Information Flows Supporting Hinterland Transport by Rail: Applications in Sweden

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Idea of the study

- Interest in how information flows are being managed and how they are used to support the physical operations
- Hypotheses
  - Rail shuttles and dryport operations are much simpler organised and controlled than generally expected
  - Particularly when contrasted to container port terminals, liner shipping, forwarding and conventional rail
  - The larger actors in the shipping, forwarding and seaport segments pressure the intermodal and dryport operators to invest in ICT systems they do not think they need
  - If simple ways of handle the information flows appear in the study – it might be because it is sufficient
- Interviews with Swedish actors
  - Four terminals, three intermodal operators, one each of shipper, seaport and software supplier
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Information system support

- Maturity of business processes and their IT support in four levels (Heinrich and Simchi-Levi, 2005)
  1. Disconnected processes
  2. Internal integration
  3. Intra-company integration and limited external integration
  4. Multi-enterprise integration
- Systems used (Stair et al, 2008)
  1. Proprietary in-house developed legacy systems
  2. Off-the-self systems provided by major ERP system suppliers
  3. Single user simple office applications (e.g., Microsoft Excel)

The SCM framework

- The network structure: includes the actors in the supply chain and their links. These actors can include shipping lines, terminal operators, transport operators, forwarders, shippers, etc.
- The key business processes: include the activities that produce value to the customer; typically this include transportation, terminal operation such as lifting on and off units, short time storage, consolidation of units, etc.
- The management components: includes the managerial variables by which the business processes are integrated and managed across the supply chain. The components used in this study includes a variety of technical subcomponents including IS and IT.

Source: Lambert and Cooper, 2000
A conceptual model for managing the information flow supporting hinterland transport

Communication and Information Flow Structure

Information Flows

Shipping Lines

Seaport Terminal Operators

Transport Operators

Intermodal Terminal Operators

Distribution Centers

Business Processes

ITs Facility Structure

The Port of Gothenburg rail shuttle system as of May 2010. Numbers - dedicated port shuttles. Squares - other destinations with daily rail services via the general intermodal network.

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Intercontainer Scandinavia’s rail shuttles from January 2011

Source: TrainDrivers, 2010

CargoNet’s rail shuttles as of September 2010

Source: CargoNet, 2010
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### The actor network structure and key business processes

<table>
<thead>
<tr>
<th>Actor category</th>
<th>Key business processes</th>
<th>Typical customers (C) and suppliers (S)</th>
<th>Examples of organisations</th>
<th>Appr No. of actors in Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipper:</td>
<td>Order and pay for the transport service.</td>
<td>S: forwarder, shipping line, intermodal operator, road haulier</td>
<td>Manufacturers (Vobis, SKF, StoraEnso...), retailers (IKEA, H&amp;M...)</td>
<td>&gt;1000</td>
</tr>
<tr>
<td>Forwarder:</td>
<td>Design, market and coordinate the door-to-door transport chain.</td>
<td>C: shippers; S: shipping line, seaport</td>
<td>Kuehne+Nagel, DBL, DB Schenker...</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Shipping line:</td>
<td>Move containers between ports.</td>
<td>C: shippers, forwarder; S: seaport, intermodal operator, road haulier</td>
<td>ACL, CMA CGM, Eimskip, Maersk, MSC, K Line, Team Lines, Unifeeder... + RoRo/RoPax shipping lines...</td>
<td>&gt;25</td>
</tr>
<tr>
<td>Seaport:</td>
<td>Tranship between ship and rail.</td>
<td>C: shipping line, forwarder, intermodal operator</td>
<td>With rail shuttles: ports of Gothenburg, Gävle, Helsingborg, Målarhammar, Norrköping, Södertälje, Trelleborg</td>
<td>20 handling containers (LoLo+RoRo)</td>
</tr>
<tr>
<td>Intermodal operator:</td>
<td>Design, market and coordinate the rail transport service including terminal handling.</td>
<td>C: shipper; forwarder; S: rail haulier, inland terminal operator</td>
<td>CargoNet, ERS Railways, Green Cargo, Intercontainer (Scandinavia), MidCargo, SCT Transport, VanDieren, Vännerexpressen</td>
<td>10</td>
</tr>
<tr>
<td>Rail haulier:</td>
<td>Move trains between terminals.</td>
<td>C: intermodal operator</td>
<td>Hector Rail, MidCargo, BushRail, TGO</td>
<td>Trafig...</td>
</tr>
<tr>
<td>Inland terminal operator:</td>
<td>Tranship between rail and road.</td>
<td>C: intermodal operator</td>
<td>CargoNet, Gävle Containerterminal, ISS Traficcare, Logast, Vännerexpressen, large manufacturers and retailers...</td>
<td>&gt;25</td>
</tr>
<tr>
<td>Inland terminal principal:</td>
<td>Own terminals. Manage the tender process.</td>
<td>C: inland terminal operator (on tender)</td>
<td>Jernhusen (Swedish state), Municipalities, Vännerhamn...</td>
<td>&gt;25</td>
</tr>
<tr>
<td>Road haulier:</td>
<td>Move containers between the inland terminal and the consignor/consignee.</td>
<td>C: shipper, forwarder</td>
<td>&gt;500</td>
<td></td>
</tr>
</tbody>
</table>

### Typical information flow guiding the flow of an import container (part 1)

#### Physical location

<table>
<thead>
<tr>
<th>Physical location</th>
<th>Transmission trigger</th>
<th>Activity</th>
<th>Key data content</th>
<th>Transmission media</th>
<th>Actors involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container arriving by ship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ship</td>
<td>Estimated arrival time at port known</td>
<td>Consignee informed of arrival time at port</td>
<td>Estimated arrival time, container number and type etc.</td>
<td>EDI</td>
<td>Shipping line to consignee</td>
</tr>
<tr>
<td>2. Ship</td>
<td>Consignee informed about arrival time at port</td>
<td>Consignee contacts forwarder and orders an intermodal hinterland transport</td>
<td>Destination, container number, type and weight, arrival time in port etc.</td>
<td>Phone, fax, e-mail</td>
<td>Transport customer to forwarder</td>
</tr>
<tr>
<td>3. Ship/ Port</td>
<td>Forwarder receives booking</td>
<td>Forwarder contacts intermodal operator and makes a booking on the train</td>
<td>Destination terminal, train departure, container number, type and weight etc.</td>
<td>Excel-sheet by mail, fax</td>
<td>Forwarder to intermodal operator</td>
</tr>
<tr>
<td>Container unloaded from ship in port (sometimes before 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4a. Port</td>
<td>A few hours before train departure (according to agreement with the port)</td>
<td>Intermodal operator sends a loading list for the train to the port</td>
<td>Destination terminal, train departure, container number, type and weight, sometimes which wagon or group of wagons to load each container on</td>
<td>Excel-sheet by mail, fax, homepage forms</td>
<td>Intermodal operator to port</td>
</tr>
<tr>
<td>4b. Port</td>
<td>Same as 4a</td>
<td>Intermodal operator sends a loading list for the train to the rail hauler for calculating train weight etc.</td>
<td>Same list as 4a</td>
<td>Excel-sheet by mail, fax</td>
<td>Intermodal operator to rail hauler</td>
</tr>
<tr>
<td>4c. Port</td>
<td>Same as 4a</td>
<td>Intermodal operator sends a loading list for the train to the inland terminal operator to use as unloading list</td>
<td>Same list as 4a</td>
<td>Excel-sheet by mail, fax</td>
<td>Intermodal operator to inland terminal operator</td>
</tr>
</tbody>
</table>
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Typical information flow guiding the flow of an import container (part 2)

<table>
<thead>
<tr>
<th>Physical location</th>
<th>Transmission trigger</th>
<th>Activity</th>
<th>Key data content</th>
<th>Transmission media</th>
<th>Actors involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container loaded on train in port and train departs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. On train</td>
<td>Loading completed</td>
<td>Port send confirmation of loading to intermodal operator, listing any discrepancies from the loading list</td>
<td>Same list as 4a, with any discrepancies added.</td>
<td>Excel-sheet by mail, fax</td>
<td>Port to intermodal operator</td>
</tr>
</tbody>
</table>

Train arrives inland terminal and container unloaded

| At inland terminal | Unloading completed | Inland terminal sends confirmation to intermodal operator, listing and discrepancies from the unloading list | Same list as 4a, with any discrepancies added. | Excel-sheet by mail, fax | Inland terminal to intermodal operator |

7. Port |
| After confirmation list arrives | If discrepancies, Intermodal operator informs consignee that container is delayed etc. | Delay information | Phone, mail | Intermodal operator to consignee |

8. At inland terminal |
| After confirmation list arrives | Forwarder arrives to pick up container after scheduled release time | Inland terminal sends confirmation to intermodal operator that container has been picked up | Container number, time etc. | E-mail | Inland terminal to intermodal operator |

Classification of the Swedish hinterland transport information system

<table>
<thead>
<tr>
<th>IT and integration level</th>
<th>Intermodal system characteristics</th>
<th>IT support</th>
<th>Data transmission media</th>
<th>No. of Swedish terminals at this level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Disconnected processes</td>
<td>Low cooperation, single terminal actors, single route, small volumes (&lt;100 TEUs/day)</td>
<td>Excel, homemade systems, paper</td>
<td>Phone, Fax, E-mail</td>
<td>Many</td>
</tr>
<tr>
<td>2. Internal integration</td>
<td>Larger actors or multi-terminal actors, several routes, larger volumes (100-400 TEUs/day)</td>
<td>Excel, Hogia, InPort etc.</td>
<td>Phone, Fax, E-mail, webpage forms</td>
<td>Medium</td>
</tr>
<tr>
<td>3. Intra-company integration and limited external integration</td>
<td>Larger actors or multi-terminal actors, many routes, very large volumes (&gt;400 TEUs/day)</td>
<td>Hogia, InPort, Modality, CATOS etc.</td>
<td>EDI, webpage forms</td>
<td>Few</td>
</tr>
<tr>
<td>4. Multi-enterprise integration</td>
<td>Integrated supply chain, very large volumes (&gt;400 TEUs/day)</td>
<td>Hogia, InPort, Modality, CATOS etc.</td>
<td>EDI</td>
<td>None</td>
</tr>
</tbody>
</table>

Classification according to four types of business process defined by Heinrich and Simchi-Levi, 2005.
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Actors driving the information system modernisation

- **Ports**
  - Port of Gothenburg introduces a "ladder" classifying the capacities and functionalities of a dryport including ICT maturity

- **Terminal principals**
  - Establishing the rules of the tendered operations

- **Shippers**
  - For instance, IKEA wants control in order to determine which boxes that go to warehouses, to inland depots or directly to stores

- **Forwarders**
  - Administrative routines
  - Derived from the forwarders' customers

- **Intermodal operators by the nature of the operations**
  - Network operations
  - Mix with semi-trailers

The effect of new information systems

- **Main advantages of the new information systems**
  - Simplify the physical operation at terminals
  - Make communication efficient
  - Tool for extending the service offer

- **Respondents’ views**
  - Basically happy with the information flow and do not state a lack of information – transfer speeds and errors no big problem today
  - Reducing the administrative work is seen as the major benefit
  - ICT does not restrain them from developing new services and business models
  - Earlier bookings wanted, but not a matter of ICT
  - No wish for a level 4 integration, does not add from level 3
  - In general, they do not identify themselves as a link in a supply chain, but as a provider of a single service
## Conclusions

- Fairly low IT and IS maturity in the hinterland operations – integration level 1 or 2
- Current investment phase – integration level 3
- Integration level 4 seems neither wanted nor possible
- Changes mainly done to reduce administrative costs, improve work environment and to satisfy customer demands
- Question remains:
  - Perhaps the current simple information systems are the appropriate ones for these operations?