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RTI-potential at interfaces between logistics and freight transport in Austria

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Abstract

In most European countries the various interfaces between logistics and freight transport (such as interaction between different actors, transport planning, transport process etc.) are poorly identified and coordinated. Hence, valuable research, technology and innovation (RTI) potential at mentioned interfaces is not boosted sufficiently. As a consequence, close-to-market innovation is oftentimes missing. To encourage stakeholder´s thirst for knowledge and consequently a further development of innovation and technology in logistics and freight transport, the complexity at those interfaces, the current transport and logistics market as well as the most important stakeholders and gaps in R&D in Austria have been analysed.
First of all, interfaces between logistics and freight transport "per se" have been analysed. Therefore, theoretical approaches (such as state-of-the-art analysis of different logistics theories, analysis of goods-/transport-/logistics markets, models of applied logistics, function- and sector analysis, methods for interface analysis etc.) and explorative sectorial analysis were combined. Supply Chains of different complexity in automotive industry, vegetable industry, CEP-providers and recycling industry represented the study areas, which have been evaluated empirically (expert interviews with key stakeholders of the four branches). All interfaces identified in those branches were merged within a broad matrix; differentiated into vehicle-, infrastructural- and informational-sided interfaces to reveal gaps in RTI.

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Altogether, 57 comprehensive logistical interfaces affecting all four supply chains could be revealed. At each interface, one or more RTI gaps were identified and corresponding RTI – potential was deduced.
The paper will show and explain the specific topics with most relevant RTI-potential at interfaces between logistics and freight transport in Austria. The results were used by the Austrian Ministry for Transport, Innovation and Technology for designing new call texts for a tender in the programme "Mobility of the future" in the year 2015 and 2016.

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Keywords: logistics; freight transport; interfaces; RTI-potential; automotive industry; vegetrable industry; CEP-providers; recycling industry

1. Introduction

The research project "INCOM-F" (Interfaces and competences in freight logistics) has been financed by the Austrian Ministry for Transport, Innovation and Technology (BMVIT) within the programme "Mobility of the future 2013". Focus of the mentioned programme is the assurance of mobility while minimizing the negative effects of transport. Its results were used by the Austrian Ministry for Transport, Innovation and Technology for designing new call texts for a tender in the programme "Mobility of the future" in the years 2015 and 2016.

With its publication of the national **R**esearch, **T**echnology and **I**nnovation (RTI) strategy "Becoming an innovation leader. Realising potentials, increasing dynamics, creating the future", the Austrian federal government has completed an intense discussion and analysis process regarding the national RTI strategy for the period lasting until 2020. Based on the federal government's RTI strategy, the BMVIT is focusing on themes that will be implemented according to the following principles:

- Further development of the funding system to go from a number of programmes to transparent, clearly structured topic management that ensures the equal treatment of participants.
- Clear division of tasks between strategic requirements of the Ministry and operational responsibility of the Austrian Research Promotion Agency (Forschungsförderungsgesellschaft FFG), which implements RTI funding for the BMVIT (see Austrian Ministry for Transport, Innovation and Technology 2015)

Thus, INCOM-Fs results contributed to the national RTI-strategy by detecting need for further research in freight mobility and to create knowledge to further develop innovation and technology. In Austria and most European countries the various interfaces between logistics and freight transport (such as interaction between different actors, transport planning, transport process etc.) are poorly identified and coordinated. Hence, valuable RTI potential at mentioned interfaces is not boosted sufficiently. As a consequence, close-to-market innovation is oftentimes missing. One goal of INCOM-F was to simplify this complexity of interfaces on the market to reveal gaps[1] in RTI. In that context, INCOM-F focussed on detecting need for research in freight mobility and to create knowledge to further develop innovation and technology.

Interfaces between logistics and freight transport have been detected by analysing theoretical approaches and explorative sectoral analysis. Supply Chains of different complexity in automotive industry, vegetable industry, CEP-providers and recycling industry have been evaluated empirically and worked as examples to detect interfaces. One of INCOM-Fs results was a broad matrix illustrating interfaces for all four branches, merged within a differentiation into vehicle-, infrastructural- and informational-sided interfaces to reveal gaps and need for research. All in all, 57 comprehensive logistical interfaces affecting all four supply chains could be detected. Since not all research gaps were considered equally relevant, a prioritization was made considering the future relevance of the interfaces: 14 prioritised interfaces have been evaluated in detail.

[1] Areas that can be improved, in that case need for research in logistics and freight transport.

2. Methods

2.1. Goal and research question

INCOM-Fs goals were to:

- identify relevant stakeholders/actors at interfaces between logistics and freight transport in Austria
- simplify this complexity of interfaces on the market and
- reveal gaps at those interfaces for research, technology and innovation (RTI)

The following research questions were answered:

1. When, how and where do identified actors meet? → Identification, localisation, characterisation and evaluation of interfaces from logistical point of view
2. How do actors cooperate/function? → Assessment of organisational dynamic
3. Which branches could be relevant to activate hidden RTI-potential?
4. Which RTI-competence is already existing in Austria?

INCOM-F focused on detecting need for further research in freight mobility. The results were used by the Austrian Ministry for Transport, Innovation and Technology for designing new call texts for a tender in the programme "Mobility of the future" in the year 2015 and 2016. Moreover, (innovative) development in four selected branches (automotive industry, vegetable industry, CEP-providers and recycling industry) was examined to enhance potential synergies.

INCOM-F started with a state-of-the-art research of logistics theories, the analysis of the Austrian freight-/transport markets, models of applied logistics and a functional-/industry analysis and methods of interface analysis. It was followed by theoretical approaches (network theory, stakeholder-network-theory, regional governance aspects etc.) and concluded with explorative sectoral analysis (empirical studies).

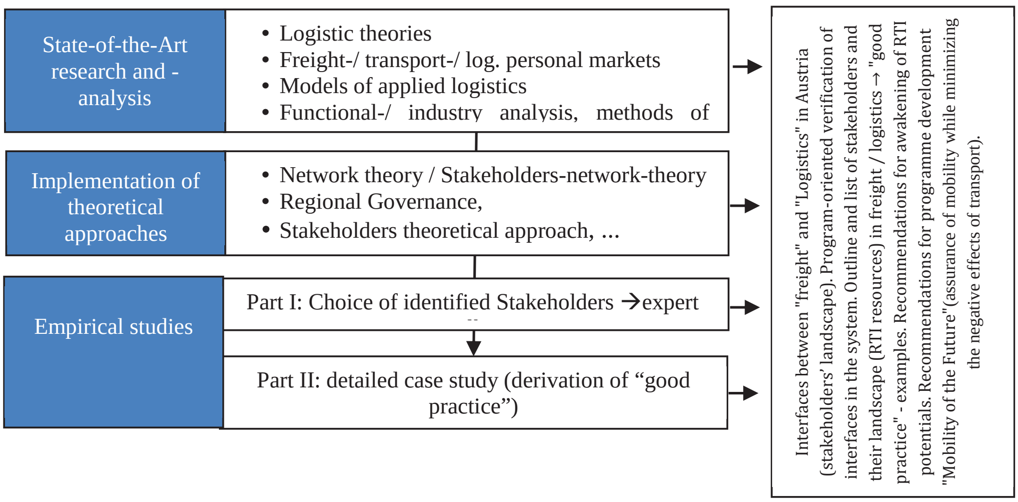

Fig. 1. Methodology for the overall project (own figure).

2.2. Identification of interfaces between logistics and freight transport

Interfaces are set between logistics and freight transport as interaction between actors along the supply chain. Such interfaces mainly affect the following areas:

- Data and information exchange
- Trade, transport and transshipment of goods
- Sticking to standards

- Disposition and use of transport means
- Offer and use of transport modes

Systemizing interfaces helps to assign responsibilities of actors (e.g. production planning and inbound logistics), to examine determining factors (e.g. customer orders, market strategies, logistic organisation), to describe interfaces' functionality (e.g. vehicle-sided, infrastructure-sided or information-sided) and to assess interfaces' operability (e.g. routine, flexibility, speediness).

INCOM-Fs applied method was:

1. ***Identification of interfaces*** via state-of-the-art literature and explorative sectoral analysis, explorative interviews
2. ***Localisation*** along specific Supply Chains (automotive industry, vegetable industry, CEP-providers and recycling industry) and the infrastructural network
3. ***Characterisation*** of functionality and operability of interfaces
4. ***Evaluation*** of interfaces with regards to the funding programme „Mobility of the future", connecting to future research potential

In a first step, involved supply chain stakeholders have been identified for each of the four mentioned branches. An industry-specific classification was created. It was followed by a sector-differentiated allocation of identified interfaces and a clustering of all interfaces divided into "Logistic/Transport Economic Setting inbound" and "Logistic/Transport Economic Setting outbound". In a second step, respective logistics and transport processes have been illustrated illuminating the specific stakeholder's constellations (actors, roles and responsibilities). In this context, need for interaction could be identified. A classification into "interface function", "priority ranking" ("must have" and "nice to have") and "technical application" was undertaken. In a third step, all detected interfaces were divided into three categories "vehicle-sided", "infrastructure-sided" and "information-sided" interfaces. They were examined in detail with regards to their deficits and potentials as well as considering their future significance. Various commonalities and differences could be demonstrated.

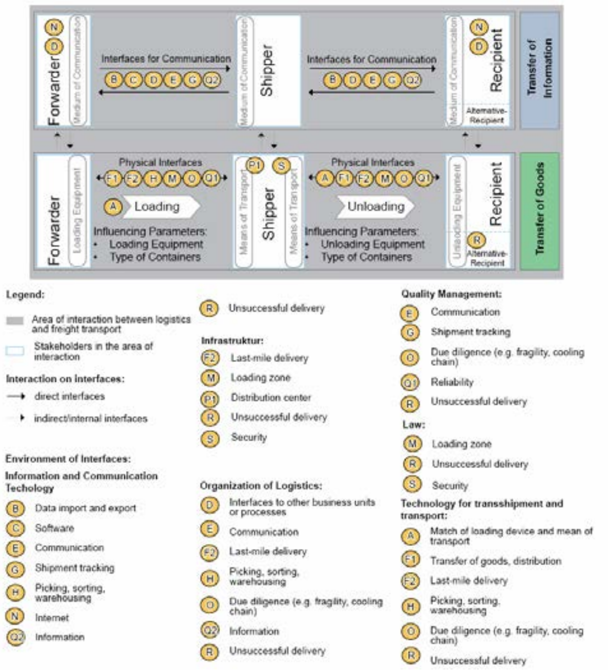

Fig. 2. Systematology to identify interfaces – example CEP-providers (own figure).

2.3. Explorative sectoral analysis

The supply chains of the four branches automotive industry, vegetable industry, CEP-providers and recycling industry worked as examples to identify logistical interfaces. All four branches use the same transport modes and means for freight transport.

Within the high-complex, organised automotive industry, suppliers and OEMs (Original Equipment Manufacturer, e.g. Opel) have been considered; both are important parts of the supply chain. To consolidate all transport flows on different production stages, a proper logistic platform is necessary. The supply chain for vegetables (Business-to--Consumer) includes all supply chain stages beginning with harvest and ending with sale to consumers. As vegetables are perishable goods, the supply chain needs to be absolutely prompt, especially regarding flexibility at interfaces when it comes to packaging (different packaging for each retailer). Flexibility is a must for CEP-providers as well: a perfect route planning does not compensate for challenges at steadily chaining places of delivery. Due to increasing E-commerce, CEP-transports increase and lead to negative impact in inner-city transport systems. Finally, the recycling industry is an important part of the sustainable economic system, aiming at minimizing material in depots and being a universal service provider for regional economic areas.

3. Examples for interfaces, identified gaps and RTI-potential

A matrix was developed containing all comprehensive logistical interfaces to localize research gaps and resulting RTI-potential at identified interfaces. In order to illustrate different actors at the interfaces, exemplifying transport chains for the four industry sectors were graphically synchronized. The result was an “interface landscape” containing four supply chains of all sectors and the actors involved therein. Depending on the industry branch, different characteristics by transport sequences could be demonstrated.

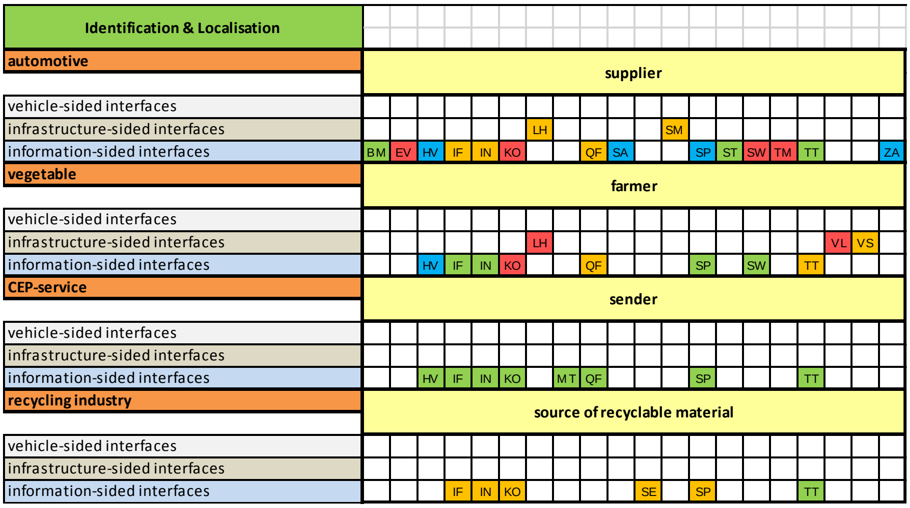

Fig. 3. Extract of interface landscape (own figure).

3.1. Vehicle-sided interfaces

Vehicle-sided interfaces are interfaces that arise in the course of a transport process due to the use of various vehicles. The functions of the on-board interfaces and their occurrence in the transport and logistics sector are determined by

- The transported products (product requirements)
- The specific customers’ requests (goals and requirements of customers)

- Requirements for the transport defined by the regulatory framework (infrastructural setting and environmental and transport policy) and
- The vehicle technologies which are available on the market (transport economic setting).

Examples for gaps at vehicle-sided interfaces:

The interface “matching transport vehicle/loading or transporting goods”, an interface which was identified in all four examined industry sectors, revealed different gaps in the four branches:

- Automotive industry and CEP provider: problem of increasing diversity of goods transported; increase in complexity in product requirements
- Vegetable industry: specialized problems of the use of different container types and dimensions of the various wholesalers
- Recycling industry: problem of the tendency to minimize the fleet due to increased cost of the vehicles

As a result, *need for research and RTI-potential* at the mentioned interface could be deduced for:

- A standardization of containers (boxes) and packaging for all vegetable trading companies in Europe or at least in Austria (source and sink). The research questions “What could a (legal?) standardization of containers and packaging for vegetables look like? Which ecological and economic advantages may arise? Could transports be reduced? Could corporate community solutions be enforced?” were generated.
- Possibilities of a direct treatment at the source of recyclable material (e.g. crushing, compression before transporting it)
- Fleet Strategic Research to determine whether synergies between different industry sectors can be produced in order to bundle traffic

3.2. Infrastructure-sided interfaces

Infrastructure-sided interfaces are interfaces that arise within a transport process along the transport route infrastructure. The functions of infrastructure-sided interfaces and the occurrence of the interfaces in the transport process of an industry are determined by

- Available infrastructure (infrastructural setting)
- From the regulatory defined framework conditions for the transport (e.g. environmental and transport policy) and
- Specific customers’ requests (e.g. source and destination of the shipment, image of the transport company).

Examples for gaps at infrastructure-sided interfaces:

The interface “heavy vehicle/driving restricted road sections” revealed the following gaps:

- Automotive industry, vegetable industry and CEP provider: restrictions on heavy vehicle and temporary driving restrictions influence reliability of the time and route planning
- Recycling industry: inadequate utilization of the available load volume due to the legal limits for the vehicle total weight

As a result, *need for research and RTI-potential* at the mentioned interface was expressed through the research question “Which good practices do exist worldwide/Europe wide to interfere into transport flows as little as possible through legal controls (e.g. driving restrictions) and thus facilitate the operation of the first and last mile?”

The interface “Turnover the freight terminal” revealed the following gaps:

- Automotive industry: reduction of long lead times and high handling costs for multimodal transport operations
- Vegetable industry: problems of different containers
- CEP provider: loss of time in the necessity of new picks or transshipment operations
- Recycling industry: trading materials with low volume of cargo to and from the Austrian waterway

Need for research and RTI-potential at the mentioned interface could be deduced for developing strategies for reducing the “break even distance”, standardization and automation of physical processes in transport nodes, more efficient processes to reduce the circle time of transnational cooperation and fostering recycling transport on the Danube.

3.3. Information-sided interfaces

Information-sided interfaces are interfaces coming up through the organization (preparation, implementation and follow-up) of transports. The functions of information-sided interfaces and the appearance of these interfaces are determined by

- Specific customers' requests (goals and requirements of the customers: reliability, just-in time deliveries, etc.)
- Communication technologies available on the market
- Framework for transports defined by the regulatory (environmental and transport policy: amongst other environmental constraints, traffic restrictions, etc.) or the implementation of economic activities (including obligation to keep records or documentations, rules concerning the import and export, etc.) and
- Company objectives (including increasing efficiency, maximizing profits, etc.).

Intersectional information-sided interfaces aim to reduce the business risk (relevant to planning among other liability and insurance contracts, qualification of personnel, data collection, etc.), to meet specific customers' needs, and to fulfil regulatory conditions (including environmental regulations). In addition, information-sided interfaces usually represent industry-specific features.

Examples for gaps at information-sided interfaces:

The interface "collection and treatment of route planning-relevant data" revealed that the lack of timely information on infrastructure-related traffic restrictions and, consequently, an inefficient route planning is immanent for all four branches. Additionally, specifically for the recycling industry, continuous route planning tools for the optimization of multimodal transport routes are not useable.

As a result, *need for research and RTI-potential* at the mentioned interface could be deduced for:

- Development of real-time-based, IT technical solutions to receive exact position data and spatial information for freight shipments
- Development of advanced methods and sophisticated evaluation standards

The interface "coordination of requirements/qualifications of the staff" recorded gaps in all four branches. They manifest themselves in different industry-specific effects due to the use of insufficiently qualified personnel. While the automotive and recycling industry cite a lack of appreciation of the logistics staff, CEP providers cite the damage or underutilization of delivery vehicles. Vegetable industry reports impediments in delivery statements due to a lack of social skills of the crew. As a result, *need for research and RTI-potential* at the mentioned interface could be deduced for an improvement of social value of logistics personnel, specific inclusion of logistics occupations in career promotions and a survey of the need for training, education and development of a concept concerning the content of the training programme.

4. RTI-potential at vehicle-sided, infrastructure-sided and information-sided interfaces between logistics and freight transport in Austria

All in all, 57 matches of cross-industry interfaces could be identified, localised, characterised and evaluated. In each of the 57 matches, one or more gaps were revealed. Out of those deficits, research gaps/RTI-potential could be derived. Since not all research gaps were considered equally relevant, a prioritization was made considering the assumed future relevance of the interfaces:

1. Determination which gaps were most commonly identified across all sectors
2. Determination of value digit and weighting
3. Ranking interfaces according to the generated value digit
4. Merging results with sector analysis and clues from the second advisory board meeting

The integration of the final results with the results of the explorative sector analysis showed significant matches (78%). Therefore, the 14 highest ranked research gaps at interfaces were analysed in detail. Basing on those gaps, the following RTI-potential was categorised as “highly relevant” for calls coming up in the programme “Mobility of the future”:

Vehicle-sided:

- Supporting the development of “zero emission” means of transport
- Supporting the development of further measures to make vehicles more environmentally friendly – aerodynamics, promotion of lightweight construction in the automotive industry to increase efficiency in freight transport
- Supporting the development of automated processes – reduction of processing times
- Supporting the development of (Automatic) sorting system for pallets
- Consideration of trends in E-commerce
- Supporting the development of regulations for a standardization of containers (boxes) and packaging in the cooled area for all trading companies
- Supporting the development of possibilities of treating recyclable material at its source directly (e.g. crushing, compression)

Infrastructure-sided:

- Supporting the development of means and methods to determine the optimal number of transfer points while consolidating the main run of transports
- Supporting the development of methods to test necessity of goods to be cooled to what extend and when
- Supporting the development of methods to decrease stocks and capital tied and at the same time increase fragility of supply chains
- Supporting the development of means
- Reconsidering criteria for site selection processes
- Supporting the development of methods for new rules for spatial planning and zoning processes
- Supporting the development of strategies/tools in the course of zoning to reduce negative environmental impacts/externalities of (logistics) companies
- Rethinking the bans concerning the repatriation;
- Simulate impact of the restrictions (weekend bans) on driving performance and traffic
- Supporting the development of strategies for reducing the “break even distance”
- Supporting the development of standardization and automation of physical processes
- Supporting the development of more efficient processes to reduce the throughput time in transnational cooperation
- Supporting the development of concepts for recycling transport on the Danube

Information-sided:

- Supporting the development of means and methods for dynamic route planning based on real-time information (e.g. loading areas, traffic conditions, accidents, etc.)
- Supporting the development of systems for timely transmission of congestion and adaption of delivery routes (e.g. customer-specific time frame)
- Supporting the development of means to improve the planning of sales volumes and capacities in Logistics and Production
- Supporting the development of methods of comprehensive data collection
- Supporting the development of exploring strategies to improve the adaptability and capacity adjustment
- Supporting the development of methods to offer holistic platform systems
- Supporting the development of platforms for combining systems of different operators
- Supporting the development of means for connecting transporter with recipient in order to ensure delivery order on the last mile
- Supporting the development of sensors for charging status for the utilization of payload capacity for the varietal collection of recyclable materials
- Supporting the development of integration of route planning tools and spontaneous transports

- Supporting the development of measurements for a specific inclusion of logistics into career promotions
- Supporting conduction of a survey with regards to need for training, education and development in logistics
- Supporting the creation of technical applications for documentation and communication of quality defects and the introduction of emergency measures
- Supporting the development of measures for a continuous monitoring of product quality – increased product requirements in e-commerce
- Supporting the transfer of expertise and knowledge to SMEs
- Supporting the development of methods for simulating complex logistics systems
- Supporting the development and implementation of standardised software solutions for the entire supply chain

5. Conclusion

INCOM-F examined insufficiently identified and coordinated interfaces between transport and logistics and put these results in an understandable and structured matrix. Thereby, RTI-related topics can be given directly to the elaboration in future tenders.

Acknowledgement

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