduces the aforementioned risk.
- Excessive automation is a threat to functionality. In such a case, systems often become so automatic that the use of alternative functions and flexible utilisation of the system by users become quite difficult. User needs may change in the future in ways that are impossible to predict.
- Information management in complicated systems and the capability of supervisory bodies to direct the operation towards the goals set. If technology and complexity of systems were to exceed the limits of human management ability, people would be “at the mercy of technology”, and functional needs may no longer serve as the primary basis in decision-making process. To a certain extent, this risk can also be addressed by system architecture.
- Relying on a single provider of system operation and upkeep services. This is a risk that is characteristic to information management; in order to minimize it, certain information management procedures should not be entrusted to contractors. It is also necessary to compose a clear functional architecture defining the most important operations that the systems must be able to perform. In such case, technological skills or software solutions are not of decisive importance.

In general, the aforementioned automation-related risks associated with PortNet can be reduced with the help of system architecture, as well as by continual development of PortNet on the basis of user requirements.

9 CONCLUSIONS

9.1 Influence and Implementation of PortNet

From the viewpoint of economic viability, PortNet qualifies as a profitable development, although the profitability calculations only accounted for the benefits derived from administrative operations of present principal users. In addition to direct economic impacts thus calculated, PortNet also produces numerous quality-related benefits, such as:

- advanced model of co-operation between private and public actors improves the efficiency of actions and co-operation between different parties, as well as ensures the fulfilment of preconditions to successful foreign trade
- indirect benefits from improvement of the efficiency of the logistics process
- improvement of the accuracy and quality of data, improvement of work ease.

PortNet clearly supports the achievement of transport policy objectives, especially in case of transport system service level and cost efficiency. PortNet also exerts positive influence on the achievement of objectives associated with development of information society, safety, health, regional and community-related development, and elimination of environmental risks. No negative influence associated with PortNet was identified in connection with achievement of any transport policy objectives or development of information society.

The PortNet activity model is a good example of efficient co-operation between private and public sectors even on the international level. PortNet also proves that information related to safety and trade can be processed within the same system, and that the respective functions benefit from each other. The PortNet activity model has clear export potential. However, promotion of export and development of the activity model on the international level requires sufficient commercial interest in the system – it is to be turned into a commercially attractive, ready-to-use product or service package.

The users of PortNet are satisfied with its activity model and technical implementation. For the most part, the service meets user expectations, being logical and generally easy to use. User interface is also considered basically good and convenient. However, the users are of opinion that the quality of service has decreased since autumn 2002, and some technical features of the system are criticized. Special attention should be paid to system maintenance and service support, since most of the technical disorders can probably be removed at relatively low cost, by way of upkeep organisation. As much as development of PortNet is concerned, more attention should be paid to user needs. From the viewpoint

of system development, the dependence risk would be reduced if system implementation would not depend on a single software provider.

The fact that PortNet services are currently offered free of charge complies with the legislative acts regulating the charging of state official-produced documentation and services, and supports the achievement of transport policy objectives and development of information society. It also complies with the charging principles of services provided by state officials currently applied within the European Union. If surplus value functions were added to PortNet, or if commercial surplus value production were to increase, the charging principles should be revised on the basis of general principles applied in connection with planning of state official services and the respective principles applied on EU level.

Although the organisation model of PortNet community has been quite flexible from the viewpoint of users, lack of clear rules concerning PortNet's host organisation, responsibilities associated with upkeep and development of the service and other legal issues is being considered a problem. PortNet management reform effected in the beginning of year 2003 clarifies these rules and seems to be a good solution from the viewpoint of PortNet activities for as long as the services offered are not commercial.

The current Internet-based system has made it possible to develop the PortNet service into a true "single window business station". PortNet's architecture allows easy expansion of the user base and installation of solution-specific programmes in user machines is not necessary. The Intermodal Portal interface enables development of information transmission between foreign ports, as well as utilisation of PortNet in prior and successive transport operations. Nationwide schedule function will support the companies using Integrated Custom Declaration System (ITU) and the Intermodal Portal transport offer solution will enable to create a common Internet-based information system for small and medium-sized transport enterprises in order to improve the efficiency of their operation.

Positive influence of PortNet is subject to constant increase as electronic business develops and new functions and systems are integrated into PortNet. PortNet has clear potential from the viewpoint of making the operative activities of different actors and the entire logistics process more efficient. Significant additional benefits can also be achieved by creating a common system architecture concerning maritime traffic and the related activities (Maritime Administration, the Customs, ports, and other actors).

Table 8 presents an overview of the impact of PortNet. It includes both the personal opinions of authors and influences clearly determined by mathematic calculation methods

used. As an investment, PortNet is extraordinarily beneficial for the entire society, including enterprises and public administration.

Table 8. Summary of PortNet influence. + = positive influence, ++ = very positive influence. Financial estimates have been calculated for the time period 1998-2010 (net value, 5% profitability estimate).

AREA OF INFLUENCE / VARIABLE		SUBJECT	
		Public administration, society	Public administration, society
Economic and quality-related influence	Work timesavings, improvement of process efficiency	+ >1.5 mill. €	++ >3 mill. €
	Efficiency of capital use		+ >1 mill. €
Transport and society policy objectives	Transport system service level and expenses		+
	Environment and safety	+	
	Information society	+	

9.2 Development of Guidelines for the Evaluation of ITS Projects

Guidelines for the evaluation of ITS projects provide an accurate framework for the evaluation of PortNet's impact. However, upon evaluation it is necessary to remember that the guidelines are intended for use in parallel with other instructions concerning project evaluation, and that they should be adjusted to the needs of each specific evaluation task. In the process of evaluating PortNet's impact, the following needs for development of the guidelines were identified:

- The Du Pont model for evaluation of more extensive systems presents several problems. Field of activity-level influences are quite difficult to apply, since activities reports and balance sheets are not always available for specific fields.
- The Du Pont model is applicable for enterprise-specific evaluation if system has clear activities report and balance sheet-related influences.
- The Du Pont model is well applicable if enterprise-level influences are extensive, or if it is necessary to direct the influences towards activities report or balance sheet.
- The hierarchy and logical qualities of the evaluation guidelines should be developed further; e.g. the influence field and activity analysis seems to be a method difficult to comprehend. On the other hand, use of the analyses subdivides evaluation of impact and facilitates direction of evaluation activities towards significant influences and objectives.

- Evaluation guidelines do not specify the indexes or calculation methods to be used. Use of a common procedure framework should be considered.

In case of different types of projects and different areas of activity, profit requests and risks are different as well. The risks should be proportioned to profit requests (discount interest used) – different interest rates should perhaps be used e.g. in case of maritime traffic telematics investments and road traffic telematics investments. For example, if investment into maritime traffic telematics allows substantial reduction of the risk of environmental disasters on regional level, the established profit request should be reasonable and the investment threshold rather low. In each case, the appreciation of risks by adjustment of discount interest should be considered separately (Leviäkangas and Lähesmaa 1999).

10 RECOMMENDATIONS FOR THE FUTURE

In the following, we present our common recommendations concerning the development of PortNet.

PortNet User Forum

PortNet's host organisation at the time (currently the Finnish Maritime Administration) once a year convenes the PortNet User Forum. The parties gather to discuss the development needs of PortNet and to acquire information on e.g. PortNet's development plans and international contacts.

Development of Architecture

As concerns system architecture, two architecture-related needs have been identified on the basis of this evaluation report and earlier investigations:

- Maritime Administration System Architecture. Integration of PortNet into the systems of the Maritime Administration has advanced significantly. Implementation of system architecture is the precondition for successful co-ordination of the resulting whole and integration of different systems. The architecture would also function as a tool for management and administration of the Maritime Administration's system network (the Administration being PortNet's current host organisation). Such a management tool is lacking at the moment.
- Port area service architecture. Service architecture of different actors (Maritime Administration, the Customs, ports, consignors, forwarders, transport enterprises, warehousing), used for realisation of common interfaces with the purpose of provision and development of port services. With the help of port area service architecture, it is possible to develop and improve port area service processes and to integrate them in a more advanced manner in order to support and improve logistics-related functions.

Upon implementation of the architecture, it is necessary to take into account the foreign links (e.g. SafeSeaNet) and the links to national TelemArk architecture and cargo traffic telematics architecture (TARKKI) introduced in March 2003. TARKKI is suitable for use as the basis for both Maritime Administration and port area architectures. With the help of said architectures, definition of different commercial activity plans and earning models will become simpler.

Upon establishment of the interfaces of PortNet and other systems, it is necessary to ensure the possibilities for prospective integration of external systems and sufficient flexibility, since the use of PortNet through direct message communication (EDL or XML messages) will surely increase.

As concerns expansion of the market of PortNet, inclusion of the Intermodal Portal services may prove to be very important. Upon development of the Intermodal Portal (incl. definition of interfaces), it is necessary to account for the needs of foreign co-operation partners and features of their systems, as well as to follow international standardisation, in order to ensure that the information interchange with foreign actors will be resolved in the most simple and efficient manner.

Business Plan

A business plan should be composed for PortNet, which would deal with service provision principles, strategies, activity programme, marketing, earning logics, types of new services provided, charging for the services, and organisation of their provision (basic services, surplus value services produced by officials, and surplus value services produced by enterprises). Accomplishment of such a task will also generate new ideas concerning the role and significant functions of PortNet, as well as of its relations with other systems and services.

PortNet Export Strategy

There is a need for Finnish development strategy, to which all of the primary participants would be devoted: KTM, LVM, Tekes, PortNet community/users, system introducer (sales, commercial motive), and expert levels (motive for project-oriented activity)

Such an export project should include the following stages:

- 1) Development of common initiative in different countries. This requires sufficiently high-level political influence on different authorities (ministries, Customs boards, maritime administrations, etc.) and strong arguments (e.g. EU guidelines and benefits for the various participants).
- 2) Agreement upon common processes and messages. Mainly includes practices that already exist – these practices, however, should be reviewed, taking into consideration the local conditions, and amended so that all of the parties agree to follow them
- 3) Synchronized implementation in different countries based on PortNet, IP, or other technical solutions.

The means for achievement of these objectives include, inter alia:

- EU framework programmes, into which PortNet could be included as a "best practice" example or demonstration (e.g. MarNavIs project under the sixth EU framework programme)
- other EU development programmes (e.g. SafeSeaNet of the European Commission) or EU regional programmes (e.g. Intereg).

Evaluation of Influence on Improvement of the Efficiency of Logistics Processes

The influence of PortNet on logistics processes should be determined on individual basis, in case of each link of the transportation chain. The benefits associated with improvement of the efficiency of logistics processes are probably much more substantial in comparison with the quantitative benefits based on timesavings achieved by principal users of PortNet in their administrative activities.

Improvement of the Technical Applicability of the Service and User Interface

Measures should be taken in order to implement the development objectives identified in this research on the basis of user requirements (see sections 7.2, pg 38, and 7.6, pg. 43). Service applicability can be enhanced by improvement of the efficiency of the system's technical support and more extensive distribution of the responsibility for upkeep of the system, e.g. through backup arrangements and co-operation between the Maritime Administration and the Customs (currently the actual upkeep of the service is performed by only one employee of the Maritime Administration).

Development of PortNet's data exchange solutions (EDI) and improvement of their versatility is also recommended, so that various systems of the enterprises involved could utilise PortNet better than before and the need for broker-specific tailoring would be reduced.

REFERENCES

- Ahlgren, M. & Eriksson, G. 2002 (Unifeeder). Interview 18.11.2002.
- Airaksinen, J., Hohti, M., Pitkänen, O., Simojoki, S., Tervo-Pellikka, R., Bäckström, J. & Ylisiurunen, K. 2003. Liikennetelematiikan tuotteiden ja palvelujen pelisäännöt. Helsinki. FITS-julkaisuja 13/2003. 70 s.
- Arkima, A. & Bäckström, R. 2002 (Merenkulkulaitos). Interviews and e-mail correspondence 2002.
- Aspelin, E. 2002a. IP-järjestelmän kehittäminen osaksi Port@Net-kokonaisuutta. FITS-julkaisuja 2/2002. Helsinki. Liikenne- ja viestintäministeriö. 57 s.
- Aspelin, E. 2002b (Finnlines Oyj). Interview 18.11.2002.
- Aura, M. & Tarnanen, K. 2002. (Suomen Satamaliitto). Interview 17.12.2002.
- Auvinen, J. 2002. PortNet-mobiilihankkeen loppuraportti (4.10.2002). Helsinki. Merenkulkulaitos ja Atbusiness Communications Oyj. 8 s.
- Auvinen, S. 2002. PortNet vaikuttavuus – meklarien ja varustamojen näkemykset. Yhteenvetomuistio 20.12.2002.
- Berglund, R. & Kotovirta, V. 2002. PortNet vaikuttavuusselvitys. Tekninen arviointi. Muistio 19.12.2002.
- Hautala, R., Lähesmaa, J., Kummala, J., Bäckström, J. & Nurmela, M. 2001. Standardien rajapintojen määrittely liikennetietojen välitykseen (STARA). Helsinki. Liikenne- ja viestintäministeriön mietintöjä ja muistioita B 15/2001. 46 s.
- Intermodal Portal 2001–2002). EU Intermodal Portal project materials, 2001–2002.
- Kulmala, R., Luoma, J., Lähesmaa, J., Pajunen-Muhonen, H., Ristola, T. & Rämä, P. 2002. Liikennetelematiikkahankkeiden arviointiohjeet. FITS-julkaisuja 3/2002. Helsinki. 83 s. + liit. 15 s.
- Laurila A. 2002 (Transfennica). Interview 8.11.2002.
- Leviäkangas, P. & Lähesmaa, J. 1999. Profitability Comparison between I.T.S. Investments and Traditional Investments in Infrastructure. Ministry of Transport and Communications Finland, Reports and Memoranda B24/1999.

Leviäkangas, P., Hautala, R., Nokelainen, A. & Kulmala, R. 2002. Telematiikan hyödyntäminen meriliikenteen hallinnassa. Alustava visio, strategia ja toimintalinjat 2003–2006. Merenkululaitoksen julkaisuja 3/2002. Helsinki. 30 s.

Liikenneministeriö 2000. Hankearvioinnin yleisohjeet. Liikenneministeriön julkaisuja 8/2000.

Liikenne- ja viestintäministeriö 2000. Kohti älykästä ja kestäväää liikennettä 2025. Liikenne- ja viestintäministeriön ohjelmia ja strategioita 1/2000.

Merenkululaitos ja Oy Edi Management Finland Ltd 2003. PortNetin päivitettyä esittelyaineistoa. Helmikuu 2003

Miranda, A. 2002. E-mail communication and annexed file 19.6.2002.

Perrett, K. E. & Stevens, A. 1996. Review of the potential benefits of Road Transport Telematics. Transport Research Laboratory. TRL Report 220.

Rautiainen, P., Kaskinen, E. & Koskinen, P. 1991. Tuonti- ja vientitoimintojen yksinkertaistaminen Helsingin satamassa (HELSAT). Loppuraportti, työversio 1991-11-27.

Toivonen, R. 2002 (Turun Satama). Interviews and e-mail correspondence 2002.

Tuomisto, O. 2002 (Tulli). Interviews and e-mail correspondence 2002.

Turun Satama ja Oy Edi Management Finland Ltd. 2002. Turun Sataman asiointikuori. Loppuraportti.

Vaarama, H. 2002 (Viking Line). Interview 29.11.2002.

Valtiovarainministeriö 2002. Asetus 1129/2002 Tullilaitoksen suoritteiden maksullisuudesta 18.12.2002.

Westerholm, B. 2002 (Wallenius Wilhelmsen Lines). Interview 27.11.2002.

PortNet's Economic and Quality-related Impact

1. Attribution of Impact

In addition to direct economic and quality-related impact, PortNet causes indirect economic and lateral influence on the various participants of the logistics process. Influence field analysis (section 2) and activity analysis (section 3) are applied in evaluation of attribution of PortNet's impact.

- Influence field analysis does not concentrate on utility or disutility of the influence. It identifies the parties directly influenced by PortNet economically or qualitatively, as well as determines the possible socio-economic impact. Influence field analysis identifies the users and direct beneficiaries of PortNet, as well as the parties directly or indirectly influenced by the use of the system. Direct impacts are mainly directed towards the users and beneficiaries of PortNet, while indirect impacts are associated with other participants of the logistics process.
- Activity analysis individualises the functions of the ordering-delivery process that are specified in PortNet activity analysis – does PortNet exert positive or negative influence on the activities of the parties concerned.

In case of co-operative projects, evaluation of influence and benefits is a challenging task, since the benefits are not distributed evenly in most cases, and some new functions may cause additional work to some of the participants. Such problems have sometimes hindered development of certain projects.

During the initial stages of PortNet's development, clear economic motivators were applied in order to convince brokers to use the system – those utilising electronic business were granted port fee benefits. Price benefits, for example, have so far been granted in the sum of over 4 000 000 €. During the initial stage, in 1992, economic benefits were estimated as well – the related work timesavings by function are provided in table 1 below.

Table 1. Estimated PortNet-related work timesavings during PortNet definition stage (1992), by function.

Function	Work timesavings (mill. FIM/year)
Schedule functions	1.86
Arrival and departure declarations	3.04
Management of IMO information	3.79
Unit traffic, operative functions	4.00
Sum total	12.70
Saving potential	approx. 9.0 mill. FIM / year

Interviews conducted with brokers and shipping companies (Auvinen S. 2002) included the following users of PortNet: Finnliness, Suomen Satamaliitto, Viking Line, Transfennica, Unifeeder, and Wallenius&Wilhelmsen Lines. According to these interviews, the estimated work timesaving of brokers and shipping companies amount to approx. 0.5 h per vessel call. Therefore, in case of an employee earning 2 000 € per month, work timesavings amount to approx. 11 € per vessel call. In 2001, 34 600 cargo traffic-related port calls occurred in Finland (according to Finnish Maritime Administration), and total timesavings thus amount to approx. 0.4 mill. € per year.

Work timesavings of the Customs amount to approx. 1.5 employee work years (Tuomisto, O. 2002). This mainly emanates from automation of maritime traffic fees calculation, as well as from the fact that electronic declarations are easier to process. Work timesavings amount to approx. 0.14 mill. € per year.

Automation of maritime traffic fees will result in impact of the same magnitude. From the viewpoint of statistics only, in 2002, work timesavings of the Maritime Administration were estimated at approx. 0.01 million €. Processing and storage of declarations used to require three employee work years; the present level is only two years (Arkima A. 2002).

As concerns the ports, work timesavings amount to approx. 0.5-1.0 employee work years (in case of larger ports). In total, this amounts to approx. 3-6 employee work years (Toivonen R. 2002).

Other work timesavings-related evaluations were not performed. Assuming that the calculations concerning the Customs, Maritime Administration, and brokers/shipping companies are more or less correct, yet represent only a fraction of the actual savings, estimated initial saving potential indicated in table 1 are to be considered quite accurate.

Truly great influence potential still lies in improvement of the overall efficiency of logistics process. Increase in capital turnover rate and improved prior resource planning result in significant (socio)economic influence. Calculations will be described in detail below, as much as it is possible based on the source materials available. The most important potential impacts and their orientation will also be evaluated.

2. Influence Field Analysis

There are many actors using and benefiting from PortNet system, and the use of PortNet influences the entire logistics process either directly or indirectly. Some of the influences are potential influences made possible by PortNet as a system, and some have not yet reached their full capacity because of scarce use, lack of usage possibilities, or inability to utilise PortNet information (table 2). All of the influences are basically economy-related.

Table 2. PortNet: influence field analysis. In the left column, the active participants using PortNet system are indicated by grey background, and the upper row lists all of the levels participating in logistics process. "S" signifies direct, immediate influence on principal users, "e" signifies indirect influence and "p" potential influence. Indirect and potential influence has not been taken into account.

Actors, who are affected by the use of PortNet either indirect(E) or directly (P) Present principal users of PortNet (darkened and bold)	Trade, industry	Forwarding	Transport (road, rail)	Shipping comp's,	Stevedores, port op's	Port authorities	Port services	Customs	Maritime Administration	Police	Fire and rescue	Border guard	Product supervision
Business, industry													
Storage and handling services													
Forwarding services													
Transport services (road, rail)													
Shipping comp's. brokers	p	e		S	p	e			e			e	
Stevedores, port operators													
Port authorities	p	p	p	e	e	S	e	e	e		p		
Port services													
Customs office	p	e		p	e	e		S	e	e		p	p
Maritime Administration	p	p	p	e	p	e	e	e	S		p	p	
Police													
Fire and rescue services													
Border guard													
Product supervision													

Instructions on how to read the table: the Customs, for example, uses PortNet actively in connection with its activities (left column, grey background, bold text) and this use has potential (p) or indirect (e) influence on trade and industry, forwarding, shipping companies and brokers, stevedores and port operators, port administrations, Finnish Maritime Administration, the police, border service, and product supervision. Direct influence (S) is associated with the Customs' own operation, and the influence has been included in numeric profitability calculations. The table has to be considered as a visual influence field explaining the range of the system's identified influence. Section 3 "Activity Analysis" indicates the functions influenced by PortNet.

3. Activity Analysis

In connection with improvement of the efficiency of the logistics process, *trade and industry* benefit from more efficient use of liquid and capital assets. Increased rate of capital and stock turnover improves the profitability of trade and industry. Due to better

preliminary information and improved pre-planning, PortNet has direct influence on warehouses and turnover rate of the transport-related assets. Efficiency of the entire logistics process is improved owing to preliminary information and increased functional efficiency.

Producers of warehousing and transport services benefit from better timing and management of operations. This exerts direct influence on both fixed and variable costs. Due to the availability of high-quality information made possible by PortNet, *forwarders* are able to improve their customer services in many ways. Forwarders also benefit from the use of PortNet's electronic document functions.

Road and railroad service providers, stevedores and port operators, as well as providers of port services benefit from improved preliminary information. Planning of the use of personnel and equipment is easier and more precise, which directly influences the costs of service providers and efficiency of assets utilisation.

Shipping companies and brokers derive economic benefit from automation of document processing in the form of work timesavings, and quality-related benefit in the form of improved reliability and decrease in the number of errors made. Nine former paper forms have been replaced in PortNet by electronic declarations – Viking Line, for example, used to process 11 000 documents a year before PortNet was introduced; by now, the number has decreased to about 400. Common activity procedure at ports and entry of data into the system only once also improves labour convenience.

The *ports* benefit from electronic business by improved efficiency of their activity, mainly through decrease in the volume of manual paperwork, which further leads to decrease in the number of errors and substantial timesavings. PortNet also allows ports to increase their turnover, due to the fact that acquisition of invoicing and statistics master data is accelerated and the invoicing procedure is sped up, thus developing business activities and improving profitability. Information on vessel calls and service requests, as well as cargoes in general and dangerous goods in particular is acquired via PortNet from the ports' own information systems, in default format and by term agreed. Owing to common development of the system, statistics services can be provided for small ports with the same quality as in case of large ones.

PortNet allows the *Maritime Administration* to transfer basic statistical information directly into its information systems without the data re-entry phase required earlier. Information storage and statistics functions are accelerated and the quality of information improved. Maritime Administration is provided with the possibility of using updated information concerning decisions related to maritime traffic fee decisions, as well as

other statistical and source information required for planning and realisation of operative activities.

The *Customs* benefits from uniform activity procedure and electronic business documents by faster and more efficient administrative work (statistics, archiving). Owing to electronic declarations, administrative functions are less dependent on time and place, and this releases resources that can be used for other purposes.

Overview of the results of activity analysis is provided in table 3. The overview is a synthesis of the visions of different actors (interviews, source materials) and personal opinions of researchers. The table presents activities by the organisations influenced by PortNet according to the results of the influence field analysis. In case of these, the extent of influence was not evaluated, but only the direction. No significant negative influences were identified.

Table 3. PortNet's activity analysis, performed in connection with the influence field analysis (+ = positive influence; - = negative influence).

ACTIVITIES BY SUBJECTS		Economic impact			Qualitative impact				
		Turnover	Variable costs	Fixed costs	Liquid and current assets	Ability, precision, flexibility Delivery chain quality	Supervision over deliveries	Information accuracy	Maritime Safety
Trade industry	Acquisition of raw materials								
	Warehousing & storage				+				
	Production & manufactor.								
	Finished products				+				
	Int. sales & Basic distribut.					+			
	Interm. storage				+				
Storage and handl. services	Local sales & distribution								
	Service provision and pricing								
	Mediation of delivery info								
	Activity timing and management		+						
	Cargo reception and unloading								
	Cargo dispatching and loading								
	Warehouse balance manag.								
	Payment transfer manag.								
Forwardin	Transport order/reservation manag.		+	+		+			
	Bill-of-lading management///med.		+	+					
	Advising								
	Reception of forwarding/freight etc. invoices								
	Mediation of forwarding/freight etc. invoices								
	Customs declaration submiss.								
	Customs decision reception								
	Paying customs dues& taxes								
Transport services	Submission of Intrastat- and VAI-stats								
	Advance notice		+		+	+			
	Freight orders (bookings)								
	Confirmations								
	Bills-of-								
	Confirmation when cargo delivered								
Shipping brokers	Invoicing								
	Ship booking, cargo instructions								
	Booking confirmation								
	Ship notice		+			+		+	
	Manifest		+	+		+		+	
	Invoicing								
	B/L-lists, package spec's								
	Unloading & damage rep.								
DG cargo notices		+			+	+	+		
Stevedores, port operators	Loading instruct.								
	Freight car info, Bill-of-Lad								
	Dispatch lists & packing spec's								
	Final inform.								
	Departure/Arrival notices		+	+		+			
	Consignment								
	Forw. invoice								
	Cargo invoice (for export customs decl.)								
	Bookings and booking confirmation								
	Notices and confirmations								
	Freight plans								
Ports	Manifests		+	+					
	Adv. notice, berths, human resources					+			
	Reception of vessel decl, and manifests	+				+			
	DG and ja loading/unloading permissions					+			
	Vessel service					+			
	Invoicing	+				+			
Port services	Statistics	+				+			
	Adv. information		+	+					
	Resource planning		+	+					
	Service production								
Custo	Invoicing								
	Tullaus- ja tilastointitietojen vastaanotto		+	+					
	Tullauspäätösten välitys								
	Verojen ja maksujen kanto	+	+	+					
	Tullivalvonta					+			
Maritim Administration	Tilastointi			+					
	Adv. Inform.		+	+	+	+	+	+	+
	Icebreaking		+			+		+	+
	Pilotage		+			+	+	+	+
	Vessel Traffic Services					+	+	+	+
	Ship inspection		+			+	+	+	+
	Fairway					+	+	+	+
	Statistics (fairway dues)			+		+	+	+	+

4. Influence Analysis

Economic, quality-related, and indirect influences are analysed with the help of respective influence field and activity analysis results. The Du Pont source information form recommended by guidelines for the evaluation of ITS projects was simplified by combining the activity report and balance sheet sections. Simplicity was necessary, since in case of this survey, the researchers were unaware of the exact balance figures. Influence on balance, mainly caused by increased efficiency of assets utilisation, would also had brought about indirect influence via improvement of logistics process efficiency – a separate evaluation project is necessary for assessment of such influence.

Table 4 provides an example of a simplified source information form composed for each principal PortNet user group. The form is sort of a cash flow calculation, used for determination of the indicators of investment profitability.

Table 4. Evaluation of PortNet's economic influence. Example of source information. Sign indicates the direction of cash flow.

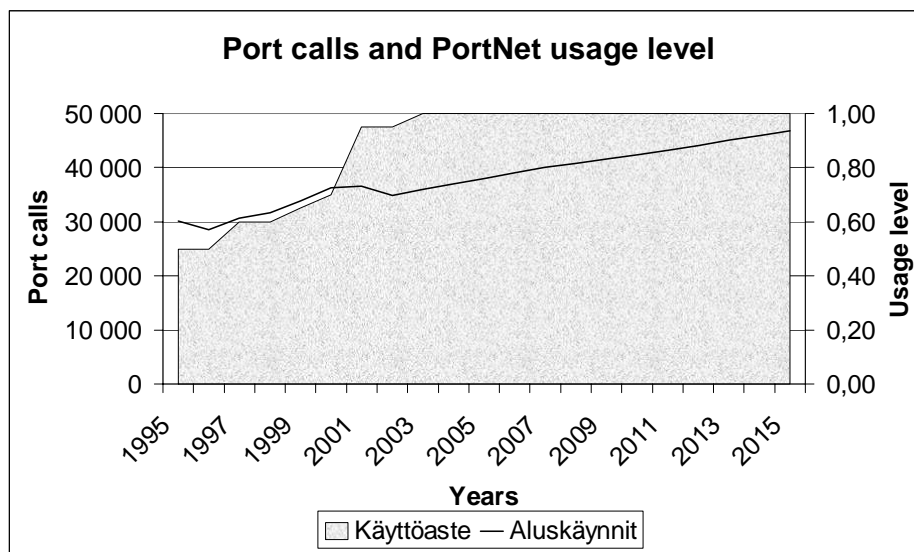
Ports	euro / y
Sales income	-500 000
<i>Salaries and personnel expenses</i>	60 000
<i>Other variable expenses</i>	0
Variable expenses, sum total	60 000
<i>Salaries and personnel expenses</i>	0
<i>Other fixed expenses</i>	
Fixed expenses, sum total	0
Working and liquid assets	
Investments into system	-90 000
Operation cost	-70 000
Sum total / y	-600 000

In the exemplary case (ports belonging to PortNet community), savings have been achieved in non-fixed salaries and personnel expenses. Port fee benefits have been interpreted as decrease in sales income. This group (ports) was the only group to which PortNet caused sales profits influence. The benefits granted by ports were cancelled at the end of the year 2002. On the other hand, port fee benefits functioned as indirect support offered to enterprises (shipping companies and brokers), for which reason the benefits were regarded as enterprise savings until the end of 2002.

Profitability calculations were made for four periods of time:

- 1) The entire history of PortNet, i.e. from 1992 to 2015. The development, investment, and upkeep costs of the years 1992-1995 were roughly summarized and transferred into the year 1995; therefore, time series analyses always started with the year 1995. This simplification exerts no practical influence on calculation results.
- 2) The entire history of PortNet's arc of development, but until the year 2010, i.e. 1992-2010.
- 3) PortNet's latest development phase, 1998 – 2015
- 4) PortNet's latest development phase, but until the year 2010, i.e. 1998–2010.

In the course of consideration, the time division of annual data presented in table 5 was specified as well. For example, port fee benefits were cancelled since 2003, and timesavings were considered to depend on PortNet's usage level and the number of vessel calls. It was presumed that the usage level has been rising evenly since the year 1995 (50%) until the year 2003 (100%) and stabilizes at 100% after the year 2003 (Picture 1). In 2001, usage level was already 95%.

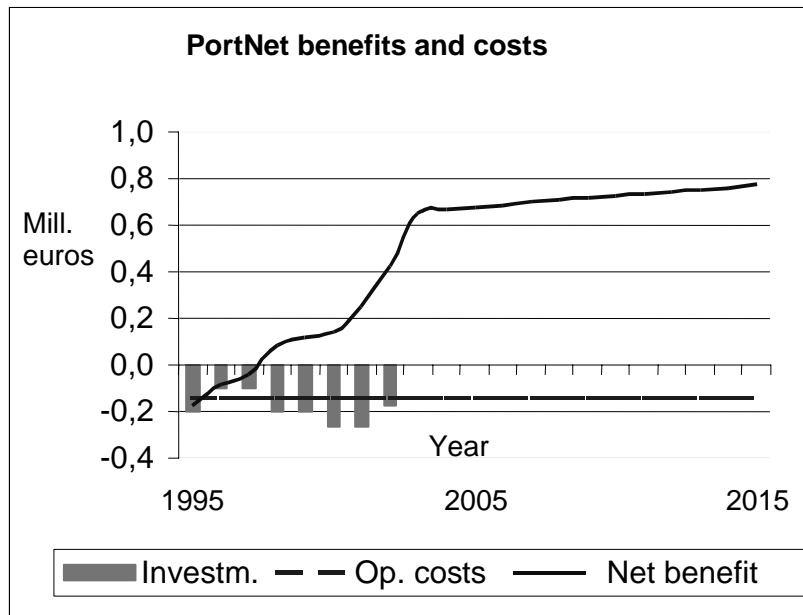


Picture 1. Vessel calls trend estimate and development of usage level (basis for calculations). Usage level indicates the share of vessel calls registered in PortNet for all foreign traffic vessels visiting Finnish ports.

The calculations were made regarding PortNet's principal users: the Finnish Maritime Administration, the Customs, ports, and shipping companies/brokers. It was assumed that one call results in timesavings for only one broker or shipping company. PortNet-related

expenditures and benefits calculated according to these principles are described in picture 2. Net benefits have increased in pace with rising of the usage level. From the viewpoint of benefits, investment and upkeep expenditures are modest. Net benefits were calculated on annual level and in nominal value, using the equation:

$$\text{Net benefit} = \text{Benefits} - \text{Investments} - \text{Operation costs}$$



Picture 2. PortNet's net benefits rise in pace with the development of usage level. The figures are nominal (no inflation corrections).

5. Profitability Calculation

5.1 Calculation Method

Basic assumptions and source information of the profitability calculation are as follows:

- calculations only take into account clearly identified direct influence that can be expressed in numbers; in practice this meant self-directed influence of PortNet's principal users.
- calculation base year (year 0) is 2002
- discount interest, i.e. the required level of capital income rate was 5 %, which is a common income rate in case of transport management investments
- inflation was not taken into account – therefore, the 5 % discount rate is nominal

- number of vessel calls, with which the savings were associated, is based on a simple statistical trend developed on the basis of Maritime Administration’s statistics and call history (picture 5).

In case of the calculation, an assumption has been made that there will be no more investments after year 2003. The reason for this is that future investments are not included in the “present” investment calculation; they will be accounted for in future calculations.

The following were selected as indicators of profitability:

- Net present value (NPV), describing the total profit and acquired by way of subtracting present cost value from present profit value. From the viewpoint of investment theory, net present value is the most unambiguous means for profitability measurement; positive net present value indicates profitable investments and vice versa.
- Internal rate of return (IRR), describing the internal profit rate of net cash flow. Since investment income rate has been set at 5 %, internal rate of return higher than this value denotes profitable investments. Accordingly, internal rate of return lower than 5 % denotes non-profitable investments.
- Benefit-cost ratio (B/C), ratio of discounted benefits and costs. If the benefit-cost ratio is higher than 1, the investment concerned is profitable.

Indicators were calculated both for specific actors (ports, the Customs, Finnish Maritime Administration, enterprises) and in total. Calculation of internal profit, for example, was sometimes impossible. If cash flows were negative only, the internal rate is (-) ∞. “e” marks the cases when the indicator could not be calculated.

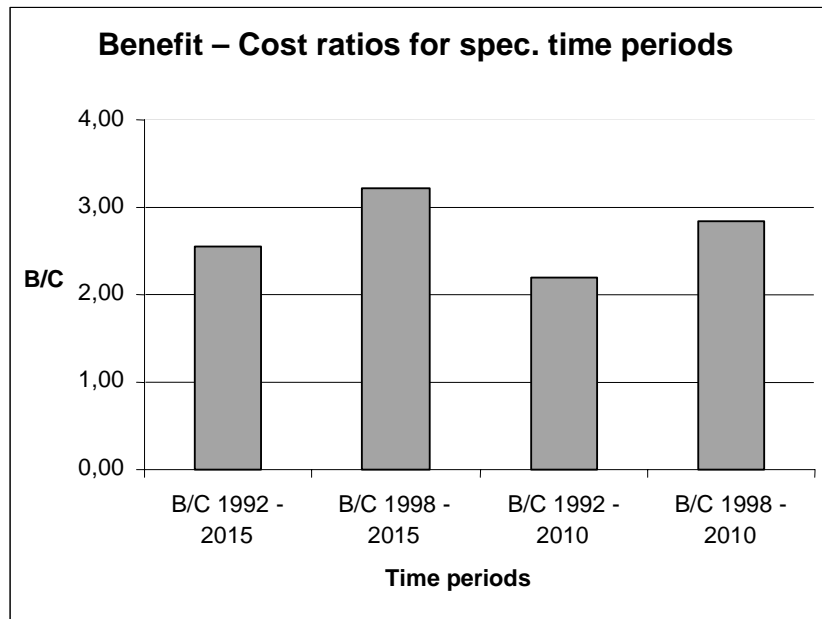
5.2 Results

Indicators of the efficiency of entire PortNet system have been provided in table 5

Table 5. Indicators of the profitability of PortNet. Direct economic influence on principal users has been taken into account. (e = cannot be calculated)

Indicator	Periods considered			
	1992–2015	1998–2015	1992–2010	1998–2010
IRR, %	44 %	e	44 %	e
NPV, Mill. €	6.90	7.34	4.92	5.36
B/C	2.55	3.23	2.20	2.84

When considering the indicators, there is ample reason to state that PortNet has been a profitable investment, irrespective of the period under consideration, inclusion of the investments and costs of the past or estimated profits in the future. PortNet's benefit-loss ratio improves with each additional year, since the benefits are calculated further into the future (picture 3).



Picture 3. PortNet's benefit-cost ratio is at least 2, irrespective of the period under consideration.

Therefore, PortNet has been a profitable investment, even more so because only some of the potential savings have been taken into account.

Tables 6–9 provide PortNet's profitability indicators in case of various principal users. Symbol "e" means that indicator cannot be calculated for mathematical reasons (e.g. divisor is 0 or the result equals to ∞).

Enterprises have neither invested into PortNet nor participated in the payment of upkeep costs. For this reason, only the net present value can be calculated, which is naturally positive (table 6).

Table 6. Profits derived from PortNet – enterprises.

Indicator	Periods considered			
	1992 - 2015	1998 - 2015	1992 - 2010	1998 - 2010
IRR, %	e	e	e	e
NPV, mill. €	11.30	8.43	10.00	7.13
B/L	e	e	e	e

Although the Finnish Maritime Administration has achieved some minor benefits derived from timesavings, these indicators still prove it to be one of the net payers (table 7).

Table 7. Profits derived from PortNet – Finnish Maritime Administration.

Indicator	Periods considered			
	1992 - 2015	1998 - 2015	1992 - 2010	1998 - 2010
IRR, %	-3 %	2 %	-9 %	-4 %
NPV, Mill. €	-0.38	-0.08	-0.44	-0.14
B/L	0.66	0.90	0.56	0.80

The Customs is among the levels that benefit from PortNet. The indicators are so good because of extensive estimated work timesavings and modest participation in investment activities and payment of upkeep costs. See table 8 for indicators of the Customs.

Table 8. Profits derived from PortNet – the Customs.

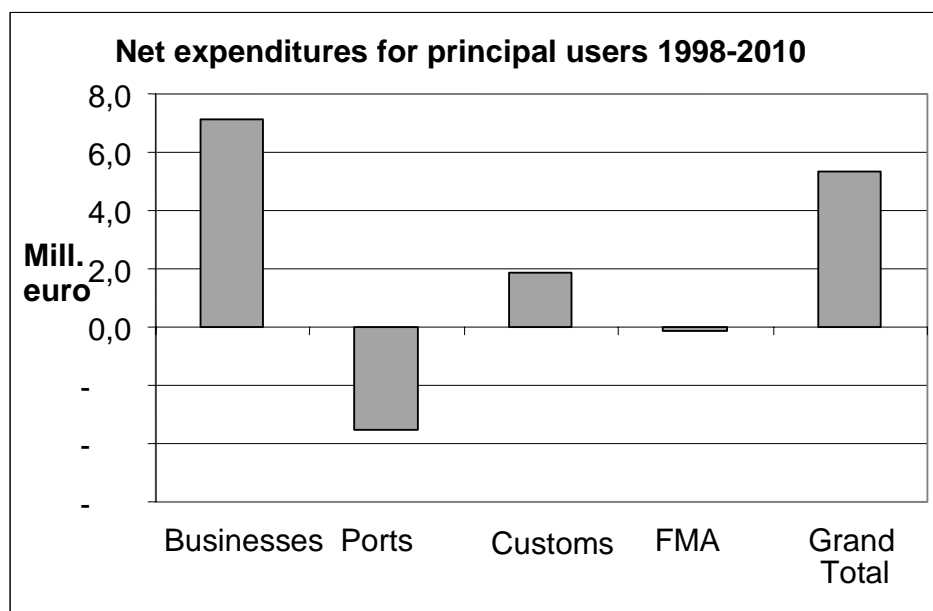
Indicator	Periods considered			
	1992 - 2015	1998 - 2015	1992 - 2010	1998 - 2010
IRR, %	34 %	e	33 %	e
NPV, Mill. €	2.24	2.53	1.59	1.89
B/L	2.81	3.69	2.39	3.22

Largest net payers are the ports of Turku and Helsinki (table 9). Their share in PortNet-related costs of Finnish ports and granting of port fee benefits has amounted to approx. 80 %. The port fee benefits have been considered as profit made by the enterprises involved.

Table 9. Profits derived from PortNet – ports.

Indicator	Periods considered			
	1992 - 2015	1998 - 2015	1992 - 2010	1998 - 2010
IRR, %	e	e	e	e
NPV, mill. €	-6,26	-3,54	-6,23	-3,51
B/L	-1,87	-1,22	-2,12	-1,50

Picture 4 presents an overview of the net expenditures of the principal users of PortNet users.



Picture 4. Net expenditures of the principal users of PortNet, 1998 - 2010.

These differences were somewhat equalised after full cancelling of port fee benefits at the end of the year 2002 (fees are transferred to enterprises). On the other hand, relieving of the enterprises using PortNet from the service fees charged by the Customs is currently under consideration. This is based on Regulation No. 1129/2002 of the Ministry of Finance on chargeability of Customs operations (Ministry of Finance 2002). Cancelling of service fees is to enter into force in the beginning of the year 2004, which means decrease in the economic benefits derived from PortNet by the Customs, and a respective increase in the benefits derived by enterprises (cancelling of the port fee benefits is thus compensated to enterprises). These changes equalize the benefits and costs of the bodies financing PortNet

Sources

Arkima A. 2002 (Merenkululaitos). Interviews and e-mail communication 2002.

Auvinen S. 2002. PortNet vaikuttavuus – meklarien ja varustamojen näkemykset. Yhteenvetomuistio 20.12.2002.

Toivonen R. 2002 (Turun Satama). Interviews and e-mail communication 2002.

Tuomisto O. 2002 (Tulli). Interviews and e-mail communication 2002.

Valtiovarainministeriö 2002. Asetus 1129/2002 Tullilaitoksen suoritteiden maksullisuudesta 18.12.2002.

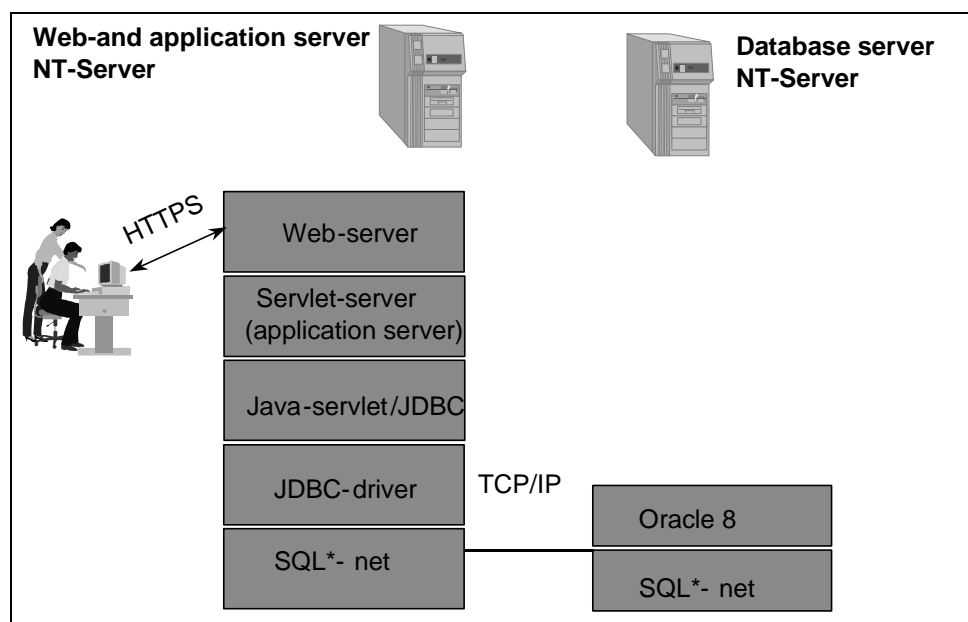
Evaluation of Technical Implementation of PortNet

This Annex concentrates on technical implementation and expandability of the PortNet system, as well as provides development recommendations on general level (what should be developed and/or investigated in more detail).

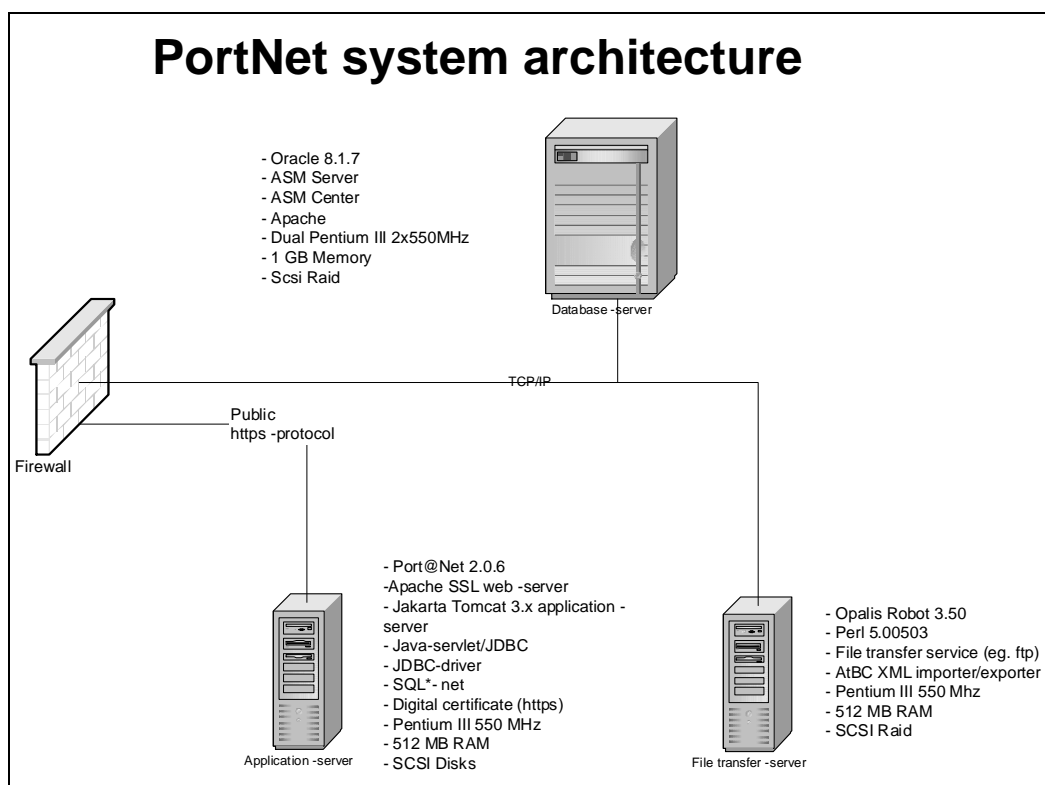
Robin Berglund and Ville Kotovirta from VTT Tietotekniikka have composed the present evaluation of the technical implementation of PortNet. Sauli Tujunen and Mika Thynell from At Business Communications Oy have been interviewed as experts. Section 1 has been updated based on comments by Reijo Toivonen (Turku port).

1. PortNet System Architecture

Current implementation of the PortNet system is based on architecture, in which case the users communicate with respective application located in an application server with the help of a browser. The application uses standard interface (ODBC/JDBC) in order to establish communication with database management system. Expandability in relation to the number of users is a significant advantage of such architecture (installation of solution-specific programmes in user machines is not necessary). If the number of users should increase, efficiency of the server can be improved, or several servers used together with a load-distributing router.



Picture 1. PortNet solution architecture [AtBusiness Communications]

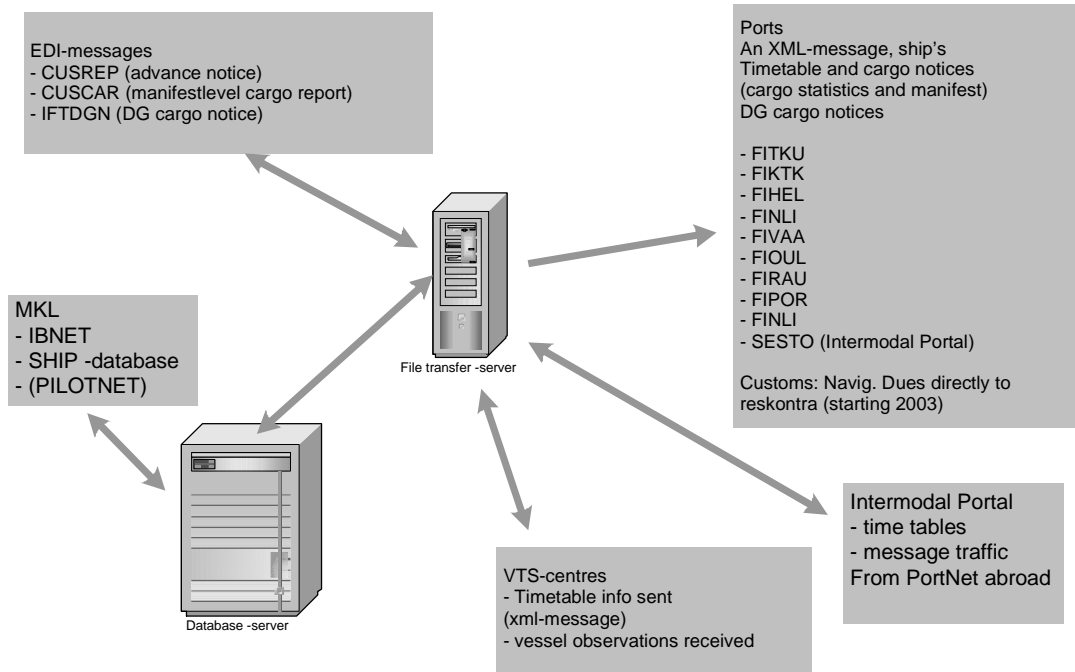


Picture 2. Physical architecture of PortNet

Addition of functions can be implemented whether by expansion of the existing PortNet solution (amendment/development of existing solutions) or by realisation of functions with the help of new solutions suitable for use in the application server. Common PortNet database will be the uniting factor.

Looser integration characteristic to PortNet system has been implemented in the form of message transmission, using messages complying with XML syntax. Own message formats have been defined in PortNet (with the help of DTD; now increasingly more with the help of XML scheme) based on content descriptions provided by the Finnish Maritime Administration. Since XML messages are interpreted and written using their own mediation layer, the system can be adjusted to new XML format by re-definition of converter parameters (on the condition that information content is not expanded in a manner requiring making of changes in PortNet database).

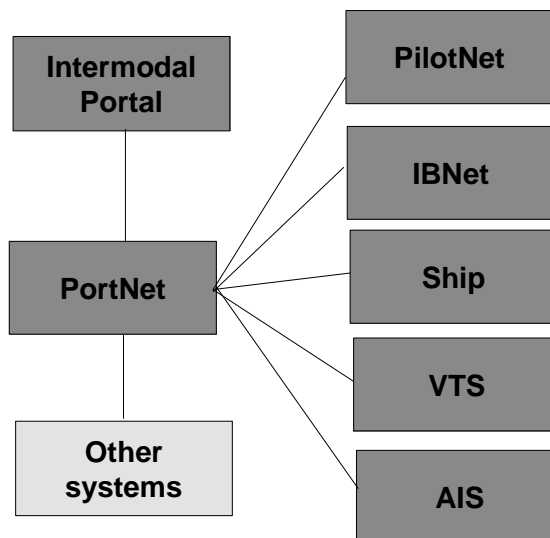
Data transmission may be effected as recurring batch transmission or by use of message transfer queues (on-line).



Picture 3. PortNet message traffic [AtBusiness Communications]

1.1 Links between PortNet and Other Systems

PortNet system is currently linked to other systems in accordance with the scheme below.



Picture 4. Links between PortNet and other systems [AtBusiness Communications]

Information exchange through the links complies with table 1:

Table 1. Information exchange between PortNet and other systems [AtBusiness Communications]

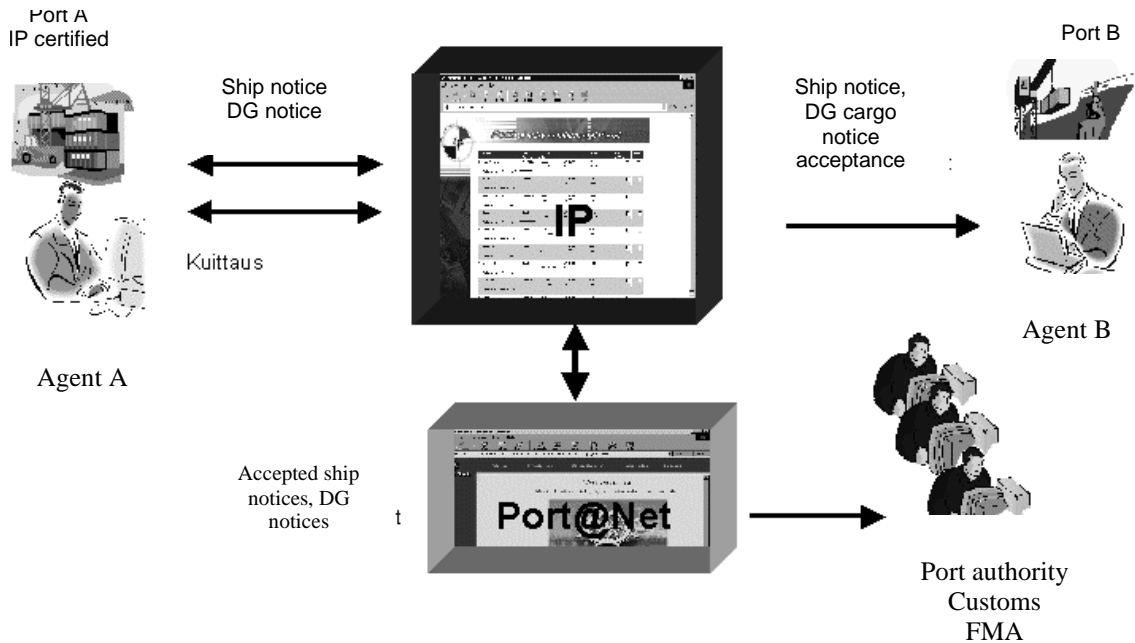
Other system	From PortNet → Other	Other → to PortNet	Mechanism
Intermodal Portal	Dangerous goods declaration – schedule information – cargo declaration	Dangerous goods declaration – cargo declaration	Batch transfer, FTP, XML
PilotNet	– piloting information – schedule information	– ETA, ETD, ATA, ATD, ETP, ATP	Through database / message transfer online (to PortNet)
IBNet	– ship register information – schedule information	– ETA, ETD, ATA, ATD, ETP, ATP	Through database / message transfer online (to PortNet)
Ship	– ship register information	– validated ship register information	Through database
VTS/AIS	– port call information	location, speed, and direction of ship – piloting information – rough information about dangerous cargo , passengers	On-line message transfer XML
Other systems: Port systems	Dangerous goods information – port call information – cargo information	Final arrival/departure times	Batch transfer by message communication, data transfer, or direct entry into PortNet database.
Other systems: Ship representatives		Dangerous goods information – port call information – cargo information	Batch transfer by message communication or data transfer

1.2 Intermodal Portal Interface

Through the Intermodal Portal (IP-system) interface based on the Internet, the users can view e.g. ship and port-related schedule information of shipping companies, as well as arrival or departure codes assigned by the Customs in connection with customs-related documentation. Intermodal Portal's transport order application allows realisation of a common Internet-based information system for small and medium-sized transport enterprises in order to improve the efficiency of their activities (transport orders, bills of lading, freight bills).

The system was originally developed under the framework of a EU research project, and AtBusiness Communications Ltd presently operates it on behalf of the PortNet

community. The portal can also be used for declaration of dangerous goods (see <http://impi.atbusiness.com/>). IP system functions as the gateway connecting PortNet system with foreign levels (although e.g. the port of Stockholm can access PortNet directly as well).



Picture 5. Information transfer between ports with the help of IP system [impi.atbusiness.com]

Communication between IP-system and PortNet system takes place with the help of XML messages.

IP-system supplements PortNet system, offering a freely accessible place for exchange of such information that can be made public and is still useful for many levels. PortNet shall remain an Extranet-type system accessible for registered users only and allowing input of confidential information as well (such as detailed cargo information meant for the Customs).

2. Development Objectives

The use of PortNet in the form of direct message communication between systems, using EDI or XML messages, will be subject to constant increase. Interactive use through browser will remain mainly for small-scale input and sporadic retrieval or browsing of data. The linking possibilities and flexibility of external systems are therefore important from the viewpoint of PortNet.

Interfacing with other systems of the Finnish Maritime Administration has reached a quite advanced stage. After realisation of the integration, the functionality and reliability

of these interfaces must be ensured and sufficient supervision tools developed in order to resolve the possible problem situations, so that the users could be sure that information entered once will be transferred correctly and in good time into other systems.

Since the PortNet community will benefit from widest possible inclusion of all the groups operating in the port traffic environment into the system, special needs of these parties should be taken into consideration, if possible, in order to ensure continuous interest of these groups in participation in use and further development of the system. Some parties, for example, may consider mobile use of the system to be the most important function, allowing to promote real time input of information into the system, which will be useful for other participants. Upon development of the system, it is necessary to support and implement small-scale pilot projects in order to find ideas that work.

Applicability: Since there are already approximately 1300 users to the system, planning and conducting of an Internet-based opinion poll in order to acquire as much feedback as possible is recommended. In addition to that, it would be beneficial to identify the main user groups and interview some representatives of each such group. This would allow to ensure that the features developed and modifications made agree with the actual needs of users.

Information interchange with foreign partners: The development of IP system should be guided so that information interchange with most important foreign partners is promoted.

Reliability and response time: The present architecture of PortNet enables technical improvement of applicability, e.g. by using dual application servers and establishment of fault recovery service for elimination of technical faults. By supervision of the present system's operation (e.g. logging of response times and system faults) it is possible to evaluate system reliability and the need for measures improving response time, but also resulting in increased expenses. Response times are often influenced by capacity fluctuations within the public data communication system or router faults possibly causing the delays that annoy users – in such cases, improvement of the server system does not result in shorter response times. Systematic logging of data traffic, allowing to distinguish between the delays caused by the data communication system and the delays caused by the server's own treatment delay, is very important.

Background: evaluation criteria

PortNet service evaluation check lists. **Most important parts are in bold.**

EVALUATION OF TECHNICAL IMPLEMENTATION	
Target	Example
Technical solution risks	Compatibility of equipment supplied by different manufacturers
Consistency and common system architecture	Possibilities for modular replacement, the need to follow standards
Availability and development level of the equipment required	Is the current equipment reliable enough; is the introduction of more advanced versions expected soon?
Dependence on other systems	Does the functionality of PortNet depend on the functionality of other systems? And if it does, what are the risks to PortNet's functionality and availability of PortNet services?
Integration of component systems and new services into PortNet	What are the possibilities for integration of component systems and new service solutions into PortNet? Is it possible to first implement a pilot solution as a part of the entire system?
Supplier dependence risks	Does the implementation of PortNet depend on a certain system supplier?

TECHNICAL EVALUATION	
Target	Example
Technical functionality	Does the system and services function in the way they were technically intended to?
Reliability	Number of system errors
Rate of operation	Duration of transactions
System maintenance	Need for and duration of maintenance activities

EVALUATION OF USER INTERFACE	
Target	Example
Optical qualities	Readability of visual information, size of symbols and characters
Understandability	Interpretation of message content from the viewpoint of own actions in the respective environment
Information order	Possibility for erroneous actions in menu
Compatibility of information with the rest of the system	Compatibility of the information provided by different component systems
Terminal devices (the Internet, mobile devices)	Applicability, reliability under different circumstances
User-system interaction	Sufficiency of feedback, behaviour in error situations
Satisfaction	Are the features considered useful? Frequency and extent of use, willingness to pay
Accompanying information and user manual	Intelligibility of user manual

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