

Hub to Higher Performance?

An Internet Hub for the Vos Logistics Supply Chain

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ABSTRACT: Sharing information between multiple parties in a multi-modal logistics chain can potentially improve coordination within the chain. However, information sharing also requires the participation and collaboration of multiple parties whose goals are not always aligned with each other. This paper describes experiences from the ongoing implementation of a Logistics Hub system for a transport supply chain directed by Vos Logistics. Interviews with participants in the logistics chain were conducted to analyse the Hub, its implementation process, and its effect on performance of the supply chain.

1 INTRODUCTION

1.1 IOS for supply chain management

Effective management of supply chains is a key element for firms seeking world-class performance (Davis, 1993). Firms today are expected to provide ever faster and more agile order-to-delivery cycles. Parties in the supply chain are expected to improve efficiency in terms of reduction of waste and unit cost, compress time between order and delivery, and respond flexibly to orders (Brewer and Speh, 2000). Facing such competitive pressures, firms are looking beyond the boundaries of their organisations for performance. By collaborating with other parties in a supply chain, a firm seeks improvements beyond what is currently possible without collaboration. In fact, managing this type of collaboration and the challenges it raises is the essence of supply chain management.

Access to accurate location and status information in a timely manner can potentially improve coordination within the logistics chain. A wide array of ICT solutions has been suggested, ranging from information hubs to electronic markets. Although we have witnessed substantial investment into these solutions, little recent research is available that reports on actual experiences. This paper reports on a recent and ongoing project to create a logistics Hub, an interorganizational system (IOS) for a supply chain directed by Vos Logistics in the Netherlands. Vos Lo-

gistics will be called Vos in the remainder of this paper. For more information on Vos see <http://www.voslogistics.com/>

1.2 The Vos Logistics Hub project

Vos Logistics is a third party logistics service provider that is active in adding value to its portfolio of logistics services. Vos is one of the larger, asset based, transport and logistical companies on the European market. The company employs more than 4000 people working at more than 30 offices throughout Europe. The firm's long-term strategy is to become a full logistics service provider for its customers, offering services such as warehousing, transportation management and supply chain (re-)design.

This study is concerned with the Vos sea containers transport from its Veendam terminal to the Rotterdam harbour for customers such as Avebe, Domo, Friesland Dairy Foods, Kappa, Akzo and Dow Chemical. Several parties are involved in the supply chain such as rail operators, barge operators, charterers, terminals etc. Although the use of multi-modal transport and multiple parties provides potential flexibility and efficiency, the management of the supply chain is more complicated. Early 2000, Vos and Informore, an ICT company that specializes in providing logistics hubs, initiated a project to create a logistics information hub that would improve monitoring and management of the Veendam-Rotterdam supply chain. The Dutch government program *Connekt* decided to fund the project.

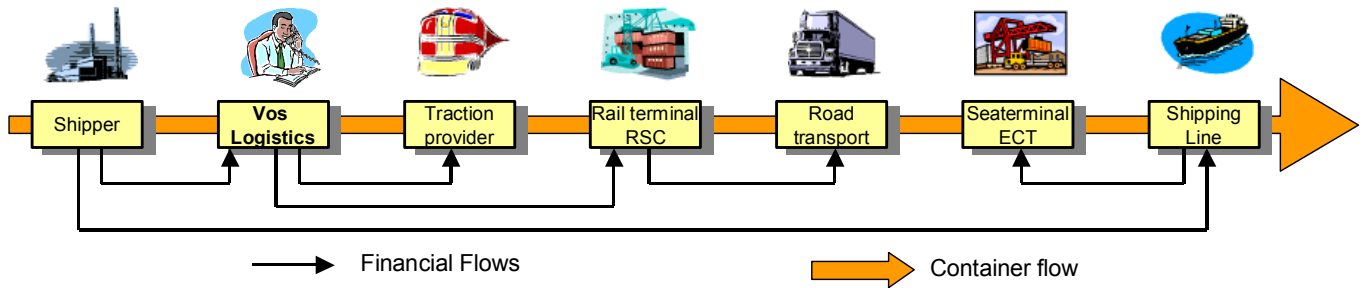


Figure 1: Current financial flows in the chain.

1.3 Research questions and approach

While implementation of the Hub was proceeding, Connekt by the beginning of 2002 requested the Erasmus University Rotterdam to conduct a study on the implementation and benefits of the Hub. In this research we focus on three main questions (Table 1).

Table 1. Research questions

Nr	Question	Paper section
1	What information, financial and logistics processes take place in the Vos supply chain?	2
2	How will processes change and what performance improvements are expected/realized as a result of the hub?	3
3	What are success factors for implementing a hub for supporting transport chains?	4

Our research approach includes literature study, semi-structured interviews with the supply chain parties involved and Informore, analysis of the hub software design and of actual operational data after the hub goes into operation. The first round consisted of seven semi-structured interviews in five organisations participating in the Hub. A second round of interviews will be conducted as the participants start to use the Hub (anticipated mid 2003). A number of inward adapters, to enable automatic confirmation messages to the Hub, still need to be finalized and discussions on pricing agreements are still ongoing. This paper thus represents an intermediate set of research results. However, the results of the first scan already include several interesting findings and lessons learned.

1.4 Outline of the paper

The remaining sections of the paper address the three research questions sequentially. Section 2 de-

scribes the current Vos container transport chain and the proposed design of the hub. Section 3 briefly discusses expected performance improvement as a result of a hub. Section 4 highlights some of the implementation issues identified. Section 5 presents conclusions and reflections.

2 THE CURRENT VOS SUPPLY CHAIN

2.1 Current physical flows

The logistics chain in this study involves the transport of maritime containers from a hinterland terminal in Veendam (Northern part of the Netherlands) through the port of Rotterdam. We describe in this section the current physical and information flows in some detail and some of the limits of the current situation.

In Figure 1 the main arrow represents a simplified image of the physical container flow and financial flows. In reality, many variations of this flow can occur. The container flow directed by Vos between Veendam and Rotterdam involves about 100 full containers daily. At the same time, a similar number of empty containers are moved from Rotterdam to Veendam to replenish the container stock in Veendam. A train shuttle transports full containers between Veendam and Rotterdam on a daily schedule. Currently, Vos batches its daily shipments into one daily trainload. The train shuttle to and from Veendam is managed by the train operator (ACTS) and its load capacity is booked by Vos at an earlier stage.

Veendam – Rotterdam Current situation

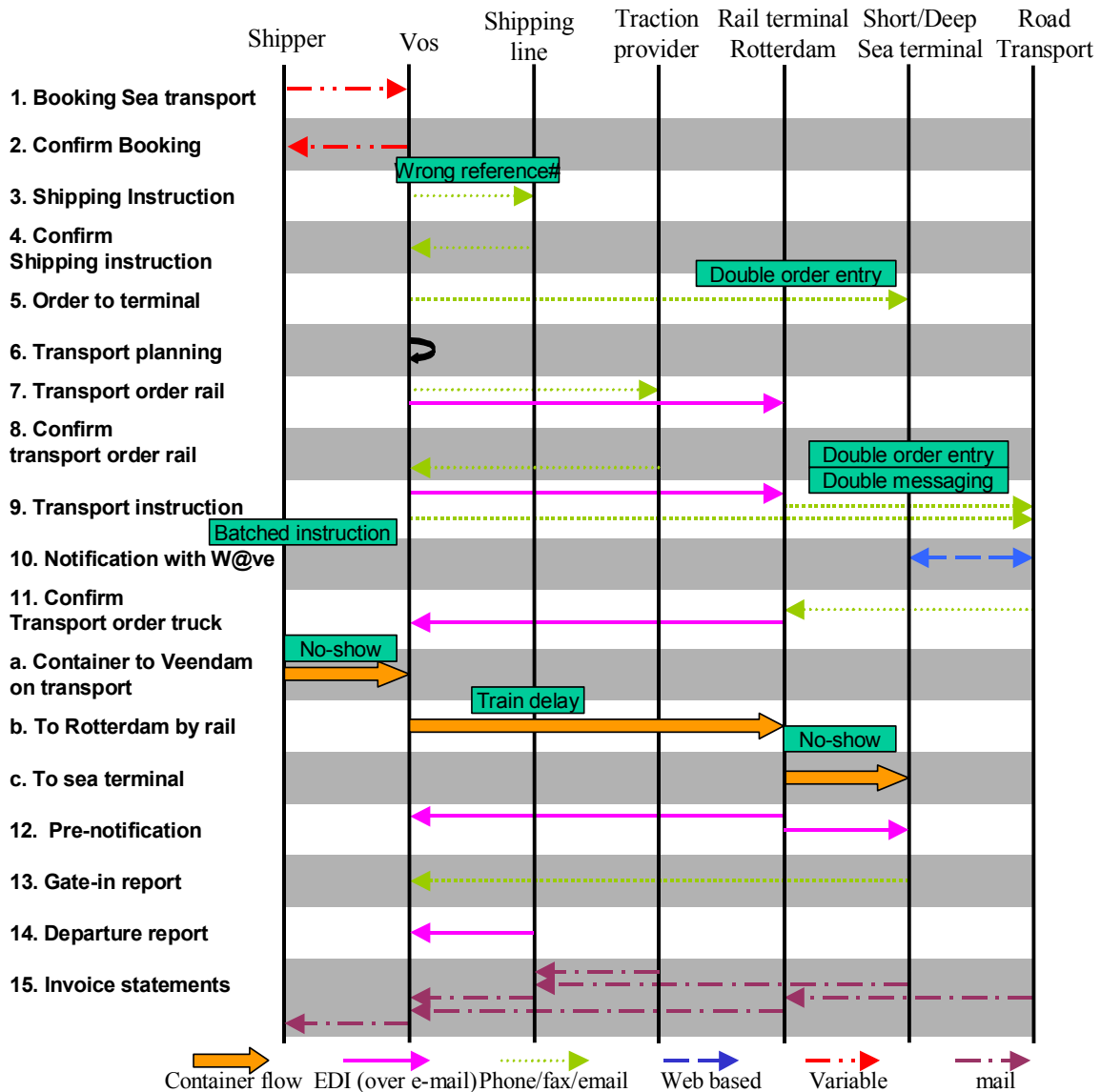


Figure 2: Current Veendam-Rotterdam information flows and sample problems.

The trigger for starting transport and information processes in the Vos chain is a transport order by a shipper to Vos. After having received a customer order, the Vos planning department plans the entire route to Rotterdam including the timeframe of this order and the operators that will be involved.

2.2 Current financial flows

The financial flows depicted in Figure 1 consist of invoices that indicate supplier-customer relationships. RSC-railcenter plays a role in co-ordinating between the truckers in the logistics chain, communicating with Peeman road transport and ECT sea terminal. Vos also sends messages to these parties (via fax and e-mail), but the communication between RSC and these parties is more extensive. Vos pays a fee to RSC for its co-ordination services. Although a party like ECT is an important link in the transport

chain, it primary has a business relationship with the sea carrier.

2.3 Current information flows

The communication medium of the shipper to Vos varies per customer (generally fax, email or phone). Vos collects all individual customer orders during the day and batches them into one EDI-message to RSC containing the data of the complete train load with detailed information at container level (container load, destination ship, the planned route for that container, the involved transport operators, and some other information). Between RSC-Rotterdam and the other parties in Rotterdam, communication takes place to co-ordinate the transport from the Rail terminal to the final destinations of the containers.

Prior to the implementation of the Hub, as can be seen in Figure 2, the majority of the activities are coordinated using a combination of telephone and fax messages. EDI is used between RSC and the deep-sea terminal (ECT), and ECT and the sea carrier (P&O). Also, there is EDI communication between Vos and RSC-R using a standard bilaterally agreed upon. To ensure delivery of the message, a 3rd party message forwarding service is used that charges a small fee per message.

2.4 Current limitations of physical and information processes

The current information process results in several limitations (Fig. 2). Vos sends a load list of the *planned* trainload 24 hours before the train arrival in Rotterdam, but the message with the *actual* trainload is often sent only 4-5 hours before arrival of the train in Rotterdam. Especially for the planning of further transport at the other involved transport providers, earlier notification would be beneficial.

No real-time information about the status of containers is available. Although some individual parties such as ECT have built web-based tracking and tracing, there is no comprehensive system for tracking the containers in the current logistics chain. Current status information is unreliable because it depends on parties in different stages of automation and it is not timely because it is based on batch-based processing of EDI messages.

A large number of containers are involved in exceptions. Examples are: delays of train arrival at the train terminal, “no-shows” of containers while loading a train and administrative problems concerning references to containers or bookings. Although usually enough time slack is available in the chain, any type of delay results in additional effort. Up to 10% of the containers on the train load list cannot be loaded before the critical departure time resulting in “no shows” and a negative impact on the train utilization rate. These “no-shows” may be due to the lack of accurate information (inaccurate references) or containers that are still not physically present at the critical departure time. A container can be delayed because a trucker is unable to retrieve the specified container from the empty container depot. These errors then propagate throughout the chain, disrupting action plans, and requiring extensive human intervention through telephone and fax messages to rectify. Re-scheduling cannot take place until the source of the error can be identified. This is not always easy to accomplish without up-to-date status information.

Furthermore, in the current situation, the information processing activities suffer from duplicate order entries that may result in errors and reduced transparency as status information is not shared frequently enough. The Hub for the Vos supply chain

designed and implemented by Informore should address these issues and improve supply chain performance.

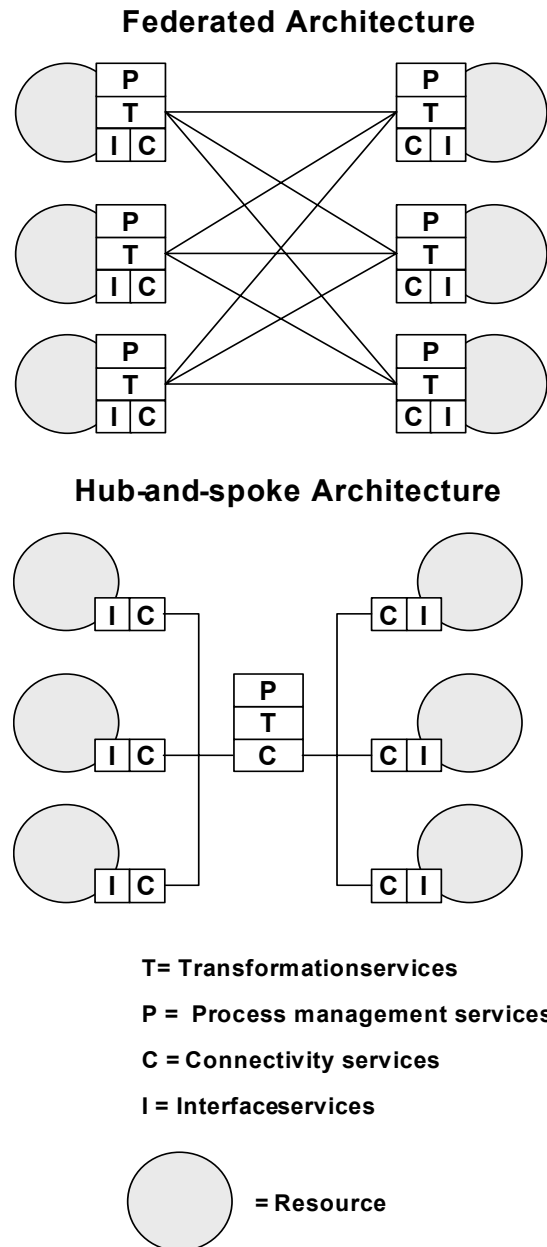


Figure 3. Two basic forms of IOS architectures (source Puschmann & Alt, 2001).

2.5 The Hub architecture

Two basic architectures of IOS can be identified. The first (federated) is based on a collection of bilateral connections between the participating parties, the second uses a central node that connects to all parties involved (Fig. 3). As several of the parties in the supply chain lack up-to-date systems, skills and resources to implement a federated architecture, a hub architecture was selected for this project.

Most current IOS enable data-integration and only deploy basic connectivity and interface services. Advanced IOS should allow flexible process

integration and could achieve this by offering transformation and process management services.

Puschmann & Alt (2001) propose a framework to assess integration solutions at three layers: Data, Object and Process. These can be used to examine technical properties of the Vos Hub architecture:

Data integration - The Hub architecture is a variant of hub-and-spoke. Interface translation services are -custom built for parties. Vos has its own proprietary EDI format to specify the route leg planning for each container. Before each train departures, Vos exports the EDI message from its planning systems and sends it to the Hub. Here, the proprietary EDI format is translated into an Informore specific internal XML format. Similarly, other message formats are translated. Message addressing and connectivity is very basic, using FTP. The Hub simply places outgoing messages into a directory accessible by FTP to the destination party. Ingoing messages to the hub are also FTP-ed to the Informore server. The Hub does not send out requests, but passively waits for parties to send in orders and confirmations.

Object integration - As the volume and frequency of inward and outward messages are low (max. a few messages a day), the Hub does not incorporate any transaction management. It does not check if outgoing messages are fetched nor does it alert parties actively to provide inward messages.

Process integration - At this level the Hub offers some process modelling services. The route for each container can be planned. Timing constraints can be

set on maximum allowed time leg between planned and actual arrival of a container. These are mainly business rules that can be built in. When confirmations are lacking, the Hub will display alerts on its web-based user interface. However, it does not push messages, nor emails to the parties that should act based on the broken business rule. According to Informore, its technically simple to built in such functionality, but it should be supported by parties connected to the hub.

Figure 4 depicts the high level architecture of the Hub. The main component is a transport scenario and route/leg management system. It defines and stores information on transport routes serviced by different transport partners. Pre-arranged contracts with business partners and subcontractors are stored as transport scenarios and business rules. Tariffs, locations, transport modes and transit times are determined for each route. The transport scenario management system manages bookings and transport orders in the logistics chain. A transport manager would use the transport scenario and route management system to initiate a booking or transport order, which in turn initiates information exchange between the relevant parties. These transactions then trigger actions and notifications based on the transport scenario and business rules for that transaction. The user-interface is customized for the various parties in the chain. The attributes shown and the access rights (view, update, delete) are tailored towards their needs.

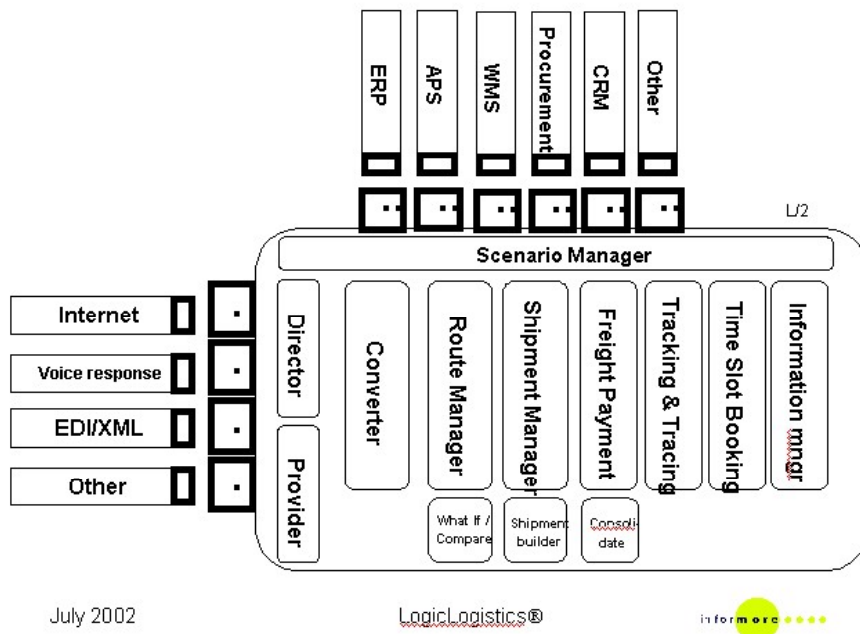


Figure 4: the Hub architecture (source Informore, 2002)

Veendam - Rotterdam Hub full rollout

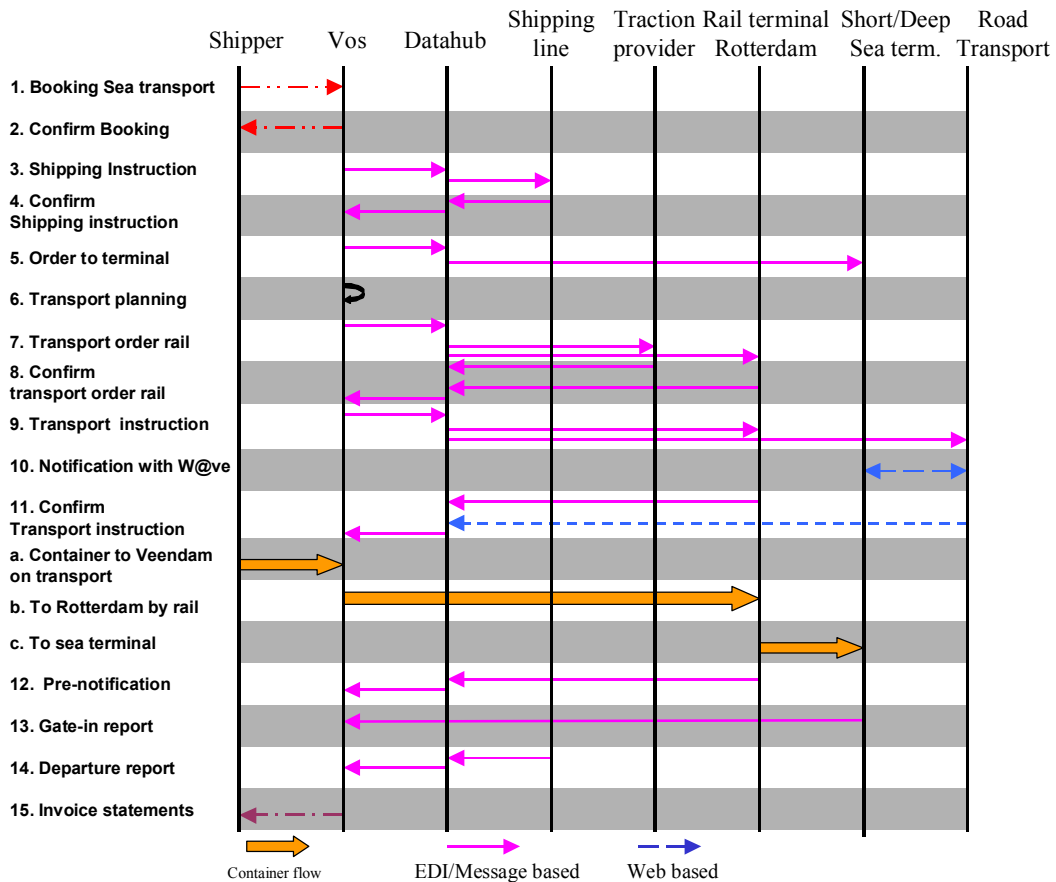


Figure 5: expected improvements after Hub implementation

Using the Hub, the chain director can monitor the information exchange and the activities taking place on a “real-time” basis. Other parties connected can monitor part of the information in the hub of interest to them. The hub supports various standards, but is also designed to support proprietary message formats through custom-built adapters. The hub also includes a browser based user-interface designed for monitoring, planning and demo purposes. It can also be used for data-entry, but is unlikely to be useful for large volume data entry.

3 IMPROVEMENT WITH THE HUB

3.1 Information processes with the Hub

Figure 5 illustrates the situation after the Hub goes into operation (mid-2003). Most information processes now go through the hub. Only the road transport (Overbeek) will use the web-interface for data entry and monitoring. All others will communicate through EDI messages. The Figure only shows the main information flows. Any party can go at any time to the web-interface when specific information is needed, e.g. to monitor a container status in the

case of an exception. To assess how to measure performance improvement, the next section identifies performance indicators (PI) relevant to parties in the chain.

3.2 Identifying Performance Indicators

Several frameworks have been introduced to provide performance metrics not only for individual firms, but also for supply chains. These are e.g. based on the balanced scorecard Brewer & Speh (2000), profit and loss statements (Lambert & Pohlen, 2001), activity-based costing (Conkins, 2001). Unfortunately, there is no generally accepted framework for supply chain measurement. Supply chain metrics have traditionally been defined in terms of internal logistics performance. This focus reflects the lack of chain wide orientation, which often presents an impediment to collaboration within a chain.

We identified PI's by asking the interviewees to elaborate on the PI's they believe to be relevant to their own organisation for the management of logistics processes (Table 2). Some PI's (punctuality, throughput times) are at an operational level, and can be measured quantitatively. Others (number of

operators that use EDI messages) are at a more tactical or strategic level, and constitute with other aspects the relationship between two organizations.

Table 2. Performance indicators for each party mentioned in interviews

ECT – Deep Sea Terminal	Peeman – Road Transport
Timeliness of information	Order processing time
Quality of information received messages	Quality of information, error rate
No-show rate of containers on arriving trains	Timeliness of received information
Punctuality of train arrivals	Truck utilization
Throughput time of containers at terminal	
RSC-Rotterdam – Train Terminal	Vos Logistics Service Provider
Train load planning vs. realization	Train utilization
Throughput time of trucks at terminal	Waiting time at terminals
Punctuality of train arrivals	Loading time
Quality of EDI messages	Quality of information
Number of operators that send EDI messages	Timeliness of information
	Chain transparency

As expected, several PI's are shared among multiple parties. For example, *punctuality of train arrivals* is a PI of ECT and RSC-Rotterdam. When several parties share a PI, there is a potential for joint measurement and improvement through an IOS. Table 3 summarizes the expected benefits of the hub based on the interviews with the various parties in the Vos supply chain. We discuss these in detail in van Hillegersberg et al. (2003). We give a short summary below.

Table 3. Summary of expected benefits

Administrative/strategic benefits	Logistic benefits
Increase of administrative productivity and efficiency	Shorter chain throughput time
Chain transparency	Better resource utilization
Chain coordination	Higher resource productivity
Increase of customer satisfaction	Chain wide monitoring and improvement

3.3 Administrative/strategic benefits

Increase of administrative productivity and efficiency. Administrative effort relates to the time and resources that are required to co-ordinate the logistical flow. In the current situation, several parties in the Vos chain are forced to do a re-entry of the order information into their internal systems because they receive their information by e-mail or fax. Implementation of the Hub will make re-entry of orders redundant and may streamline exception handling.

Chain transparency can be defined as the ability to provide accurate and up-to-date information for parties to coordinate activities within the logistics

chain (e.g. the level of detail on location and status information, the timeliness of notifying other parties for planning purposes). Currently, Vos is using a batched order processing system. As soon as information emerges somewhere in the chain that is useful for other chain members, that information should be made visible real time throughout the whole chain. The Hub could be a useful tool to get more transparency in the chain. The Hub may have additional value if it enables alert messaging.

Chain coordination can be defined as the ability to synchronize activities between different parties in the chain (e.g. the timely release of containers from a terminal). As such, chain coordination does not merely concern the punctuality of individual processes, but also the synchronization in (re-)planning of these processes. Despite the remarks in the interviews of the danger of information overkill in the Hub, the interviewed chain members agreed that a good exception and alert messaging system could be very useful for this chain.

Increase of customer satisfaction. Customer satisfaction can be defined as the extent to which the perceived logistics performance of contractee matches the expectations of contractor. In the performance measurement framework, this will be measured in terms of service levels. At the current stage in the Hub project, we have not yet interviewed a customer of Vos, but we expect indicators to be important such as timeliness of container arrival, and quality of tracking and tracing information.

3.4 Logistics benefits

Shorter chain throughput time. Chain throughput time can be defined as the time required to deliver from the source of the logistics chain to the destination (e.g. port to door, door to door). Logistics throughput time does not merely require acceleration of individual processes, but also improved coordination between chain members (in order to avoid waiting times). One process that depends considerably on co-ordination is multi-modal transition.

Better resource utilization. A critical PI for Vos is the train utilization rate. Up to 10% of the containers on the train load list of the Vos shuttle cannot be loaded before the critical departure time, resulting in a negative impact on the train utilization rate. These "no-shows" may be due to the lack of accurate information (inaccurate references) or containers that are still not physically present at the critical departure time.

Higher resource productivity. Waiting times of e.g. trucks have a negative impact on the productivity of these resources. Punctuality of train arrivals is an important issue, as many resources (cranes, trucks) will have to wait if the train does not arrive on schedule.

Chain wide monitoring and improvement. An IOS can have several levels of functionality. At the first level, chain members get connected. Next, the information interchange between chain members could support the operational activities, for example better co-ordination of activities. In the final stage, an IOS system could generate input for management information, a chain wide performance monitoring system. Currently, the parties involved are mainly at the connectivity level. During the pilot, the opportunities for the Hub to generate input for a chain monitoring system will be assessed. For instance, using gate-in and gate-out status messages it becomes feasible to generate chain wide throughput time reports. In addition, error reports can be retrieved from the hub data.

4 IMPLEMENTATION ISSUES

Although several of the identified benefits are relatively straightforward, the implementation of the Vos hub has been lengthy and complex. The project has been ongoing since 1999. During some months rapid progress was made, but also there were lengthy periods of little activity. Vos, Informore and government sponsor Connekt had to keep acting as champions pushing the project to try keeping the momentum throughout the supply chain.

Few studies have reported on implementation issues and processes concerning IOS. Golden and Powell (1999) report on risks that have to be managed during IOS implementation. They have indications in their research that flexibility is unequally shared between initiators and non-initiators of an IOS. This has two reasons. Firstly, the initiator has a better coupling with his internal systems, by that the IOS increases its internal efficiency and non-initiators have not (in most cases). This initiator realizes a higher degree of internal efficiency, because his goal was to implement such a system. Secondly, suppliers may be pressured to respond faster for the same prices, as the IOS makes their performance transparent.

As a result of the "Virtual Port Rotterdam" project (Janssen et al, 2002), several guidelines for successfully implementing IOS are identified. A number of these are of particular interest to the Vos Hub:

- 1 create bearing, trust and volume between the parties linked to the IOS, adding more functionality once trust has been built and users are familiar with the system.
- 2 work with open calculations to enable the various actors to accept the IOS investment costs, maintenance costs and running transactions costs.
- 3 have the IOS provider work with a SLA per application to specify obligations and liabilities for all contracting parties a/o. specifying ownership of data and data sharing rules

How these three guidelines were addressed in the Vos case is discussed below.

4.1 *Bearing, trust and volume*

The initial decision by the chain director to trial the Hub was not resisted by the larger parties since they regarded themselves as sub-contractors who were keen to establish further electronic integration with their customer. The Hub project has many participating organisations. The level of IT knowledge ranges from no use of computers to EDI connections. In the initial phase Overbeek (Trucking) asked for a computer, as they didn't not have an appropriate PC to connect to the Hub. According to Peeman, 'ICT still is in its infancy, especially to companies like us (Trucking). Sure, the larger corporations, especially if they do distribution and warehousing, have it working, but the pure transport companies, that's real disappointing.'

In the hub project, Informore follows an approach based on iterative implementation of the Hub. Only bi-lateral meetings have been organized, no attempt has been made to create consensus among all chain parties through workshops or seminars. The hub's browser based user-interface has proven an important tool to demo and prototype the hub, but parties have not always understood that integration through messaging and creating adapters is essential for efficient operation. Similarly to all supply chain integration platforms, the benefits only come after all major parties have connected, but some of these wait till enough volume is reached. This may lead to an impasse.

4.2 *Open calculations*

While the potential is great, there are also signs of wavering commitment, and misalignment of goals between the parties. First of all the parties involved had to be convinced to create linkage with the Hub. According to IT manager F. Scholte from Vos, 'The beginning was rather tough, especially to speak to different parties, to convince them of the possible advantages. The way of thinking in the supply chain together, to arrange this project, that was the difficult part, and it took a long time'.

The fact that previously private information has to be shared gave some difficulties. First of all the resistance has to be reduced and the organizations have to be convinced of the advantages for them. Operational director J. Peeman sees potential when private information is shared, for instance to reduce empty kilometres. As his example tells, 'Vos has P&O as a customer and now an empty container goes north by train. Vos loads it in Groningen en the container goes to Veendam, where it will go on a train. But as Peeman is in Leeuwarden for a rush or-

der for P&O, why shouldn't we look in the Vos planning to look what they have to do the next day?'

The participants have not yet agreed upon a method to identify benefits and to distribute the costs of the hub among the supply chain parties. The limited insight into the information processes and the potential of the Hub at the start of the project resulted in a start of the project without a quantified 'return on investment' calculation. The supply chain parties currently have difficulties deciding upon cost distribution, and possibly an extension of this research will be defined to devise a method to resolve this.

4.3 Service level agreements

No formal SLA's are yet in place. Although participants see advantages to share information, there is also fear to throw the doors open. This fear can be reduced through the independent ASP. According to F. Scholte from Vos, 'I think some people like to see this development, but other people are really afraid of this kind of information sharing, or showing information to other parties. But you have to from the beginning, you will be able to say if that is allowed or not, you are the one who will decide it, and together we will decide it. That is also I think the advantage of the hub, because it is not our hub, it is independent, so I think it is an advantage. If we came up with our own solution, then maybe we would have more difficulty in implementation.'

5 REFLECTIONS AND CONCLUSIONS

This paper describes a case study of information sharing in a logistics chain in the Netherlands. We survey the architecture, the performance measures, implementation issues. We do not attempt to generalise from this case, nor do we suggest that the performance indicators in the previous section could serve as meaningful indicators of chain-wide performance improvements in other logistics chains. The performance indicators will vary for other supply chains, but do elaborate how parties in a specific logistics chain expect performance to improve through collaboration and information sharing. The Hub as discussed in this paper is particularly suitable for vertical integration of a number of companies in a specific transport chain. In fact, we believe one of the successes of the Hub is its focus on interconnectivity, translating between file and message formats without well-established standards in advance. Adoption of private information hubs through small incremental changes may be more successful than the grand solutions proposing industry wide standardization.

Supply chain management, when planned, designed and executed effectively, is one of the keys to

achieving high levels of operating performance. Monitoring the performance of the supply chain, facilitates collaboration and the adoption of a chain-wide orientation. Monitoring performance is not always economical, but hopefully, it has become more so with the use of information technology. One needs to keep in mind that information technology only serves as an enabler for further collaboration and information sharing; in the end it is the willingness of parties to collaborate, change their current ways of working and trust a new method of working before this can lead to success and a chain-wide adoption. Important to achieve such adoption is a clear insight in an (honest) division of costs and benefits.

6 ACKNOWLEDGEMENTS

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