Introducing E-brokerage in European Transport Services; the Case of the PROSIT Project

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Abstract

The use of advanced telematic solutions in the transport sector is already a market trend as well as a policy choice of the European Commission (EC), aiming to improve mainly the overall efficiency of waterborne transport. The R&D project PROSIT, co-funded by the EC, is an effort to introduce telematic technologies in the traditional field of the shipbroker. As middlemen tend to be excluded in an era of "new economy", PROSIT aims to explore the substitution of an actual commercial procedure with web-based tools. PROSIT has been developed through four major case-studies (scenarios), involving different states of technology, market needs, and organizational structures. In this paper all scenarios are described, discussed and evaluated. Given the results of PROSIT some qualitative issues of e-brokerage and the future of such services are discussed in view of the modular structure of modern enterprises.

Keywords Waterborne Transport, Intermodal Transport, E-Brokerage, Validation, Logical Framework Method.

According to statistics, road transport is steadily increasing. Reduction of road transportation and road traffic is a major issue for European and national policy, as all forecasts predict a further increase in global trade. Bottlenecks in traffic and pollution will become extremely serious problems within the next few years. This fact creates a need for activities in two directions: reduction of traffic volume and shifting transport from road to rail and water. The shift from road to sea, decrease of energy consumption and environmental sustainability, but also avoiding bottlenecks on transport networks, are all major objectives of the European and national policy [3] [5].

Use of modern information technology in transport is an important task for the realization of these objectives. Various Research, Technology and Development (RTD) projects in the frame of large scale programmes of the European Commission are dealing with this subject, such as the besides the Transport programme, the Telematics Application programme or the programme on Advanced Communication Technologies and Services.

Therefore, shifting transport from road to sea is an important challenge within the framework of the European Transport Policy and any relevant project faces mainly the following main tasks:

- Promote Shortsea Shipping and Inland Waterway Transport
- Increase Use of empty or partial empty transport equipment
- Support an intermodal brokerage between the demand and supply sides by implementing and developing advanced telematics solutions.

In this context the aim of the PROSIT project has been to promote shortsea shipping and inland waterway transport by use of modern telematics. PROSIT's "applied" goal has been to act as a test platform for research work for the transport industry, the environment and the European transport policy. In the case of PROSIT, modern telematics systems include two different kinds of software that need to communicate and cooperate: the Interconnectivity Manager (IM) and the Brokerage and Control Software (BCS). The IM is a reliable and stable tool for interconnecting heterogeneous electronic data processing environments via Electronic Data Interchange (EDI). The BCS was the final-outcome of the development process in PROSIT. Later for marketing reasons, it was slightly improved and renamed to PROSHIP.

1 GOALS AND OUTCOMES OF THE PROSIT PROJECT

In comparison to other R&D projects in the field of transport, PROSIT concentrates on the improvement of the quality of waterborne transport embedded in intermodal chains and on the co-operation between the demand (industry and trade) and supply (transport industry) sides.

PROSIT is focusing on a chance for achieving the goals mentioned above. This chance is the willingness for a short termed planning of transport demand in accordance with short termed (actual) employment of partial empty transport capacity. There is a high potential for reducing traffic by decreasing movements of empty transport equipment and by improving the use of its full capacity. [12]

Customers of transport operators are asked to review their philosophy. Instead of ordering transports without considering momentary employment of the fleet of transport operators, the shippers should use their timely scope of planning for procurement and distribution in order to enable transport operators to realize full loaded trips.

This kind of co-operation requires exchange of a lot of short-term information on the momentary and actual situation, of shippers as well as of the various partners in the transport chain.

Regarding the shift from road to sea, unfortunately, shortsea shipping and inland waterway transport are not sufficiently accepted by shippers and forwarders located in hinterland, even if the transportation fee is much lower than the one regarding other modes.

This is also caused by lack of information regarding short-term knowledge on intermodal transport alternatives including waterways as well as a lack of reliability and quality of inland waterway and coastal shipping integrated in intermodal transport chains. Aiming at the acceptance of the transport industry requires overcoming these barriers.

Transport operators have to perform and ensure reliable door-to-door transports including the waterborne mode. In cases of delay or other unforeseen circumstances, customers should be immediately informed. Quality and reliability are becoming the most important criteria shippers consider when choosing a mode of transport between competing suppliers and modes. In addition to reporting deviations, fallback solutions must be activated in order to reduce negative effects. This requires an improvement of organizational structures in the companies and especially the use of modern telematics.

Therefore PROSIT wanted to demonstrate the use of modern telematics in order:

- to support an "intermodal brokerage" for linking and tuning the demand and supply side in transport including shortsea shipping and inland waterway transport,
- to focus on organizational aspects in order to improve the quality and reliability of shortsea shipping/inland waterway transport and its integration into intermodal transport chains,
- to establish an after sales service for monitoring the transport, reporting deviations, activating fallback solutions etc., or else
- to guarantee quality and reliability required for the acceptance of shortsea shipping and inland waterway transport.

Referring to PROSIT's overall objectives as mentioned before, specific and measurable objectives to be fulfilled within PROSIT were:

- the successful operating of procedures and software (on logical, technical and organizational level)
- co-operative planning and control along the transport chain, aiming at improving efficiency and quality of SSS and inland waterway transport in intermodal chains (using the Interconnectivity Manager Software)
- brokerage between demand and supply sides (using the Brokerage and Control Software)
- improvement of interconnectivity and interoperability
- improvement of planning and control of freight transport and employment of resources
- improvement of co-operation between partners in transport (including waterborne transport) for planning and control of freight transport and employment of resources
- removal of bottlenecks or other obstacles that hamper logistical efficiency and quality
- improvement of brokerage between industry/trade on the one side and transport providers (including SSS and inland waterway transport) on the other side
- shift from road to waterborne transport.

The PROSIT consortium comprised 23 partners from six European countries. This wide consortium almost automatically bore some synergy for common work. On the one hand, it was a chance to gain experience and knowledge from a wide geographical range in the field of shortsea shipping and inland waterway transport. In order to benefit from the chances and avoid the disadvantages of such a large consortium united under a research project, PROSIT partners were grouped into four scenarios. By allocating users to single scenarios and grouping them in four categories, a smooth and convenient operation in the project could be ensured. Scenarios focused on relations between the Rhine area and the North and Baltic Sea, and between the North and Baltic area and the Mediterranean Sea.

In Scenarios 1 and 2 intermodal transport chains including inland waterway transport and seagoing barges were involved on two different directions for the employment of the main capacity (south bound and north bound). In Scenario 3 container traffic was the focus, while Scenario 4 focused on integrating hinterland transport and shortsea shipping.

There is of course some overlapping between the scenarios regarding the relations for the freight flow as well as the various kinds of co-operations. Concerning the role of single users and their positions in the various scenarios, the users have additionally been divided into the following user categories [12].

1. **User category 1:** User (without an own EDP system) participating in communication by use of an IM (Interconnectivity Manager) user interface with access to an IM of a partner
2. **User category 2:** User with an own EDP system will be interconnected to partners who have an IM installed
3. **User category 3:** User with an own EDP system who installs an IM **for** interconnecting its EDP systems to systems of partners
4. **User category 4:** User who installs the new software supporting the "brokerage and control".

Figure 1 shows the principles for the networking of the users and the use of the brokerage and control software. BCS and IM as well as other software tools and applications used in the PROSHIP integrated tool have been developed in other R&D projects funded by the EC, such as BOPCOM and COREM. As a result, PROSHIP can be considered as an outcome of the needs identified in the past and the practical solution provided for the demands of PROSIT partners [6] [7] [8].

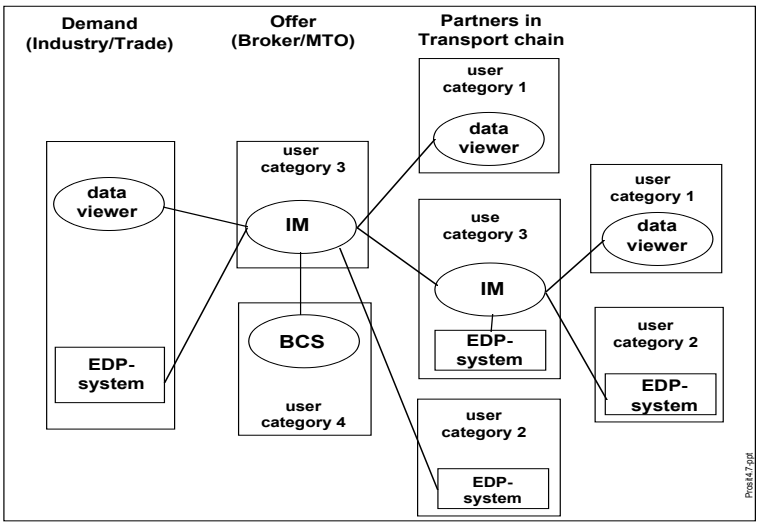

Figure 1: User Networking and Use of the Interconnectivity Manager and the Brokerage and Control Software (PROSHIP)

1.1 Scenario 1 (Rhine/North Sea)

Rhine/North Sea, RMSD

The Rhein-, Maas- und See- Schiffahrtskontor GmbH (RMSD), located in Duisburg, is one of the leading companies in the European coastal and in particular sea-river shipping industry. RMSD operates a fleet of 117 modern vessels, while members of the RMS Group of companies offer a variety of shipping-related services which include stevedoring, clearing, bunkering, ship sale & purchase, forwarding, trucking, warehousing, brokering, liner, and ship financing.

The steel industry forms an important part of the clientele of RMS in Germany and in the United Kingdom. A regular feature of RMS day-to-day business is the transportation of steel coils from Thyssen Stahl AG in Duisburg to their customers in the U.K. The interest of RMSD was the establishment of a telematics network enabling partners in an intermodal transport chain to exchange cargo and transport details. The variety of different electronic data processing systems imposed the installation and use of the interconnectivity manager as a nodal point in the system.

RMS had already developed an in-house software system named KoLDAS, assisting the management at the operational level throughout the entire transport chain. KoLDAS is interconnected to the interconnectivity manager on the premises of RMS in order to exchange information with other electronic data processing systems. Figure 2 presents the context diagram of the application.

Thyssen Stahl AG in Duisburg produces steel coils and plates, which have to be delivered to customers in Great Britain. RMSD is ordered by Thyssen to plan and operate the waterborne transport to the UK with seagoing barges. RMS in Goole (RMSG) organizes transshipment and door-to-door transport to the consignees in the U.K. and operates warehouses where the cargo can be stored. RMSD is already operating an electronic data interchange with Thyssen based on electronic data interchange via an IBM Value Added Network. The data flow to RMSG is based on paper, fax and telephone. The realization of an electronic data interchange between RMSG and RMSD was the main objective of this scenario.

The British Steel Strip Products, BSSP, distribute their steel products through RMS in a similar way to Thyssen, but in the opposite direction. RMSD undertakes the hinterland transport of BSSP products in Germany. In the future, an electronic data interchange will be established between BSSP and RMSD and similar information will be exchanged with BSSP that is done today with Thyssen.

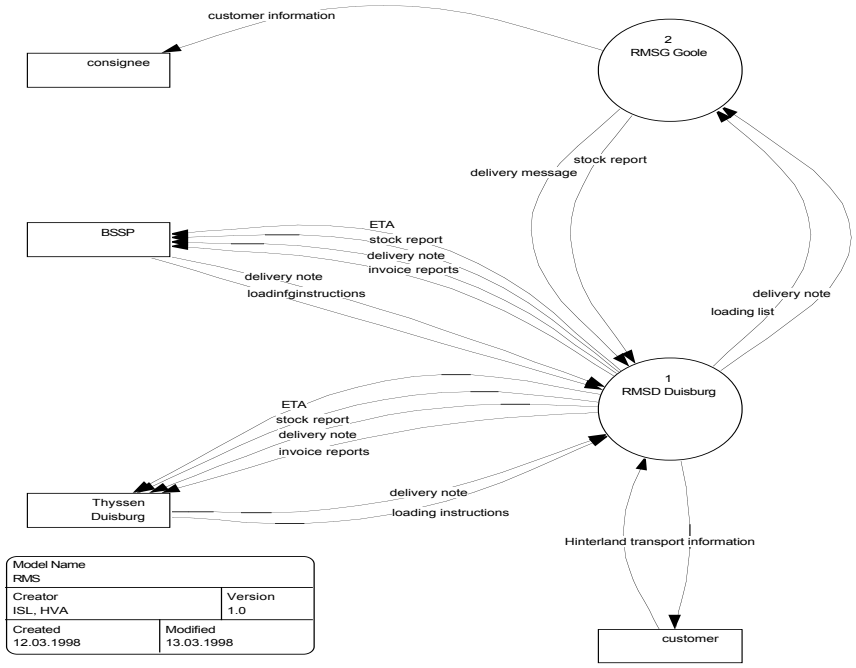

Figure 2: Context diagram for RMSD and RMSG

Cuxport, CUXP

Cuxport is the operator of Cuxhaven's new terminal. Cuxport is a joint venture between HHLA-owned Cellpap, Hamburg based Gerd Buss AG, Midgard (parent company Stinnes) of Nordenham, and the State-owned Seefischmarkt Cuxhaven. The terminal handled some 750.000 tons of general cargo in 1997, including close to 26,000 TEUs.

Facilities, situated on the estuary of the Elbe River are occupying some 400,000 m² and providing three river berths with a total length of 1,050 m allowing a maximum draft of 14.5 m at all times.

Cuxport intended to improve its service by providing telematics interconnectivity to the Danish shipping line DFDS Transport in support of the latter's service between Cuxhaven and Immingham, UK. The electronic data processing system of DFDS was interconnected to the interconnectivity manager of CUXPORT in order to allow the exchange of cargo and transport details including the voluminous loading and unloading lists. The context diagram of the application appears in Figure 3.

All-round Container Service GmbH, ACOS

In addition to the two PROSIT applications presented above, which comprised Scenario 1, a third application was added at a later stage. This concerned ACOS, a multimodal transport service provider, operating trucks, private trains, barges and sea-going feeder vessels.

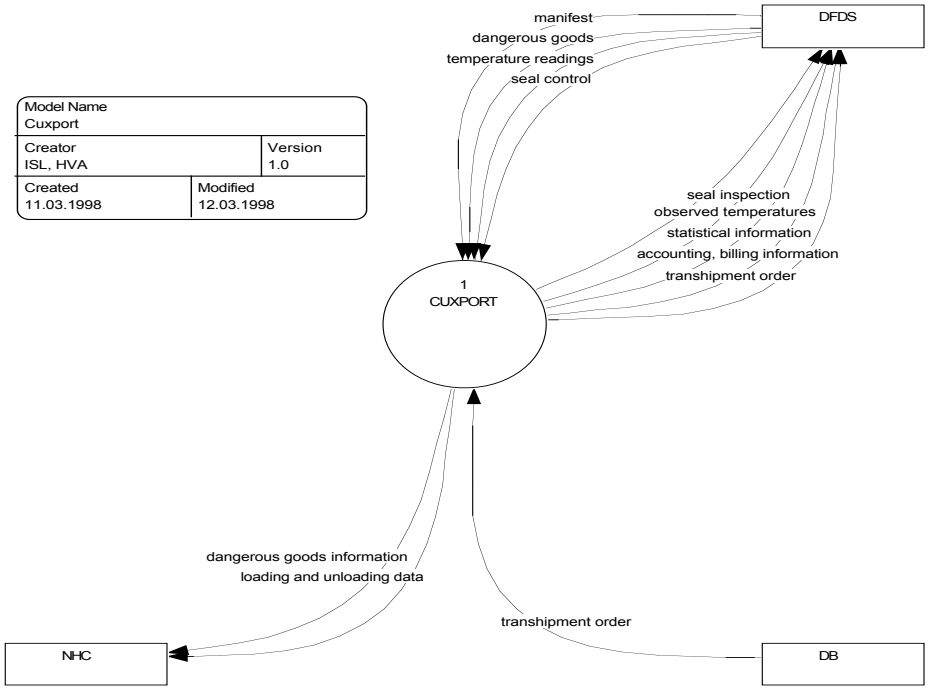

Figure 3: Context diagram for CUXPORT

Aiming at attracting more cargoes to inland waterways transport by increasing transport speed, improving transparency to the customer, and improving utilization of transport capacity, ACOS installed PROSHIP in their premises, so as to offer to a restricted group of about 80 client companies information on prices and transport capacities, enabling them also to book cargoes directly.

1.2 Scenario 2 (Finland/Rhine)

Oy Saimaa Terminals, SAIMAA

Originally, this was the only application of Scenario 2. Its focus was shipment of forest products (timber, plywood and paper) from Finnish inland waterway ports located in the Lake Saimaa area via the Saimaa Canal to Central European inland waterway ports with river-sea vessels and smaller coaster tonnage. In addition to seasonal interruptions (Saimaa Canal is closed for about 4 months per year due to ice), the main problem in transportation via the canal is the fact that most of the cargo suitable for waterborne transport cannot be accessed and exploited at all. This leads to the fact that the biggest part of the waterborne transport volume is concentrated on the major shippers (forest and paper industry), while the remaining cargo is being shipped via truck. This is partly due to the fact that it

is almost impossible to buy part load capacity in out sailing ships. As a result, for example, a sawmill that is located in the Mustola port about 150 meters from berth, has to ship via rail or truck to Kotka port.

Another important business issue in the Saimaa area was how to attract incoming cargo to the lake Saimaa ports. For the time being, close to 60% of the arriving ship capacity is empty. Therefore, the biggest benefit PROSIT could provide would be the capability of selling cargo from Central Europe to lake Saimaa ports.

Oy Saimaa Terminals is a port operator in the two ports of Mustola and Joensuu. The services of Saimaa Terminals include stevedoring, forwarding and warehousing in the two ports. Forestry products are exported and dry bulk products are imported. The annual cargo volumes in these ports are: Joensuu 265.000 tons and Mustola 240.000 tons. Saimaa Terminals belongs to the Steveco group of companies, which is the biggest port operator company in Finland. Steveco is operating in the ports of Hamina, Kotka and Hanko.

Saimaa Terminals is a key player in the development of the Lake Saimaa sea traffic. The company was willing to invest and develop new Information Technology (IT) applications like PROSIT, as it expects:

- more easily accessible information;
- enabling spot trade for cargo transport, especially for part loads; and
- business development potential for the lake ports through exploiting part loads instead of losing them to sea ports.

In addition to PROSHIP, which was used for matching part loads with available ship capacity, the application also involved the interconnectivity manager for interconnecting a number of PROSIT partners, namely the Finnish Maritime Administration, the Inland Waterway District (FMA), the transport service provider EWT Duisburg, the shipping line agent Intercarriers (INTERC), and the Lappeenranta Port of Mustola (MUST). None of these entities exchanged documents in electronic format; all communications with other parties were based on telephone calls, fax and telex messaging. Each party, however, recognized the business benefits of being able to exchange documents in computer-readable format. Figure 4 below depicts the context diagram for SAIMAA.

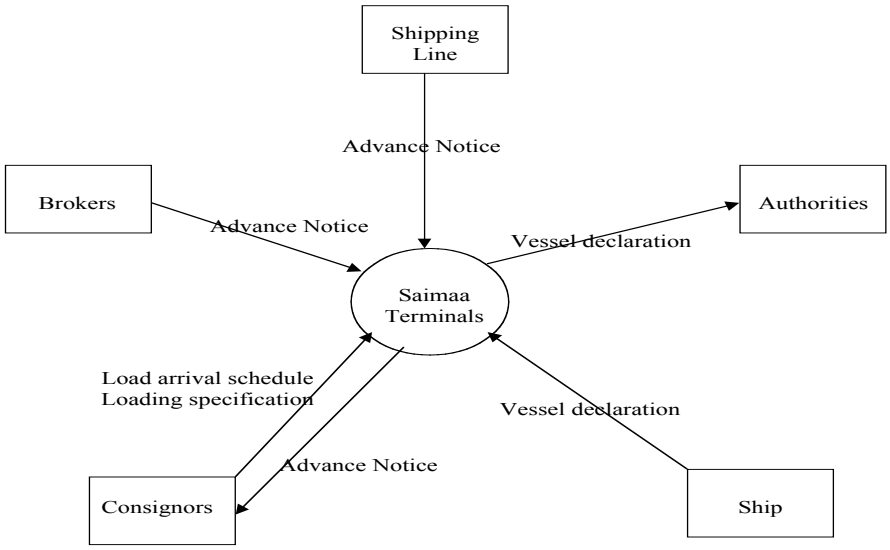

Figure 4: Context diagram for SAIMAA

Satellite tracking system

One of the most serious concerns, customers have against waterborne transportation is the fact that their cargo disappears in a kind of a "black hole" and *surprisingly* pops up again at the final destination. This seems quite anachronistic as topics like supply chain management, international collaboration and shared working processes are taking place in a more and more networked economy. On the other hand, waterborne transport is by far the least costly and environmentally friendly way of carrying cargo. Therefore, ensuring transparent monitoring and continuous supervising of the transportation process is seen as a factor contributing to the advancement of waterborne transport. By means of satellite communication, this can be effectively achieved throughout the entire transportation chain at affordable costs [12] [13].

In view of the above, a PROSIT satellite tracking application was added to Scenario 2, that makes vessel movements and current vessel positions visible. The purpose was to allow clients to follow their cargo on its way at sea. During the project, a total of five vessels of RMS, of POHL Shipping, and of Vagenborg Shipping will be monitored.

1.3 Scenario 3 (Mediterranean Sea)

Container transportation in the Mediterranean Sea was the main content of this scenario. It concerned the operations of Sarlis Container Services S.A. (SCS), a ship managing and liner operating company in the Mediterranean Sea.

About 40% of its annual traffic volume concerns container feeder activities for a number of lines (like CGM, Cosco, Italia, Lloyd Triestino, D'Amico Soc. di navigazione, Ellerman, MISC, Mitsui, P&O, NYK, DMA, DSR) on a permanent or occasional basis on different routes. As regards the inter-Mediterranean traffic, SCS controls a considerable market share in the routes between Italy - Greece - Near East, and Spain - Greece - Near East.

Aiming at enhancing the company's effectiveness in dealing with the large volume of documents concerning container transport, and at improving the quality of services offered to a restricted group of regular clients, SCS wished to install and test both the interconnectivity manager and PROSHIP in their premises.

In addition to the physical entities of the ship and the cargo, container operation involves also a third entity, the container itself, which raises the complexity of the corresponding administration system. The context diagram of Figure 5 shows the data flows associated with the shipment of a container under the following simplifying assumptions:

- the consignee is in control of transporting the goods (ex factory terms of trade);
- the selection of the road carriers at both ends of the journey is not made by the consignee;
- the inquiry for services comes from the consignee and not his agent;
- the cargo to be transported represents a full container load (FCL);
- the containers to be used are not owned by the shipper or the consignee;
- there are no freight forwarders involved.

Even this operation, however, was too complicated to be modeled in the framework of the PROSIT project. The following subset of flows was considered sufficient for the application of PROSIT, as it formed the core of the business negotiations taking place in the transportation of a container, while it served well at the same time demonstrative purposes of the project:

- the consignee sends an inquiry to the agent;
- the agent makes an offer;
- the consignee accepts or rejects the offer;

- in case of acceptance, the shipper prepares the bill of lading; and
- the agent books and releases the containers to be used for the particular shipment.

There two other PROSIT partners participating in this application, CONSIGMAR, the SCS agent in Valencia, and Piraeus Port Authority (PPA), the container terminal in Piraeus.

1.4 Scenario 4 (Baltic Sea)

Lübecker Hafengesellschaft mbH (LHG)

Lübeck is the largest and south-westernmost German port at the Baltic Sea. There are four port areas (Nordlandkai, Skandinavienkai, Schlutupkai, and Konstinkai) featuring 20 berths in total. A fifth location is being developed and will be added in the near future. With almost 25 million tons of throughput in 1998, a turnover of 160 million DM, and more than 800 permanent employees backed up by a port labor pool, Lübeck is a major logistic hub and cargo distribution centre. The port receives over 5,000 ship calls per year to/from Central Europe, Scandinavia, Finland, Russia and the Baltic States.

Lübecker Hafengesellschaft mbH (LHG**)** is the main operator of the Port of Lübeck and handles about 94% of the total transit cargo volume. LHG belongs to the Hanseatic City of Lübeck. LHG provides up-to-date facilities and port operations for all transport modes. LHG profits from channeling cargoes via Lübeck to the Scandinavian and Baltic States and Russia. As such, LHG is actively marketing its services to the European hinterland, including industries from France, Benelux and Southwest Germany.

LHG had interest in bringing more cargoes through inland waterways via the Elbe-Lübeck-Channel, as well as in using rail instead of road transport. There are already communication interfaces to the main contractors of the port, but there was still a need for interconnectivity to small and medium trading partners and customers in the hinterland.

In the framework of PROSIT, an application was developed providing a communication link to the German car manufacturer Volkswagen. It has been expected that this interconnection would offer to LHG a tool supporting the company in planning their operations and more specifically in preparing more precise schedules for their dockworkers.

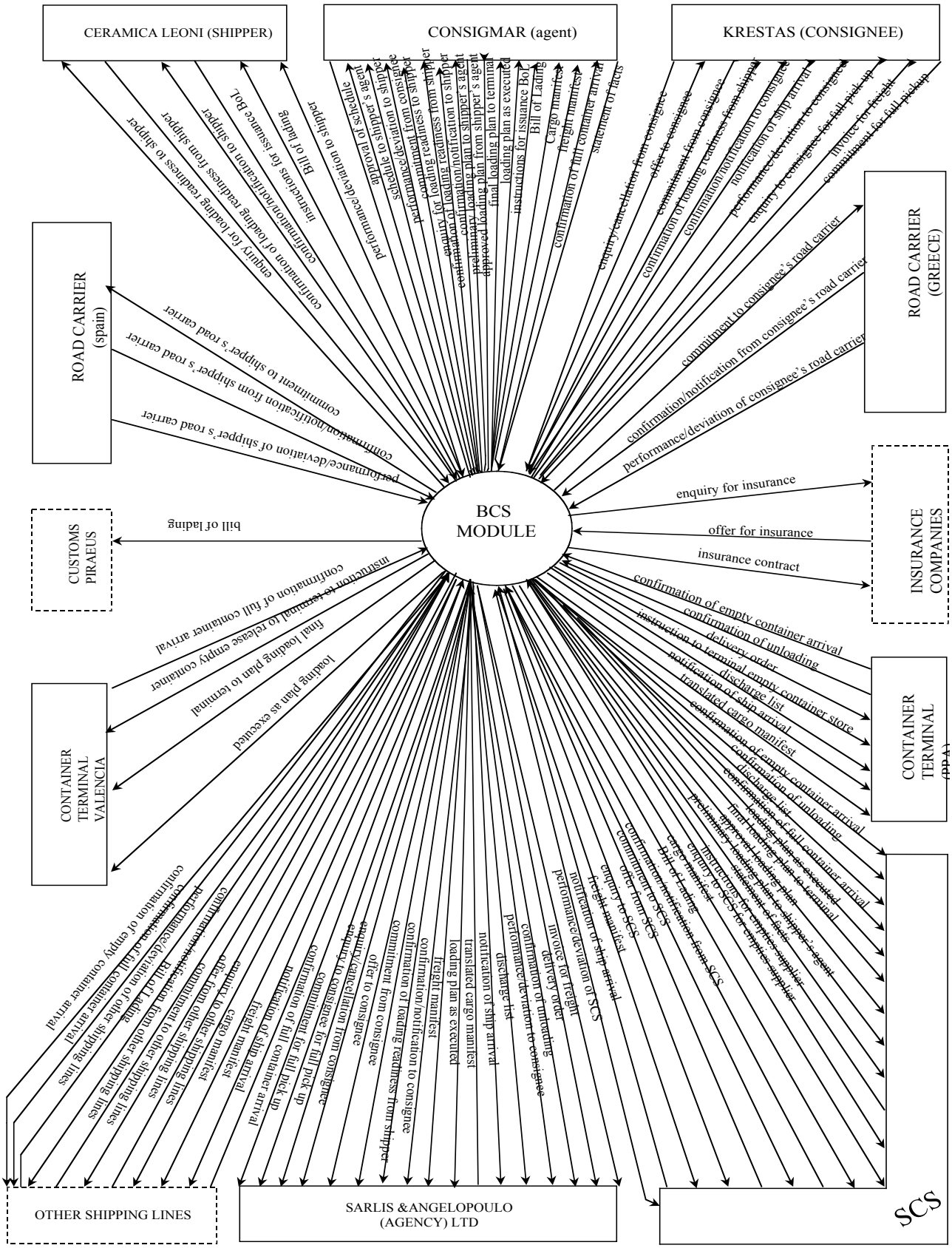

Figure 5: Context diagram for Scenario 3

Dangerous cargo management

Two more applications, similar in nature to the LHG one, were originally part of this scenario. The first one concerned Frachtkontor Finnland OHG (FRAFI**),** the German agent of the German-Finnish joint shipping line Finncarriers Poseidon, which was willing to test the interconnectivity manager and PROSHIP aiming at improving their communication links to small and medium partners in transport and the industry. The second concerned Transrussia GbR (TRE), a provider of regular shipping services from Kiel to St. Petersburg. TRE was interested in installing and using the interconnectivity manager for improving its communications with existing and new customers at both ends of the Kiel - St. Petersburg link. However, due to the extensive restructuring of Finncarriers Poseidon, which took place during the project implementation and affected both FRAFI and TRE, these companies constrained their involvement in monitoring and testing the interconnectivity manager application.

In view of this development, the PROSIT consortium decided to add a new application to this scenario, dealing with the sensitive issue of managing dangerous cargoes. Handling this type of cargo is a major issue in maritime transportation, especially as far as shortsea shipping in Europe is concerned. The transfer time here is usually very short and any emergency-situation requires immediate action by the relevant authorities. Several regulatory acts have been issued to address this problem, imposing a number of requirements on both the transport operators and the port authorities. Both these parties face difficulties to cope with them as the administrative procedures are complicated and cumbersome disrupting the usual daily operations of the carriers, while specific skills need to be developed by the port and national authorities. The provision of accurate information in real time is a crucial factor in meeting these requirements.

The application of PROSIT involved the development of an advanced information system for the announcement, notification, verification, and administration of information on dangerous cargo in the Port of Lübeck. It was developed by TraDaV, a company specializing in managing communication traffic along the transport chain and establishing EDI connections between the companies involved in the transport and logistics sectors.

2. PROJECT EVALUATION

2.1 Evaluation Criteria

The selection of evaluation criteria is not an easy task when no figures or other 'tangible' evidence is involved. In the specific case of PROSIT, the goal was not only to develop a software system and to attract users, but to change business mentality and practices through the application of the new technology. So what the PROSIT consortium really undertook was to promote an idea by installing a software application at the premises of the interested parties.

The consortium faced two main technical tasks:

1. To establish or to improve interconnectivity between different software systems, connecting the market forces to a common communication environment.
2. To provide solutions or to support decisions along the transport chain.

Usually transport companies, manufacturers, ports and every single partner or user of transport services has an in-house software system. These systems are not usually capable of exchanging data with systems of other parties; even when using magnetic means (tapes, disks, etc.) there is always the problem of retrieving the data and finally getting the required information out of them. In other cases the connection between the systems is relatively expensive. Additionally the industry has never actually "enjoyed" the communication of data and information, so secrecy was one of its characteristics. The solution for these problems was the use, the installation, and the modification, where necessary, of software developed in the past for relevant reasons. The interconnectivity manager is such a software application that secures the interconnectivity between the systems, translating, or interpreting data to a retrievable format for both systems.

The interconnectivity manager alone, however, was not sufficient as it could not support decisions. This created the need for PROSHIP. Apart from technical issues, PROSHIP provided the interface for the communication or exchange of information between the demand and the supply. The innovative point of PROSHIP was not only the static express of interest of any side but the dynamic exchange of information, since negotiations and monitoring of the agreement were served by the same tool [12].

Consequently at the first layer of PROSIT, there was a software application aiming at connecting systems and at providing adequate interface to the users. Therefore, the first set of criteria was [1] [10]:

1. The reliability of the system
2. The accuracy of the transferred data and information
3. The low-cost for the initial acquisition, update and required hardware as well as software
4. The user-friendly attributes of the whole package
5. The commercial and technical life of the application

At a higher layer of PROSIT, existed the network of users, i.e. shippers, carriers, terminals, consignees, and any other interested party entering the system. It was a network of people and regardless of their goals or the services they provided, it consisted of a group of people familiar to transport practices, if not of experts. As a result, this network demanded not only a technically sound software application but also a business-wise attractive system; a trigger to shift from the old practices to the new one. At this layer there was no concern on the connection cost or any other expenses. These users are employees, they do not have real access to the strategic or corporate decisions and they execute orders facilitating everyday business. Consequently they demand also a specific quality of service, expressed by the same criteria, as in the previous layer:

1. Reliability of the system/application
2. Validity of the information
3. Cost-effectiveness
4. Usability
5. Sustainability
6. Ability to support decisions

It shall be noted that ‘cost-effectiveness’ is approached in a more qualitative way than real, actual costs, and for this layer cost-effectiveness can also be substituted by the term ‘time-saving’. However, for consistency reasons, saved or wasted time is evaluated under the criterion of cost-effectiveness, as time is usually translated in money.

Finally, at the level-layer of the company or the strategic decision-maker, the criteria are the same but their focus is merely different. The upper management of the company is usually not involved in the everyday booking of space or trip assignment, yet there is a special interest for market advantages and growth [9].

The six aforementioned criteria are analyzed according to the needs and demands of the three different layers, used for the evaluation that is based on the logical framework matrix approach, which sets objectively verifiable indicators (OVIs) as means for the measurement of the change and the impact of the project [12]:

1. Reliability
2. Validity
3. Sustainability
4. Usability
5. Cost-effectiveness
6. Ability to support decisions

The above OVIs are further broken down to more detailed criteria that validate the project in terms of goals and aims set for the project as such, in other words they evaluate if the PROSIT consortium has dealt efficiently with the goals and aims as set in the technical description.

Then the following two OVIs:

- observed shifting of cargo from road to sea modes
- increased volume of transactions

actually check the impact of the project in the real-world business. These OVIs express the policy goals of the funding organization, so a positive change monitored by the above OVIs leads to a successful result. The concept, the materialization and the final implementation of the ideas and means of PROSIT actually assisted in achieving the policy goals.

2.2 Evaluation of the findings

Reliability

The reliability of the system and the software is crucial parameter for the impact of PROSIT and its ideas in everyday business. In the matrix two points are mentioned:

- Reliability of the technical solution in terms of failures or crashes, and
- Reliability of the system supporting everyday decisions

The term reliability is becoming nowadays more important than ever, as no failures are allowed and the cost of control, check and feedback increases. As companies and offices become more computerized several tasks are transferred to electronic systems. The case of banks is a very good example transferring human tasks, such as deposits, transfers and credits. In the 60s thousands of employees were used to perform just a fraction of the today activities and money was mainly in physical form. As computers entered the functions of a bank, the shift to the new innovative system did not happen before ensuring the reliability of the system. Only one wrong figure could undermine the whole function. In addition the rapid exchange of data allowed the booming of virtual money. In other more blatant and extreme examples, as in the aviation industry, reliability is not only a keyword for the booking, i.e. the income procedure, but also for the safety of the flights. A wrong figure or an ill transmission can sentence many people.

In the case of PROSIT, the results are in no case so profound but the companies need nevertheless a reliable tool to operate. The idea of introducing a computer system operating among the parties involved and replacing brokers seems to be part of the future pattern of business. However, it is not so simple to change the habits of people and to convince them that the new system is at least as good as the old one. Furthermore, the shift to a new system demands more triggers to ‘lure’ the sector. As the system is not run by only one company as an in-house application, but many companies participate, an allurement or other stimulus shall attract the interest of the sector. Therefore, as computers and software technology convinced people that the tasks of many employees could be undertaken by business computer solutions, increasing the efficiency or the productivity of the company a relevant trigger is also necessary in the case PROSIT. Computers convinced the market because of their reliability among other characteristics. Companies that installed computers at their early stage of development faced many problems and in many cases

abandoned these systems for several years long. Consequently as PROSIT and its technology is still under development it is crucial to measure the reliability of the system, in such a way that no disappointed customer will appear in the market.

Another point of concern is the reliability of the system in supporting commercial decisions. The essence of PROSIT is to support decisions of the kind “to book or not to book” and “to offer or not to offer”. At the end of the day, PROSIT melts down to the support of these decisions. So apart from technical reliability, it is very important for PROSIT to ensure the quality of the provided data or information. In the contemporary ‘manual’ system the decision-maker bases his decision on human communication and documents, in other words he can also provide evidence. This point is strongly interrelated with the issue of validity, as it will be discussed in the next paragraph.

The reliability of the application is evaluated as per the following two criteria:

- System failures/Breakdowns in actual running time per week
- Everyday decision support

The main criterion for measuring reliability is the figure of failures and breakdowns per a specific time interval. In this context the reliability of the system is considered as very high because none involved partner has reported any technical failures. The only technical problem, which came up and threats the smooth operation of the system, is the ‘uncertain’ of dial-up connections. Small businesses and involved parties with small volume of business transactions on the internet may not need additional internal resources for the preservation of the well being of the system.

System integrity and smooth operation have been reported by almost all partners inquired; representatives of the RMSD, Cuxport, Saaima terminals and the port of Lubeck have never complained about anything of technical nature. However, dial-up connections are failure-prone links and it might be interesting to discuss the installation of a leased line instead. This is a matter of cost and of communication policy. There is a strong belief that in a very short period almost all companies will dedicate a line to internet business and especially for local communication purposes. The fixed link will enable a problem-free communication of the partners, yet there is a strong need to keep PROSIT and relevant application in a secure third-party server, as in the case of Saaima and Lubeck. In cases where partners shape commercial links without the interference of other third parties as in the case of RMSD-Thyssen, there is no special concern on the security and the physical management of the server. Things become more

complicated when the system is originally designed for a few customers and then it attracts many more, as it seems to be the case in Cuxport and Lubeck.

It is obvious that PROSIT has technically succeeded and managed to adapt to many different situations. Nevertheless, reliability is also a question of 'every decision support'. At this point things become complicated; in the case of scenario 1 and 4, Thyssen, RMSD, RMSG, Cuxport, LHG and all other involved parties can fully rely on the information transmitted through PROSIT application. The main reason is that the system is tailor made for a specific inter-corporate need; there was an obsolete, uncertain and doubtful communication link, replaced by a modern communication tool. PROSIT created the necessary smart interface. On the other hand, in the case of the lake Saaima, things are not so clear. PROSIT calls the local shipping community to enter the system and to book space in a cyberspace. The ability exists, yet partners are not so willing to exploit it. The idea given was that even if the system is fully updated, people prefer to book space the traditional way and to get something like a confirmation document or to monitor the booking procedure and discussion. PROSIT offers the same 'product' (and in a more transparent way) but there is an inherent resistance to change.

What is really interesting to notice in the case of the Lubeck port community, is that several interested parties enter the system 'spontaneously', because they believe that this is the way to do business now. The business involved is usually classified as 'freight forwarding'. Freight forwarding is a relatively younger market and service, and came up as an evolution of the traditional liner business. This sector of the transport market is exposed to many means of transport, it is more intermodal and recognizes the need to move forward. On the other hand the traditional brokerage and in particular brokerage in a very well defined and protected market of the lake Saaima does not permit the 'violation' of the equilibrium. People and trade practices have been adapted to the needs imposed by extreme weather conditions and to the restrictions imposed by commercial and technical aspects of the trade. This is totally the opposite; PROSIT did not cover any need of the trade, therefore, it was not really accepted. In other scenarios and especially in Lubeck PROSIT fulfilled a need. Concluding PROSIT supports adequately decisions in every case where users permit it.

Validity

The validity of the data in the system is a major of point of concern. By using the term validity it is almost the same as using the term quality; in this specific case, the term is almost equal to the quality of information or of the data. This issue intertwines three major points of concern:

1. The procedure of data input
2. The transmission of the data, and
3. The extraction of the information

These points are not strictly technical, except maybe for the second one. The procedure of entering data into the system is not only a question of correct and proper typewriting, as this is always a point in 'manual' procedures too. The problem lies in the interface, the proper quantity of required data and actual relevance of these data with the desired information.

The transmission of the data is mainly a technical problem and has to do more with the network and Internet technology in general rather than the development of the system and the application of PROSIT ideas. Yet the question is not of proper transmission, i.e. a full compilation, byte to byte, of data but with the interference of third parties in the link and the system. A supposed extreme case could be the transmission of ill data, say much of available space, and the instant reply of shippers. After the surprise, shippers and carriers may communicate via phone and straight things out, but the validity of the transmitted data could be harmed. Therefore, apart from the case of hackers and other criminal offenders, the interface shall safeguard the user from ill data. The format of the data and the way of presenting them are some of the best and maybe the only ways to protect the users. The experienced user can almost easily identify right from wrong while the computer system cannot for the time being.

Supposing that the system provides proper interfaces and data-consistency control procedures, what remains is the proper extraction of information. The 'garbage in- garbage out' phenomenon shall be either restricted within the machine or attributed to human error. Thus in the case of ill transmission the ill information shall lie in the system and shall be totally ignored by the user. Several flags or relevant warning signals can be introduced alerting the user. Then the user himself is the one to blame if ill data is then used to support decisions.

The real problem does not lie however in ill data or ill transmissions and interfaces. The provided data may be insufficient to support the decision. Therefore, a space opening (offer of supply) may be posted with very few data and shippers (demand) may start querying the offering side by phone or telex. This hampers transparency and excludes many users from entering the negotiations with other offers and remarks.

Some of these system-attributes may be ignored in the first stage of PROSIT implementation. In many cases the users adapt to the attributes of the systems and after a period they require the adaptation of the system to their needs. That was also the case with DOS™ and Windows™ when PCs penetrated the market.

According to the matrix the following criteria shall be satisfied:

- Accuracy of information
- Internal self control procedures

Data integrity was the key of success for PROSIT applications at the early stage. PROSIT managed to "smooth" data transmission and create a valid a communication link, in other words the recipient was relatively sure that the message contains the proper information. This was not the case in various scenarios: in the case of RMSD the message was sent electronically and then retrieved manually for a couple of times. In Cuxport, the same problem was dominating the transactions. In the case of Lubeck, PROSIT managed to create also uniform messages improving the communication links. Consequently the criterion of 'information accuracy' was fully satisfied.

The other criterion of automatic self-control of the data (or the information) is rather difficult to evaluate. Goal of PROSIT was the development of inter-alia a software package, which would have a twofold objective: to support brokerage services and to connect different logistics systems. The second objective of the interconnection of systems was achieved. The errors have been reduced or eliminated in the cases of RMSD, Cuxport and Lubeck. There is valid information coming through the system, and therefore management can rely on the application.

However in the first objective of the brokerage and control software (BCS), as in the case of the lake Saaima, things are more complicated. The openings, i.e. the offers for space from the carriers, and the requests of shippers are not really under a check mode. It is possible to set some criteria of checking typing but it is not possible to check the actual status of the offer or the request. The system relies on good faith (as many things do in shipping).

The idea is that it is rather easy to set some filters when entering the data, asking for confirmation from the user. It is very easy to check the available space of a vessel servicing the Saaima channel, as the approximate figures are available, but there is no actual knowledge, that the vessel can provide this space. This could be the case by installing cargo-monitoring devices, a feature that is relatively expensive and useless, as business is still on without these devices.

As it is technically possible but commercially questionable to acquire actual information for the openings it is almost impossible to acquire relevant information for the shippers. Even state-of-the-art technology cannot assist in this field, as the problem is not "well-defined" and there are many and complicated parameters involved.

The only solution for this issue is to set the system in such a way that it asks for confirmation of the entered data and to ask automatically again the user after the lapse of some time for any updates or modifications. This procedure assists in pushing the user to review the data for a couple of times as well as to remind him to update the information. This feature is relatively easy to install in the existing system without any real technical effort.

Finally, the decision-maker has to rely on the basis of good faith for the information quoted in the system. Shipping has relied on it for many centuries, even when technology could not provide security and data integrity. As a conclusion, PROSIT has performed adequately in transmitting valid data and is a reliable tool for the users. Some fine-tuning may be necessary in the future, as users will adapt it to their needs. This is considered as normal, as PROSIT has to undergo its market-maturity procedure in the near future.

Sustainability

The results of such a project have to sustain changes. Organizational changes are not so frequent, yet there is a shift to flexible schemes, assuming continuous transformation periods as the market conditions change from time to time. On the other hand a telematics solution has to endure technical changes, such as shifts to new operational systems, computing environments and telecommunication connections.

The criterion of sustainability evaluates the endurance of PROSIT as software application and idea against time and evolution. The following two parameters are used to measure:

- Endurance with technical evolution

- Endurance with organizational changes

PROSIT is mainly an application rather indifferent to the technical evolution because of its structure. The contemporary trends in computing are the shifting towards client-server applications as well as network services. PROSIT with all its necessary and already tested components, such as the IM, is a network application. It resides in the forefront of the gate to cyber-world of every system and uses commonly accepted communication protocols, mainly those of internet. PROSIT has been developed mainly on a JAVA platform and this enables the user to install PROSIT in every system with a gateway to the internet. Additionally there is no real need for extreme computing resources, so the hardware is only defined by the needs of the user and not of PROSIT. A common web-server is fully capable to host PROSIT and its applets, and to connect different or remote systems. As nobody can tell the future, especially in the rapidly changing world and market of computers, there is a strong belief that PROSIT will sustain successfully every system development and in fact belongs to the new generation of applications.

A parenthesis is however necessary at this point: network computing including internet is not at commercial and technical infancy. These services are successfully and widely deployed for a decade long and the only limitation comes from the telecommunication industry. Limited bandwidth is just one of the problems delaying signal process. In the US as well as in some parts of Europe and SE Asia, a new idea is on the air: the creation of specialized networks strongly focused on a specific purpose, such as segmented business and markets. The technology employed, is almost the same with that of Internet and PROSIT, yet there is need for new protocols and communication links. This is also a sign that PROSIT may survive coming developments.

As in the case of validity and reliability, PROSIT is not facing any technical threats but only organizational and managerial ones. The sustainability of PROSIT as a tool in everyday business is not so easy to be evaluated because transport business becomes more co-evolving than collaborative. The idea is that the transport market following the trends of large companies and adopting IT solutions, as thoroughly discussed previously, encourages synergy more than collaboration between business entities. Synergy and co-evolving is about expanding business in a different field; the issue of a credit card from an oil major was a typical and extreme example. However in the transport market a clear example of co-evolving is the merge of liner shipping with freight forwarding or the blending of container business with port operations [11]. In both cases, there is a mix of carriers' activities with shore services, a

rather radical concept. Collaboration is on the other hand not restricted to strategic alliances or code-sharing and corporate agreements [2] [4].

These issues complicate the task to evaluate the sustainability of PROSIT in the organizational evolution. In co-evolving companies electronic communications and business compete with their counterparts and new technologies oppose to existing and well-tested techniques. This is the case in the transport sector now. PROSIT will face the resistance of abandoning techniques and the challenge to adapt to new business realities. The concern is to keep PROSIT in the first line of business and not to keep it as a tool for back-office activities.

As PROSIT has been adopted very efficiently in ports and in freight forwarding (scenario 1 and 4) there is a belief that PROSIT will stay 'afloat' through the troubled waters. In addition the co-evolution trend in the industry is more an opportunity than a threat. Shipping businesses are relatively small, although there is a capture of big capitals, and there is also an inherent momentum to adopt needs to machinery or supportive material. The trend may be different as the segmentation of the market falls apart, but there is a belief that PROSIT will also survive as an interface between systems, department and companies.

Usability

It was intended from the very beginning that PROSIT should be evaluated as part of everyday business and not as an isolated system. PROSIT may be immune for many pitfalls at an early stage but this is not the case in a latter stage of application or idea dissemination.

The matrix indicates three criteria to evaluate the usability of the application:

1. Technically PROSIT applications shall be fully compatible with the existing systems,
2. PROSIT shall be practical in use, and
3. PROSIT shall improve the level of co-operations between partners

These three criteria are obvious and can be split to many sub-criteria. However, they point mainly on the technical issues while the last criterion of improving co-operation is rather vague.

Technical criteria are relatively easy to be evaluated even if the application is not incorporated in everyday tasks. The assumption of widely accepted and utilized system becomes hard. Consequently the evaluation shall either wait for a

long period before jumping into a conclusion or make assumptions and project the success of such an application in the near future.

PROSIT is a very easy-learning tool and is also a very easy tool to use. The criteria for the usability are the followings:

1. Full compatibility with existing systems
2. Practical in use
3. Level of co-operation between partners

PROSIT is fully compatible with other systems. The technology involved allows interaction with other networks. From the very beginning, as an early planning stage, PROSIT has incorporated the successful applet of the interconnectivity manager, permitting communication between almost any kind of system. In addition the JAVA technology can run on every platform.

The whole application is very easy in use. In the interviews in Bremen and Lubeck, it was stressed that no training was necessary for the employees. Almost every partner inquired admitted that too. The minimum requirement from the employers is basic computer literacy, a requirement, which is almost a necessity nowadays.

Finally, the co-operation between partners is a field of full success for PROSIT. The examples of RMSD and Lubeck community are evident and distinct. Different entities communicate through PROSIT exchanging information and limiting trouble and efforts. In the case of Cuxport, a major shipping company is about to expand business as the data communication issue is almost overcome.

The usability of PROSIT has been proven in every case and it is not questionable.

Cost-effectiveness

Cost is always the most interesting point in business. Cost is not only expenses; it is also time and efforts. Delivered quality is also part of the cost. These ideas are very well known and therefore PROSIT was evaluated under a set of relevant points, such as:

1. How many people are really necessary after the installation of the application?

2. How many errors do the procedures or the system encounter?

3. What are the response-times after the installation?

The points are case-dependent and in some cases they are not the same, even within the same scenario.

From the three aforementioned criteria, it was concluded that PROSIT has demonstrated sustainability, data validity and information reliability. These three characteristics are just enough to lead to the conclusion of cost effectiveness, i.e. the reduction of cost due to the use of PROSIT. In the actual evaluation process two criteria have been considered as the most important ones; one time-consumption and another measuring direct costs.

- Time reduction due to the system
- Cost reduction due to the system

For the first criterion of time reduction, the data provided by the interviewed users are enough to support the general idea. PROSIT shortens time, as every other electronic or software application does, by replacing tedious and repetitive tasks, such as re-typing, with an electronic string bearing all necessary information. All users of the system exchange this string and there is no need for further editing or retrieval. However there is always the danger of 'initial' mistakes engulfing; i.e. the erroneous transmission from the first user will be disseminated to all other parties. This may become dangerous when booking space or reserving facilities. Still this danger engulfs also in manual systems, but the scale of dissemination is usually smaller.

Regarding the direct costs, it was not possible to get any real measurements or at least figures we could rely on. There is however a feeling that PROSIT did not actually incur any direct cost reduction. Only in the case of Cuxport and the port of Lubeck some employees were freed and occupied in other tasks. Other costs such as telecommunication costs may have been reduced too, but no real feedback was provided, except of the case of RMSD and Thyssen, where PROSIT enabled a communication through the Internet and cut off the expenses of the IBM-VAN. However there were indirect cost reductions: in the ports of Lubeck and Cuxport the properly organized messages enabled better yard planning and therefore better turnovers. It is an expected outcome that better informative organization leads to better planning and management but such measurements can only happen internally and no external evaluator may access such sensitive issues.

Ability to support decisions

This criterion is the essence of the evaluation procedure. It is a restatement of the core question, whether PROSIT can really and to what degree replace brokers. The answer will also give reply to the question if PROSIT and such telematics can really promote seaborne trade, by eliminating intermediates and by offering chances and transparency.

A limitation of the above question is the ability to support decisions between departments or different companies. This communication of decisions tightens commercial links between partners and therefore establishes loyalty.

Provided that operational support, which is the aim of the interconnectivity applications, is covered by the section on reliability, the ability to support decisions is a desirable characteristic of PROSHIP installations only. Four such applications were developed by the project. Two of them are in use (the dangerous cargo management and ACOS ones), one is being tested (SCS) and one has been successfully tested but not used due to lack of sufficient interest by the users (Saimaa). By applying the market survival filter, one can be certain that the first two have accomplished their purpose and as such, they indeed support relevant decisions.

As mentioned in the corresponding chapters, the validation team devoted a lot of time on the remaining two applications, and we are now convinced that both of them have the ability to support the decisions that they were aiming at. The fact that SCS has not yet formally introduced the system is their hesitation to bother their clients with a system that covers only a limited number of transactions, prior to becoming certain that the system will not be modified again when it expands to include all necessary functions. Furthermore, the current conditions of tough competition among carriers is not the appropriate environment for experimentation, while the negligible volume of business-to-business internet transactions in Greece does not constitute the right incentive for the time being. The fact that the Saimaa application is not being used has nothing to do with the system itself. It is the constraints imposed by the physical environment, the nature of the cargo, the market structure and forces, that prevent its use for this particular trade. The system is an efficient decision-support tool, which can be put in good use in more conducive environments, including for example the sea ports of Finland.

2.3 Validation of the Overall Objectives

The first policy issue PROSIT has to face is the goal of shifting cargoes from land networks to the waterborne connections. The reply is that PROSIT assists in that direction and in many cases can do that 'alone', isolated from any other system, technique or decision. The criteria set for evaluating the project and its contribution in the overall policy objectives are:

Overall objectives

1. Promote shortsea shipping and inland waterway transport by improving their quality and reliability through the use of modern telematics.
2. Support an intermodal brokerage between demand and supply side.
3. Increase the use of empty or partially empty transport equipment.

Project purpose

1. Successful functioning of procedure and software supporting planning and control along the transport chain.
2. Successful functioning of procedure and software supporting brokerage between demand and supply side.
3. Improved co-operation between partners in transport.

Summarizing the evaluation findings we can mention that PROSIT has successfully supported planning and control along the transport chain. However, it is not clear that it supported successfully brokerage. The doubts lie mainly on the issue of business culture and the inherent resistance to changes. The third point of improved co-operation and communication between the partners is not under discussion as PROSIT there has clearly been a success.

Coming to the overall goals of promoting shortsea shipping and inland waterway transport by improving their reliability this is also not under dispute. The successful brokerage and higher utilization of partially filled vessels are not so clearly achieved as goals. Marketing and local conditions may be the source of the doubts, but not PROSIT as initiative.

PROSIT is mainly a tool to keep existing customers satisfied. It is not a marketing tool; it is a necessity for keeping business on. According to the overview of the project, PROSIT acts also as communication software. Additionally

PROSIT changes business culture exposing people to the capabilities of modern techniques. This is the great contribution to the sector.

There are many organizational differences between the two modes: ships and trucks. The most important one is the flexibility offered by the trucks. Additionally, the economic implications of selecting between the two modes has a different impact on the organizational decision layer; the booking of a ship is a decision bearing extreme cost, so this decision will be taken by the higher hierarchy layers. In contrast to shipping, trucking appears less complicated and the costs are of a decision are considerably lower, therefore this decision will be taken by employees of lower levels. Another major problem in selecting ships than trucks is the complicated procedures in the ports. While shippers and carriers can come to an agreement, it is very difficult to change any procedure at the port or exercise any real pressure.

An assumption that was never taken seriously into consideration is that PROSIT refers to real internet users, i.e. people who use internet for business and not only as a source of personal information. This is a very hard assumption currently, yet it is expected to 'soften' pretty soon and to become the everyday case.

Concluding this last section there is a belief that PROSIT has assisted the nodal points in the chain to improve their reliability and efficiency, thus making sea transport more attractive. Brokerage services may be examined in a further action, as the local conditions in the lake Saaima did not allow such an idea to grow and mature in the minds of the users. Additionally PROSIT has to be attributed a major success: it enables smooth communication and streamlines users to the trends of modern technology. PROSIT is a very advanced step ahead for many people of the industry who performed manually till recently.

3. CONCLUSIONS

Although many conclusions may be extracted, the real interest for evaluating PROSIT as a project, are given blow. There was an effort to merge all conclusions from every single scenario so as to create a list of conclusions with 'global' interest.

- There is a strong resistance to organizational changes. It is very difficult to shift to a new system and abandon old and well-trusted procedures even when the technological advances are pressing towards this direction.

- The number of shippers, carriers and other involved parties is relatively restricted thus expressing only part of the market. PROSIT or any relevant application cannot cap the market yet due to the limited number of the involved parties. In addition, the parties involved are not so committed to the idea, as they have to be streamlined with the market and not with opposing practices or requirements.

- PROSIT technically has been a success. No failures or fatal errors have been reported. All technical problems have been attributed to telecommunication failures, which is an inherent problem within the telecommunication service provider.

- Wherever PROSIT was properly applied there has been a radical cost reduction. The diversion from normal communication costs via specialized networks to internet -local communication- costs has been a real benefit for the users. In addition, no real schooling, tutoring or installation and maintenance cost has been reported.

- The real power of PROSIT comes from tailor-made solutions and agreed uniform message structure. Problems come up when the exchange of data are not of 'good quality', in other words the data integrity depends on various and unforeseen factors. The proper and agreed message structure secures and protects data integrity.

- Another benefit originating of the application of PROSIT is the elimination of errors in all cases where messages had either to be retrieved or to be re-edited and re-typed. In these cases, manual procedures have been fully replaced by a single electronic document, enabling the allocation of human and other resources to more productive activities.

- Both benefits of cost-reduction and errors-elimination consist a very powerful tool in keeping existing customers satisfied and permitting business expansions with them. However the expansion to other niches of the market or of the clientele is not coming automatically as desired. Marketing and business expansion involves also human attributes, which no IT system can fully substitute and supersede yet.

- PROSIT cannot be condemned for internal managerial problems. Every IT system needs also people of adequate capabilities and willingness to adapt to new challenges. This is a very week point in shifting to any new system. Nevertheless PROSIT is assisting in changing the attitude of people.

- As people are always the key-factor for the success of such a system, a feature underestimated at the very beginning attracts more users in the system. The satellite tracking is very important for psychological reasons as

it visualizes movements, permitting carriers to apply internal control and shippers to monitor the service they have paid for.

- The issue of control is a very important one. PROSIT has provided in a specific scenario the chance to rationalize a specific trade and in another scenario to rationalize the transit procedure. This improved control procedure enables a better understanding between shippers and intermediates, such as terminals, and therefore can expand business.

References

[1] Beynon-Devies, P., (1992), *Relational Database Design*, London: Blackwell

[2] Eisenhardt, K.M, Galunic, C. D, (2000), 'Coevolving'. *Harvard Business Review*, Vol. 78, No 1, pp 91-101

[3] EUROSTAT, factbook 2001

[4] Hochstein, A., (1996), "*Strategies for Improving Port System Performance*". in Hakim, S., P.Seidenstat and G. W. Bowman (eds): Privatizing Transportation Systems Westport, Connecticut

[5] Hultkrantz, O., Lumsden, K., (2000) *The Impact of E-Commerce on Transport.* OECD-ECMT

[6] ISL (1997), *Application Interconnectivity Manager – AIM*, Bremen, Germany

[7] ISL (1997), *Baltic Open Port Communication – BOPCOM*, Bremen, Germany

[8] ISL (1997), *Co-operative Resource Management – COREM*, Bremen, Germany

[9] Lee, B., (1987), *Case Studies in Business Computing*, Hutchinson Education

[10] Lucey, T., (1991), *Management Information Systems*, London: DP Publications

[11] Muller, G., (2000), *Intermodal Freight Transportation*, 4th edition, IANA – ENO

[12] Panagakos, G., Schinas, O., (2000), PROSIT – Promotion of Short-sea Shipping and Inland Waterways Transport by Using Modern Telematics. *D7-12: Validation Report*, National Technical University of Athens, Athens

[13] Psaraftis H, Schinas, O. (2000), Concerted Action on Short-sea Shipping, *Report on Better Collection of Short-sea Shipping Data Collection,* National Technical University of Athens, Athens