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in the Innovation Processes of the Industrial Enterprises

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Editors:
Jan Han
Pavla Holejsovska
Department of Industrial Engineering and Management
University of West Bohemia

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Dear MITIP participants,

It is my pleasure to welcome you at the annual 10th conference on The Modern Information Technology in the Innovation Processes of the Industrial Enterprises (MITIP 2008). This conference is located in Prague, in the ancient city in central Europe. During long times Prague has been the city hosting great researchers, scholars and artists. Many great people of the world were born in Prague. It gives me pleasure to see MITIP participants keeping their presentations in this great city. In this annual MITIP edition there are participants from almost 20 countries worldwide registered.

This MITIP edition is organised by the University of West Bohemia. It is symbolic regarding to the fact that the University of West Bohemia is the founder of the conference. The MITIP conference was founded in 1999 in Pilsen.

Organising committee received 75 paper abstracts. After the review process 61 papers have been accepted by the conference scientific committee. These papers have been categorised into 8 sections: Modelling and Simulation of Industrial Processes, Production Planning and Control, Digital Factory, Collaborative Networked Organisations, Systems and Tools of Human Resources Management, Measurement and Evaluation, Technological Innovations, Information Management. Common attribute of all mentioned sections is the effective and innovative application and use of modern information technologies in various industrial processes. This application has a very big potential and it allows further intense qualitative progress of companies and other institutions in the fields of management, products, economy etc. It is possible to realise the progress only by the common high level work of researchers and developers from different countries of the world. They need to share practical experiences and theoretical knowledge. They need to have a common space for cooperation, realising joint projects, intensive communication etc. The MITIP conference is traditionally and successfully supporting these activities.

Let me thank the conference scientific committee for the very careful preparation of the conference especially for the conference promotion and the expert work during the papers review. My special thanks goes to my colleague Pavla Holejšovská for her intense and valuable organisational work during the conference preparation.

Have a great conference!

Jan Hán
Conference chair
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CONCEPTION, SIMULATION AND EVALUATION OF MULTIMODAL, CROSS-COMPANY LOGISTIC MODELS FOR COOPERATIVE, REGIONAL POOLING OF TRANSPORTS

Felix MEIZER, Arko STEINWENDER, Wilfried SIHN, Susanne SCHMID, Lothar MÄRZ

Institute for Management Science
Technical University of Vienna
Theresianumgasse 27, 1040, Vienna
Austria
Email: felix.meizer@fraunhofer.at

Abstract:
The research project Trans Austria examines transport processes and material flows between automotive suppliers in Eastern Europe (exemplified by the Timis region of Romania) and their suppliers or customers in Western Europe. The project analyses the interrelation between economic and ecological factors as well as logistical competitiveness with respect to companies’ common target regions, and describes the information in a simulation model. It is possible to derive synergy and optimisation potentials from the model. These serve as the basis for the development of cooperative, inter-company and intermodal logistics models.

Key words:
Horizontal cooperation, inter-company consolidation, multimodal transportation

1. INTRODUCTION
Progressive globalisation and rising cost pressures in the automotive industry are increasingly forcing manufacturers and suppliers to move to low salary countries [1-2]. It is for this reason that Central and Eastern Europe (known as CEE) are becoming popular targets for relocation.

Whilst the relocation of Original Equipment Manufacturers (OEMs) is usually market driven, the drivers for shifting the production facilities of suppliers to CEE are often salary-based (this applies in particular to 2nd and 3rd tier suppliers). However, benefits tend to fall short of predicted cost advantages, due to rising wage costs (in particular in industrial regions). The automotive industry in particular is thus focussing on the costs of transport logistics arising from intense transportation between Eastern and Western Europe.

Previously, relocation sites have often mirrored the supplier and customer structures of the original site. This has inevitably resulted in rising transportation intensity and environmental damage. It has been proven that the logistics costs for Eastern European sites are often considerably higher than those for the associated sites in Western Europe [3]. Furthermore, transit countries in particular, such as Austria struggle with constantly rising emissions values and increased road usage, due to the rise in traffic flowing between the new and old EU countries.

It thus appears vital to develop solutions through which to ensure the most efficient logistics processes between Eastern and Western Europe. From a holistic view logistics processes utilised to date do not seem to be an optimum. Deficits can arise for example due to partial
loads, use of small transporters, general cargo transporters with long lead times or multiple cargo handling, as well as bad transportation tariffs due to small quantities.

In light of these factors, the research project Trans Austria intends to elaborate new approaches as to how transportation between Western and Eastern Europe can be optimised across different companies.

The region of Timis in western Romania has been selected as a suitable pilot region for this empirical examination and first-time testing of the new models. The automotive supplier industry is heavily represented in the region with around 25 companies situated here, of which around 15 companies are located directly in the regional capital of Timisoara, over an area of less than 20 km².

![Figure 1: Location of Timisoara](image1)

2. VERIFICATION OF THE RELEVANCE/PRELIMINARY INVESTIGATION

The first examinations were carried out with 7 automotive suppliers from the region, with a specific focus on the subject of transportation management. The diagram shows the main sources and destinations of goods transported by the companies included.

![Figure 2: Transport flows from companies questioned](image2)

It is apparent that many companies have similar source and distribution regions, meaning that there are clear potentials for transport optimisation.
In addition to ascertaining the main logistical flows, logistics processes were also examined in terms of their management. Action fields identified here included partial loads, the use of small transporters, general cargo transporters with long lead times or multiple cargo handling and high transportation tariffs due to small quantities. Logistical cooperation between individual companies in the region only exists in isolated cases. Furthermore, transportation is presently almost exclusively by Trucks, with no rail connections or other intermodal transport options being utilised.

3. PROJECT METHOD

The Trans Austria project analyses the interaction between economic and ecological factors, as well as the logistical competitiveness of the logistic structures and models between multiple companies and their customers and suppliers.

The approach applied during the project can be divided into three important stages:

- Analysis and description of the actual situation in a simulation model
- Development of the target scenarios for grouping
- Description and evaluation of the target scenarios in the simulation model

Using the logistics data obtained during the analysis phase, target regions shared by companies are identified. The actual status of the transportation processes is described in a simulation model and the routes of transported goods are added using geographic information system data with precise route profiles and road structures.

It is possible to derive synergy and optimisation potentials from the model. These serve as the basis for the development of cooperative, inter-company and intermodal logistics models.

In order to evaluate the level of achievement the objective of optimising transportation between the Timis region and Western Europe using inter-company logistics solutions, evaluation criteria were defined in the project on three different levels: Ecological factors, economic factors and factors pertaining to logistical competitiveness.

- Ecological: Emissions generated by the complete transportation process (e.g. CO₂, NOₓ and the number of particles)
- Economic: Transport costs, maintenance costs, handling costs, difference costs (such as capital tied up due to increased inventory caused by reduced frequency of transportation)
- Logistical competitiveness: Flexibility and reliability of the supply chain (ability to deliver, accuracy of deliveries), Lead Times of the transport

With comprehensive datasets stored for the purpose of evaluating the various factors, it is very simple to transfer the models to other applications.

The correlation between the different elements of the simulation and evaluation model has been described in the following diagram:
4. SOLUTION APPROACHES AND FURTHER NEED FOR RESEARCH

The findings derived from the simulation are used in order to aid the design of models for consolidating goods and transport flows, and to thus exploit potential synergy effects.

In addition to the development of cooperation concepts for achieving consolidated transportation, it is particularly meaningful to pursue the reduction of road transport through the implementation of new solution approaches such as intermodal transport chains. Increasing the efficiency of transport loads and reducing fuel consumption and emissions are central focuses of the model design. At the same time, economical requirements dictate a reduction in costs (or that these remain constant as a minimum) despite consolidation and the use of intermodal transportation. With regards to logistical competitiveness, the solution concept must be at least as flexible as the individual concepts used by the respective companies at the present time.

Logistical solution approaches

In contrast to previous approaches, possible logistical solution approaches should not only facilitate the optimisation of transportation for individual companies, but should also provide overall optimisation on an inter-company basis.

Existing models taken into particular consideration and further developed in the Trans Austria project include concepts for collective transportation - such as regional haulage and the “Milk Run” - as well as common interactive business portals - such as freight exchanges.

- Regional haulage: The model is based on collective transportation with a consolidation point. Regional haulage expresses an original concept, which describes the type and manner of integrating haulage within the framework of procurement logistics for industrial and commercial companies [4]. The regional haulage company takes over the
procurement for a complete region, collects all of the goods within the scope of a number of journeys and brings them to one handling site. From here, the products are transported to the target destination in grouped deliveries. The advantage of regional haulage also lies in the speed with which companies are able to make small volume deliveries. In addition, goods travelling along the main route are also able to utilise the high-volume carrier, rail transportation.

**Figure 4: Transport process regional haulage**

- **Milk Run**: In contrast to regional haulage, the Milk Run is a collective transportation system without a consolidation point, which can thus be described as a form of direct delivery. Goods are collected and (where applicable) empties are returned along a fixed route by the same suppliers. Extensive planning and scheduling work is required in order to achieve a good coordination of this cycle. To date, this type of transportation management has been predominantly used for deliveries made to individual companies by their suppliers or for an individual company’s distribution. It is first necessary to define an inter-company Milk Run.

**Figure 5: Transport process Milk Run**

- **Freight exchanges**: Freight exchanges or transport exchanges are suppliers who provide information on offers and requirements for freight conveyance and freight capacity on the internet [4]. In general terms, partial loads and residual transport space in haulier’s and transporter’s vehicles are secured via these “virtual blackboards”.

**Figure 6: LKWonline portal (www.lkwonline.de)**

**Necessary support to the logistics process from organisation models**

In order to implement sustainable inter-company logistics models, there is a requirement for a neutral, central organisation unit. With the cooperating companies often in competition with each other, it is also necessary to guarantee a certain level of anonymity with respect to the data. Furthermore, it is necessary to ascertain the requirements of every participant and to
cater for these insofar as is possible. This requires a set of regulations which stipulate the framework conditions for cooperation, including times and frequencies, the sharing of risk and the way to proceed in the event of fluctuations in requirements.

5. CONCLUSIONS

The cost-driven relocation of suppliers in the automotive industry to Eastern Europe is increasingly observed. Thus, transport intensity and environmental pollution is inevitably on the rise. In light of these factors, the research project Trans Austria develops new approaches in order to optimise transports between Western and Eastern Europe through Austria can be optimised.

Actual results of an analysis of the model-region Timis support the theory, that many suppliers have ample optimization potential across different companies in regard to their transports. This is mainly due to similarities of the regions where the transports originate and the regions where the transports are terminated.

This paper displays the structure of a simulation model, which simulates the transport flows of the investigated companies and evaluates aspects of logistical competiveness as well as economic and ecological factors, in order to derive improved logistics processes and organizational models.

The presented concepts are intended to created sustainable benefits for the participating companies by optimising and reducing the necessary transportation processes resulting in decreased environmental pollution.

6. REFERENCES