

# **IMPACT EVALUATION OF MARITIME I.T.S – CASE PortNet**

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## **SUMMARY**

This paper evaluates impacts of a maritime ITS service portal, PortNet. The paper also outlines how new Finnish ITS Evaluation Guidelines were applied and how useful the guidelines proved to be. Portnet system showed profitability though only part of the actual benefits could be included in calculations. It was concluded that few business organisations would invest in similar systems despite the fact that they benefit from it. Some generic conclusions concerning evaluation and similar systems are made.

## **INTRODUCTION, BACKGROUND AND OBJECTIVES**

The revised Finnish ITS Evaluation Guidelines was issued last year (1). This evaluation tool was used in the evaluation of PortNet. PortNet is a maritime operations service portal, allowing authorities and business organisations exchange information electronically, using commonly agreed formats of data. PortNet also allows more efficient utilisation of common data bases, e.g. ship registers. PortNet is an essential part of Finnish maritime telematics information infrastructure and one of the most promising IT applications in the country (see figure 2). The concept seems to be a pioneering one at least in Europe if not globally. Despite the recognised merits of PortNet, its benefits (and costs) were not properly measured and evaluated.

The following functions/services are available through PortNet:

- ship time tables, including preliminary and advance notices
- all cargo information, including hazardous materials and dangerous goods
- statistical ship data on ships that have previously visited Finland
- service orders such as piloting and towing
- data on paid fairway and exemptions
- various drop-down tables and statistics.

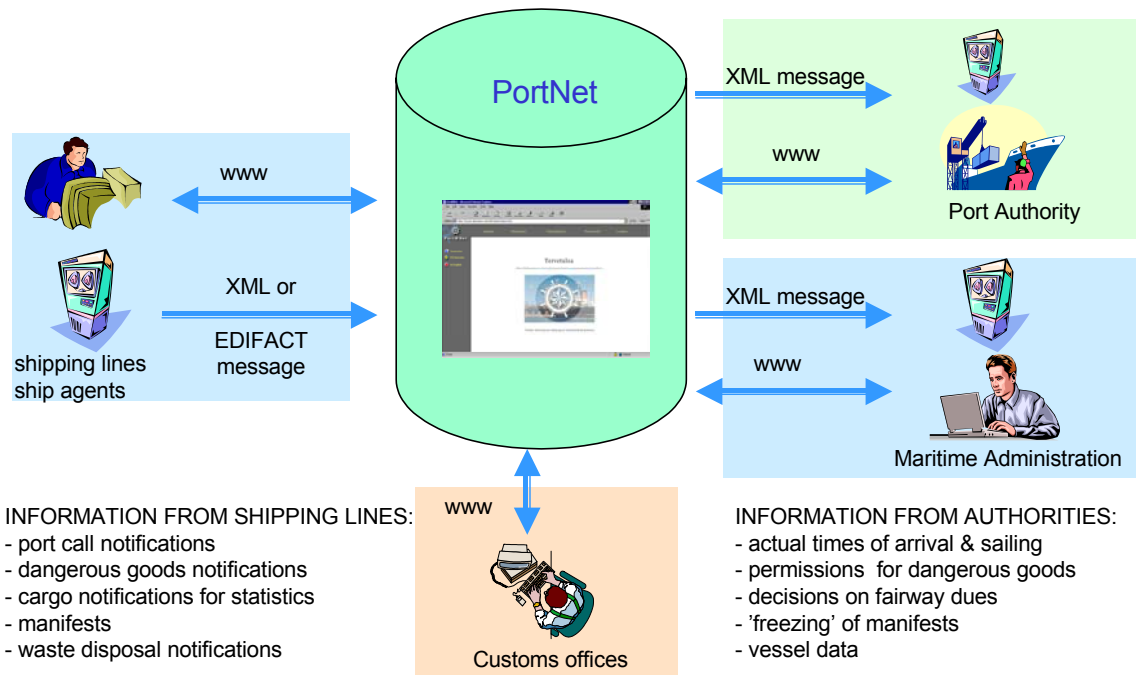


Figure 1. PortNet system operating principle (2)

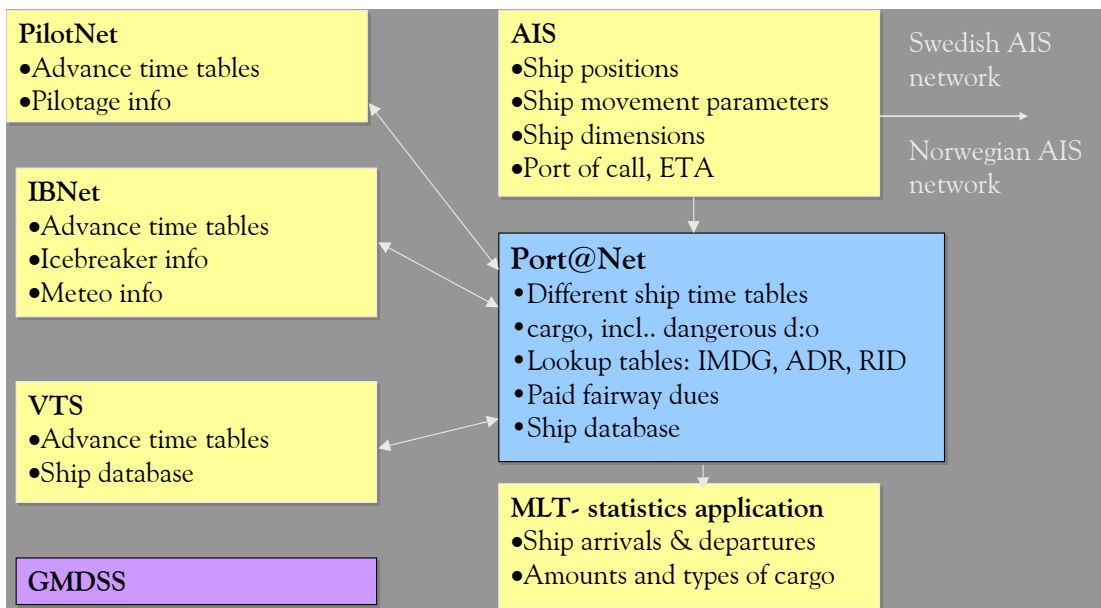


Figure 2. PortNet as part of Finnish maritime ITS architecture (3). AIS = Automatic Identification System of vessels; PilotNet = vessel pilot management system; IBNet = Ice Braker information and contol system; VTS = Vessel Traffic management System

The Finnish Maritime Administration (FMA) issued an ITS vision and strategy which stated that all the major ITS projects should include an evaluation module, at least in the beginning of the project – *ex ante* - and preferably also *ex post* (4). PortNet evaluation

was the first major ITS evaluation in Finland for a maritime system. The evaluation report has been published in both Finnish and English (5).

The objectives of this evaluation project was first of all to evaluate the impacts of PortNet system on economy, environment and information society – in sum, on the common Finnish policy goals. The evaluation including quantitative cost-benefit analysis and qualitative analysis on other aspects, such as organisation, legal aspects and technical issues, to name a few.

Secondly, the objective was to evaluate the usefulness of the Evaluation Guidelines. The applicability, usefulness and coverage of guidelines were evaluated and recommendations were produced as a result of this work.

Thirdly, the evaluation was expected to produce a sound long-term development strategy and developments needs list for PortNet system. This would then serve the commercial and other aims of PortNet stakeholder community, which includes ports, FMA, Finnish Customs Administration (FCA) and some major shipping line companies as well as brokers and agents.

In this paper, the first two objectives are given the major emphasis.

## EVALUATION PROCESS

Evaluation Guidelines process is shown in figure 3. This process was followed step-by-step and results of each step were documented and reported. However, it became evident that the guidelines could not be followed "all the way through" because many impacts were so difficult to assess clearly. On the other hand, the aim of Guidelines is naturally to provide an evaluation framework which has to be applied using common sense, varying from case to case.

Impacts evaluated were:

- **economic impacts that were given a monetary value**
  - costs for the users of PortNet and for the PortNet community; these costs included
    - the very first investment costs in the early versions of PortNet as well as later investment and update costs
    - maintenance and running costs for all parties
  - benefits for the users of PortNet and for the PortNet community; these benefits included
    - time savings in office and administrative routines that were previously performed by hand, telephone or other non-automated way
- **qualitative impacts**
  - mainly the impacts of having less data input and report errors; the time saving of these impacts was not calculated in monetary terms
- **evaluation of organisation model of PortNet**
  - the organisation model of PortNet was evaluated with reference to

- co-operation; i.e. how well were the incentives and motives of different parties of PortNet community and other stakeholders taken into account in the organisation model
  - financing; i.e. how fairly were the costs and benefits distributed among the parties and how sustainable was the existing financing mechanism
  - possible commercialisation of PortNet and exporting the concept to other countries, including commercial pricing and intellectual property rights
- **pricing principles**
  - pricing was evaluated with reference to cost coverage of services and the possible commercialisation of PortNet services and concept; the questions of commercial viability versus public information service were addressed too
- **evaluation of technical implementation and HMI (human-machine interface)**
  - user feed-back on operating failures and errors, reliability of the system
  - user feed-back on usability and usefulness of the system
- **evaluation from transport policy and "infosoc" perspective + taulukko 6**
  - how well the system supports national transport and information society policy objectives
- **other potential impacts**
  - these impacts included
    - impacts on supply chain efficiency on company and macro levels
    - impacts on IT dependency, i.e. the risk of too high IT dependency

The cost-benefit analysis was performed using 5% annual, nominal discounting rate and two time periods, 1990-2010 (from the very beginning of PortNet development) and 1998-2010 (from the beginning of current version development). The basic year (year 0) for calculations was 2002. Another round of calculations were performed using same start points but extending the future projections to 2015. Altogether four time periods (1990-2010, 1998-2010, 1998-2010 and 1998-2015) were analysed because the evaluation group wanted to see what were the actual costs and benefits when one considers the whole evolution process of this kind of ITS application and includes the very first phase investments and development costs. It is noteworthy that the "worst case" calculations went as far as 12 years back with prolongation of past investment, development and running costs and not more than 8 years forward in discounting the future benefits and costs.

In addition to cost-benefit ratios the internal rates of return and net present values were calculated using the same input data.

The emphasis in this paper is in the reporting of economic impacts, but some other impacts are addressed, too.

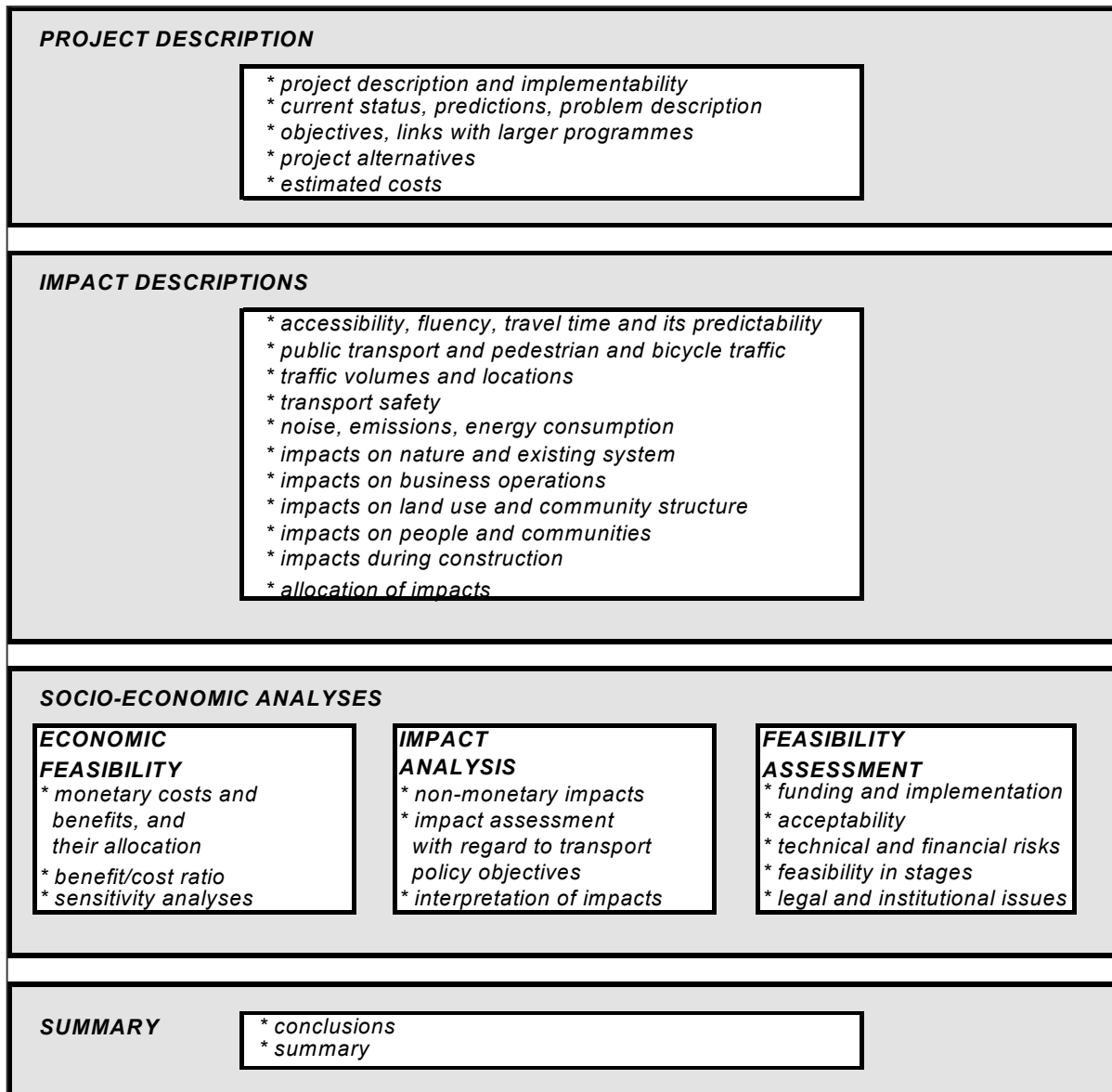


Figure 3. The evaluation process and components according to Evaluation Guidelines.

## EVALUATION RESULTS

Benefits and costs of PortNet are very much variable issues and mainly dependent on the use level, i.e. penetration of usage, and number of vessel calls in Finnish harbours. In Figure 4, both variables are shown. Penetration of usage (shaded area, the number of vessel calls using PortNet access) we know for fact quite certainly also for the future (98% penetration took place already in 2002), whereas the future number of vessel calls is based on FMA's official forecasts. The more vessel calling and the more harbours, shipping lines and agents use PortNet, the more benefits will be realised, of course.

Here is the first lesson of impact evaluation: with high levels of penetration (users, customers, and so forth) the benefits start to realise. In PortNet's case, the critical level

of penetration was around 50% assuming growth in vessel traffic. With no growth assumption the "break-even" penetration would have to be higher.

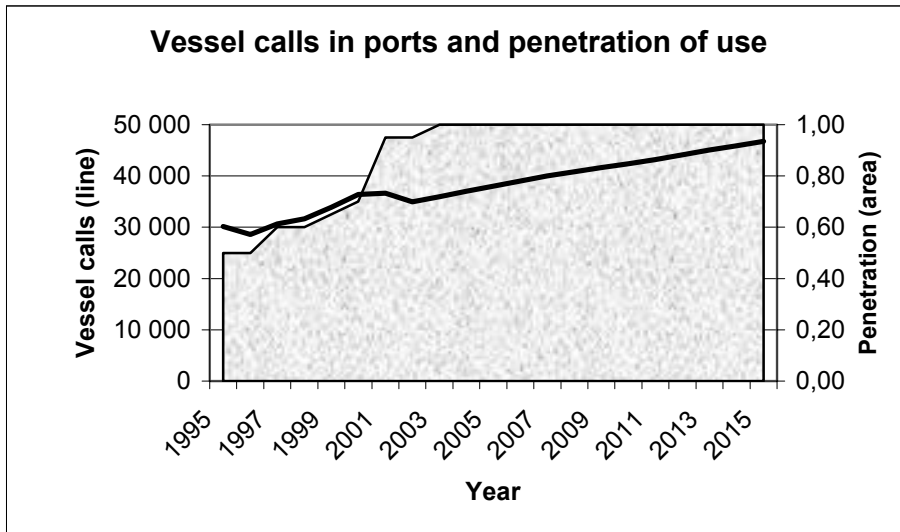


Figure 4. Vessel calls and usage penetration adopted for calculations; annual vessel calls (black line) and penetration of usage (shaded area) where 1,00 = 100% penetration

Figure 5 shows how the net benefits curve follows exactly the penetration curve and after 100% (1,00) penetration the vessel traffic volume forecast.

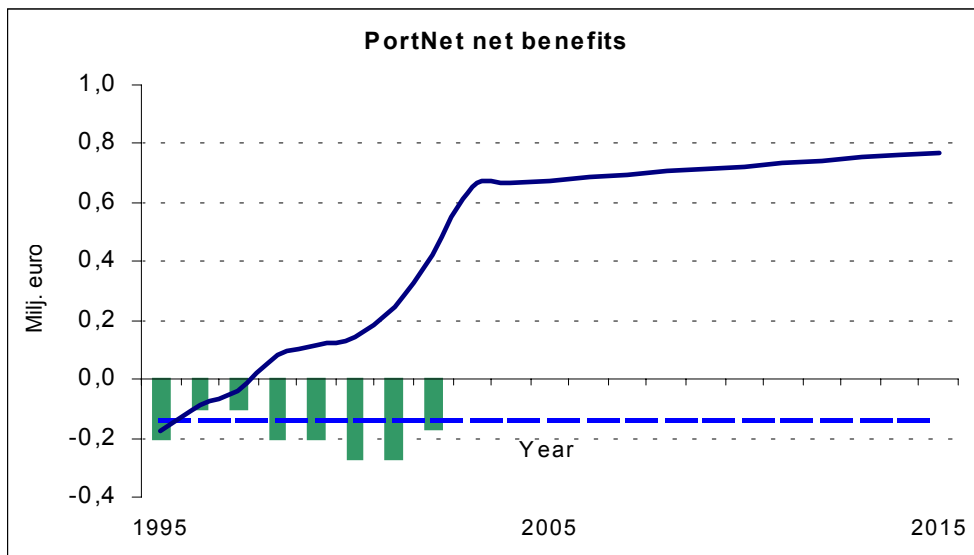


Figure 5. PortNet net benefits (blue line) after investments (green columns) and operating costs of the system (dashed blue line)

The actual benefit-cost ratios for the whole system on aggregate level of economy are seen in Figure 6. Even in the "worst case" (1992-2010) example the benefit-cost ratio is

more than 2, which certainly indicates profitability. In the "best case", the B/C ratio exceeds 3.

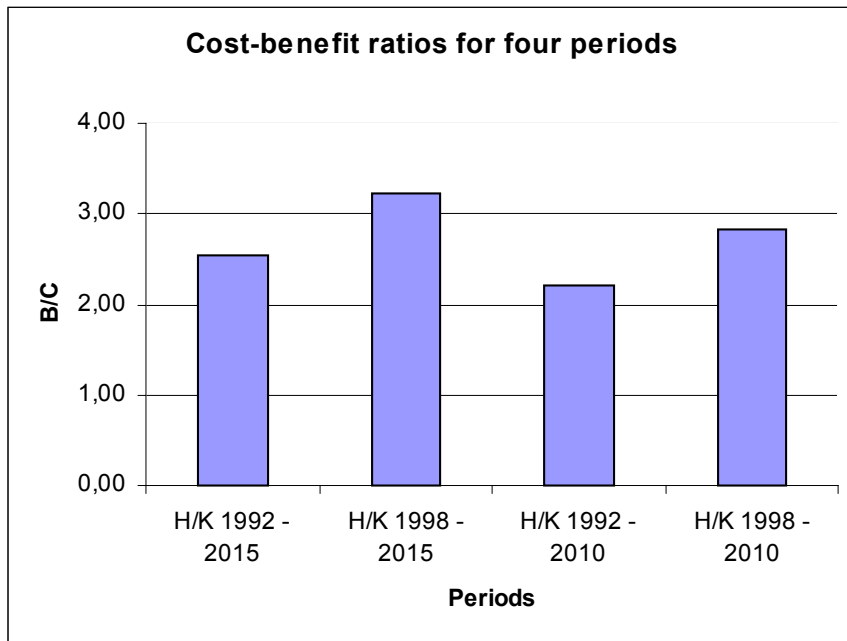


Figure 6. Benefit-cost ratios for four analysed periods

Here is the second lesson of our evaluation: the cost-benefit ratios can vary very much depending on the time horizons we choose for our analyses. But nevertheless, it seems that the penetration of usage level is even more important.

The benefits and costs were also calculated for different parties in order to see who, at the end of the day, are the net beneficiaries and who are the net payers of the system. The net present values for each party are shown in Figure 7.

What is clearly visible from the figure is that companies, i.e. the private sector, are those who benefit the most. Ports and FMA are the payers of the system. Ports' figures result from the fact that ports granted reductions for fairway fees for those companies who used PortNet for vessel and cargo information exchange. These reductions still burden the ports' key ratios, though the reductions will be aborted from the beginning of year 2003. From thereon, the ports will join the beneficiaries.

The third lesson is, therefore: somebody will always have to pay the start-up costs for any system or service. And if we wait that private sector will do this, we might have to wait for a considerable longer time. Public organisations can work as an efficient catalyst in the start-up phases of beneficial systems.

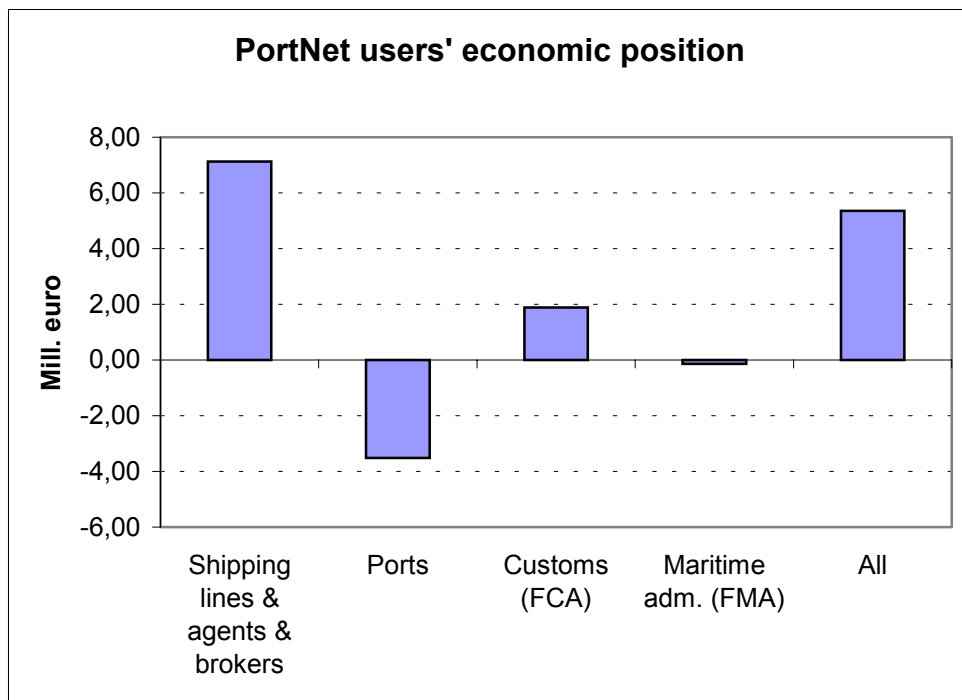


Figure 7. Net present values for each party using and running PortNet system after all costs and benefits; time period 1998-2010

**Qualitative impacts** were evaluated based on users' interviews. The evidence was clear: there were less errors in information exchange, less time consuming correction of these errors and more reliable and better quality data available for users. These impacts were not given a monetary value. However, when reviewing e.g. quality management literature, we can well assume that the overall processes of information exchange between parties could be 1%...10% more efficient than before. This is a typical impact of quality improvements in different service and production processes.

**Organisational structure** was evaluated to be a good one, but only for the existing situation and operating environment. There definitely is some pressure for main beneficiaries to assume more responsibility on PortNet. This pressure will be enhanced when FMA is restructured and more cost effectiveness will be pursued. So far, the current organisational and **financial structure** has been justified because of the "public good" and "sector benefits". If PortNet is to be commercially operated this will require structural organisational and financial changes. These changes have to be made with great care and skill because there is a risk of losing all the potential benefits if the penetration of usage level will decline because of the organisational questions or too radical changes in the pricing of the services (which are now practically free of charge excluding operating costs of each party).

**Technical and HMI** evaluation revealed nothing radical. The users were mostly happy with the user interfaces and technical issues.

**Transport policies** are supported when using PortNet:

- the use will enhance maritime **transport safety** and **reduce environmental damage risk** (hazmat information, vessel safety information, safety record statistics, etc.)
- the use of PortNet is everything that **information society** represents – sharing common data, building efficient multi-user and multi-purpose information sharing networks, and so on
- the **service level of transport system** is improved because of more efficient information exchange.

Impacts on **supply chains** was evaluated based on estimates on time savings and volumes of foreign trade. If every transport unit, whatever the unit might be, could save 30 minutes at only one point of the chain, this would yield considerable savings to the whole society. But we have to remember that this a theoretical aggregate level benefit which is not necessarily realised nor recognised on firm level, be they shipping lines, agents, container operators, truckers, railway operators, etc. And it is certainly not something that these firms would be ready to invest in. For these companies the reliability of information and advanced notices on exceptions on supply chain is far more important.

## CONCLUSION AND DISCUSSION

In sum, we can conclude that PortNet evaluation showed that the system is profitable in socio-economic sense even if only part of the benefits could be counted in. The costs, however, were included as far as they were known. In Table 1, the summary of impacts is shown.

*Table 1. Summary of PortNet's impacts; + = positive impact, no monetary value calculated; ++ = very positive impact, no monetary value calculated; calculated monetary savings are annual*

| IMPACT TYPE / VARIABLE                 |   | IMPACT ON:                       |                              |
|--|---|----------------------------------|------------------------------|
|  |   | Public sector,<br>administration | Private sector,<br>companies |
| Economic and<br>qualitative<br>impacts | Work time savings, more<br>efficient work processes | +<br>>1,5 mill. €                | ++<br>>3 mill. €             |
|  | More efficient use of capital                       |                                  | +<br>>1 mill. €              |
| Policy goals                           | Transport system service<br>level and costs         |                                  | +                            |
|  | Safety and environment                              | +                                |                              |
|  | Information society                                 | +                                |                              |

There are some relevant conclusions that can be drawn and discussed:

1) PortNet is concept of public-private-partnership which combines many interests. It is evident that public activity and support is needed in these kind of "multi-player" and "multi-benefit" systems are to be deployed. Companies seek for shareholder value and this interest is so strong that it practically hinders companies to invest in systems that produce sector benefits even if these companies would in the end benefit themselves. Wide impact investments are very hard to be justified for shareholders. This problem is particularly relevant in logistics industry which is dominated by multiple, private and competing companies. Public organisations, such as FMA in Finland, have to step in and initiate, assist and promote investments like PortNet.

2) From wider perspective, it is concluded that as most maritime ITS applications serve multiple stakeholders along the transport chain, the well-received and appreciated organisational concept of PortNet is justified and can be adopted widely across the Baltic and maritime transport stakeholder community. No single-operator systems can bring the benefits to the same extent. In order to achieve this, a good and goal-oriented co-operation between public bodies, such as ministries, maritime administrations and customs administrations are needed across the national borders.

3) It is also concluded that similar multiple stakeholder systems can bring the expected benefits only if the systems are truly used by relevant stakeholders; e.g. PortNet has brought the benefits after it has been used by most Finnish harbours, most customs clearance points and most shipping lines – the critical mass or penetration of use is essential. This is probably true regardless which transport mode one looks at. This is bad news for smaller national markets as the case is with Finland. The critical mass is ever harder to achieve. This is good news thinking of international, common markets where the critical mass can be achieved with lesser efforts - provided that the markets are really common and open.

4) The Finnish Evaluation Guidelines proved to be extremely useful. Even if the Guidelines had to be fitted in this particular evaluation and many components were not that useful it provided a framework which helped the evaluators to build a comprehensive picture about PortNet and its impacts. The Guidelines need to be updated from time to time. PortNet case provided some updating needs regarding logistics systems' evaluation. There perhaps is a need for European evaluation guidelines as well?

5) PortNet enhances Finnish transport policy goals and goals for information society. Since it is anticipated that these policy goals do not differ significantly from country to country or from region to region, these kind of maritime ITS applications support sustainable and intelligent maritime transport as well as generic transport and maritime policy goals.

6) As PortNet "matures", and becomes more and more of a standard way of handling and exchanging information a need will arise where the organisation, financing and operating principles have to be checked. The authors assume that public-private type of solution where every beneficiary will have a certain stake and responsibility will take place in the future. This might also mean a more commercial approach to the services provided by the system and to the pricing of these services.

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