



## MODEL OF COORDINATION OF TRANSPORT PROCESSES ACCORDING TO THE CONCEPT OF SUSTAINABLE DEVELOPMENT

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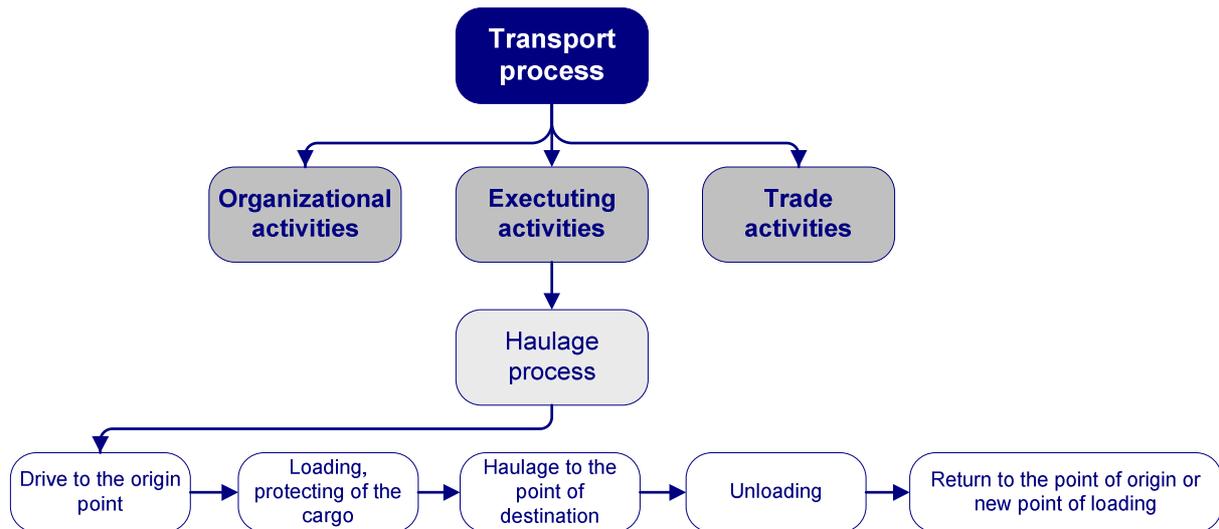
**ABSTRACT.** Sustainable development means that it is possible to organize current needs in the way, which does not eliminate the possibility of organizing the same needs in future. It is the ability to maintain a balance of a certain process or state in any system. In business activities, it is the ability to maintain a balance between three areas: economical, ecological and social one. In this article, the possibility of exploiting concept of sustainable development in organizing transport processes is presented. Additionally, the model of coordination of transport processes within companies is discussed, as well as its pros and cons.

**Key words:** efficiency, transport process, co-modality, sustainability, electronic platform.

### INTRODUCTION

In the age of rapid economic changes, companies are forced to continuously search for ways of cost rationalization. For manufacturing and distribution companies reduction of logistics costs and in particular transport ones is the most important. In order to achieve it an analysis and change of the way of transport process fulfillment as well as being open to new logistics management concepts are necessary. Obviously, when implementing the changes, the fact that transport organization is not the source of profit for the above mentioned manufacturing and distribution companies should be also taken into account. The activity is supposed to support the core business, i.e. manufacturing and sales of goods. Therefore, the companies make, after transport service providers, the second group of transport process actors [Rydzkowski, Wojewódzka-Król, 2007].

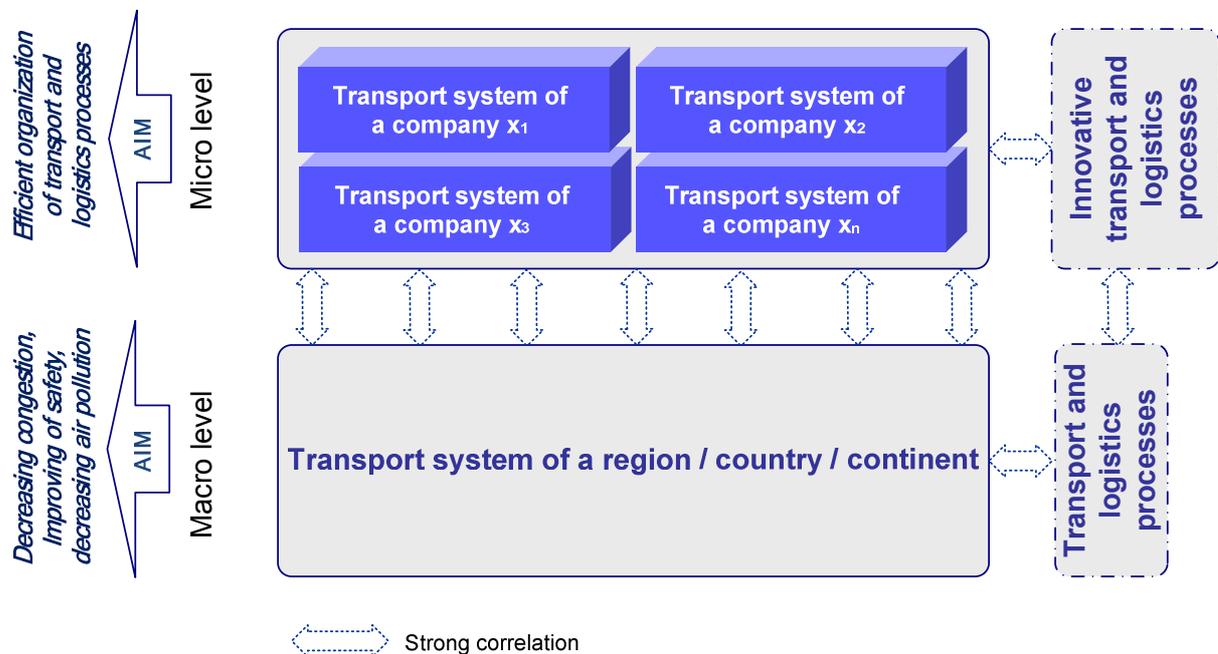
Transport process is a complex of organizational, trading and executive actions. Their main goal is to move goods and/or people from one or a few points of origin (shipment) to one or a few points of destination (delivery) with the use of certain transport means [Hajdul, Stajniak, Foltyński, Krupa 2007]. The difference between transport process and carrying process also needs to be pointed out. The carrying process is a part of the whole transport process. Detailed relations are presented in the figure 1. Therefore, transport can be considered a bridge between buyer and seller [Coyle, Bardi, Langley 2002].



Source: Own study based on [Hajdul, Stajniak, Foltyński, Krupa 2007]

Fig. 1. Example of transport process division  
Rys. 1. Przykład podziału procesu transportowego

It must be highlighted that transport processes in a company function within a big organism, i.e. the national or regional transport system. Thus, inefficiency of one element of a certain system can have a negative impact on the other one. The correlation is presented in figure 2.



Source: Hajdul M., 2009

Fig. 2. Correlation between the regional transport system and transport processes of enterprises  
Rys. 2. Zależność pomiędzy regionalnym systemem transportowym a procesami transportowymi przedsiębiorstw

The significance of transport process organisation can also be supported by transport cost analyses in various distribution network models carried out by employees of the Institute of Logistics and

Warehousing. The analyses prove that in many cases transport costs account for more than 50% of total logistics costs. As a result, more and more companies have started to pay particular attention to them and make attempts to optimize them.

Most companies have already noticed that effective transport process organisation has a great influence on their current performance, which determines total company costs [Rydzkowski, Wojewódzka-Król 2007]. It has resulted in creating many methods of business process realization and reengineering. Within this paper, the author have analysed the following methods: DRP, JIT, TQM, ECR, CPFR, TOC, Business Process Reengineering (BRP), Business process management (BMP), Trillium Model, Change management, Capability Maturity Model Integration (CMMI), Benchmarking, Six Sigma, Process Improvement and Management (PI&M), Rational Unified Process (RUP), Zachman Framework.

The methods described by the author show how logistics processes including transport, warehousing and inventory management can be improved by companies. The methods, however, do not consider the correlation between logistics processes. Customer requirements are always in the first place and the whole rationalization process should be designed to meet them. This conclusion seems to be obvious since this is the customer that brings profits to company.

Unfortunately, neither key processes nor tools for manufacturing and distribution companies in the supply chain are described by the methods.

Additionally, all methods recommend focusing on internal company processes, and strictly within a particular range (e.g. transport or warehousing). A short-term economic account and customer requirements are becoming a leitmotiv of any business activity. Nevertheless, there are no methods, algorithms or tools that solve the above described trade-off relations problem comprehensively. Moreover, the methods do not take into consideration the relationships between transport organisation effectiveness and effective regional transport activity either.

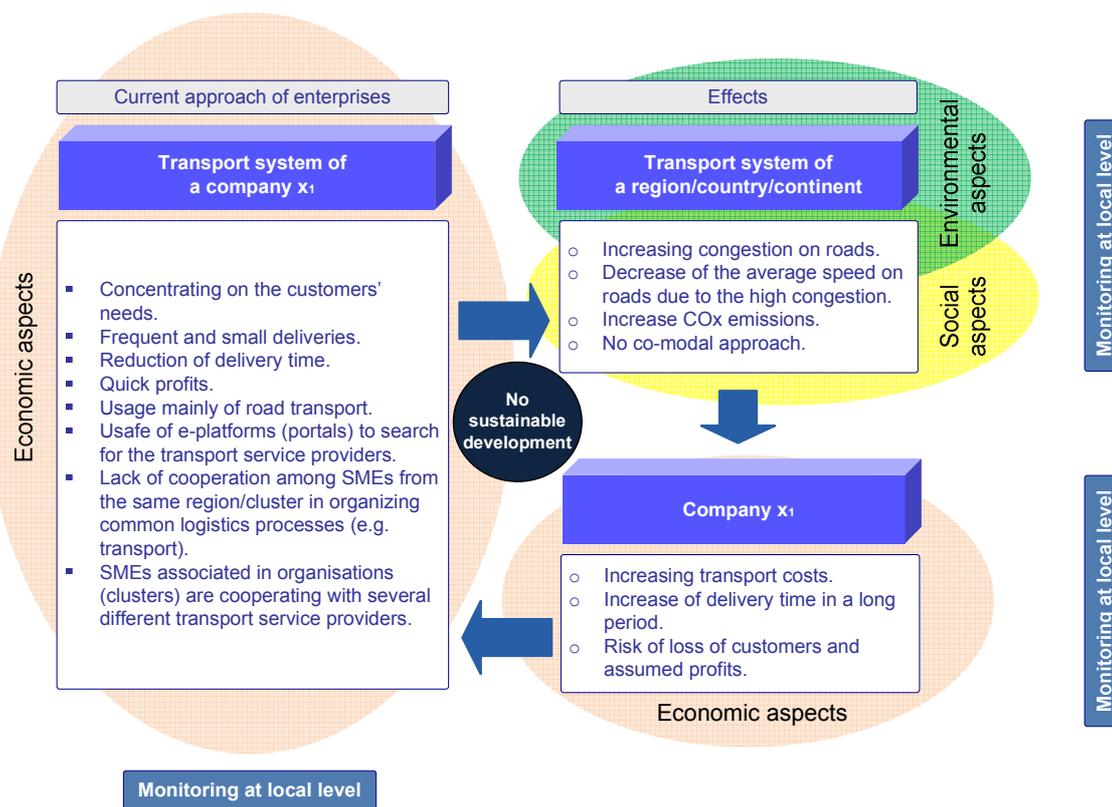
Furthermore, according to the author's observations, companies try to fulfill orders often and quickly, mainly with the use of road transport. Obviously, keeping transport costs at a reasonable level. However, in the author's opinion, this approach causes that improving processes and customer satisfaction in the short-term by manufacturing and distribution companies can worsen their long-term activity. The details are presented in figure 3, in which a straight correlation between the company and the national transport processes can be seen. The figure 3 is a result of the author's work in the Institute of Logistics and Warehousing. It proves that frequent and quick deliveries require more transport means to be involved, which makes traffic congestion bigger and road safety worse. Growing traffic congestion decreases the average technical speed of vehicles, which makes delivery time longer. Longer delivery time can cause customer dissatisfaction and, in the worst case, loss of some orders. Additionally, increased demand for transport services makes transport service providers increase their transport rates. So, in the long-term companies worsen their financial results. It is confirmed by the author's observations that many times companies have problems to find a transport service provider, particularly in distribution.

Thus, in the author's opinion, during transport process rationalization it is necessary to take into account the strong correlation between the company transport system and the regional or national one.

Additionally, it seems to be necessary to establish a solution which will eliminate the weaknesses of contemporary methods i.e. not taking into account the trade-off relations between selected logistics processes or their local optimization. Introducing changes to logistics processes should be carried out basing on the sustainable development concept. The concept assumes that sustainable development enables to meet current needs in a way that prevents certain unit from not meeting the same or other needs in the future [Adamczyk 2001, Bartkowiak 2008, Soubbotina 2004]. In case of business activity sustainable development means balancing of three areas: economic, ecologic and social one [Bartkowiak 2008].

Based on the carried out desk research and own studies such us surveys the following hypotheses were created and discussed in the paper.

- Cooperation between companies in the area of organising transport processes will result in the increase of their competitiveness.
- Using innovative IT tools and Communications methods will positively influence the efficiency of cooperation between companies.
- Coordination of transport processes carried out by groups of companies will result in the increase of co-modality of transport processes (using one or more transport branches with regards to sustainable development concept).



Source: Own study

Fig. 3. Contemporary companies' approach to the carrying process  
Rys. 3. Podejście współczesnych przedsiębiorstw do procesu przewozu

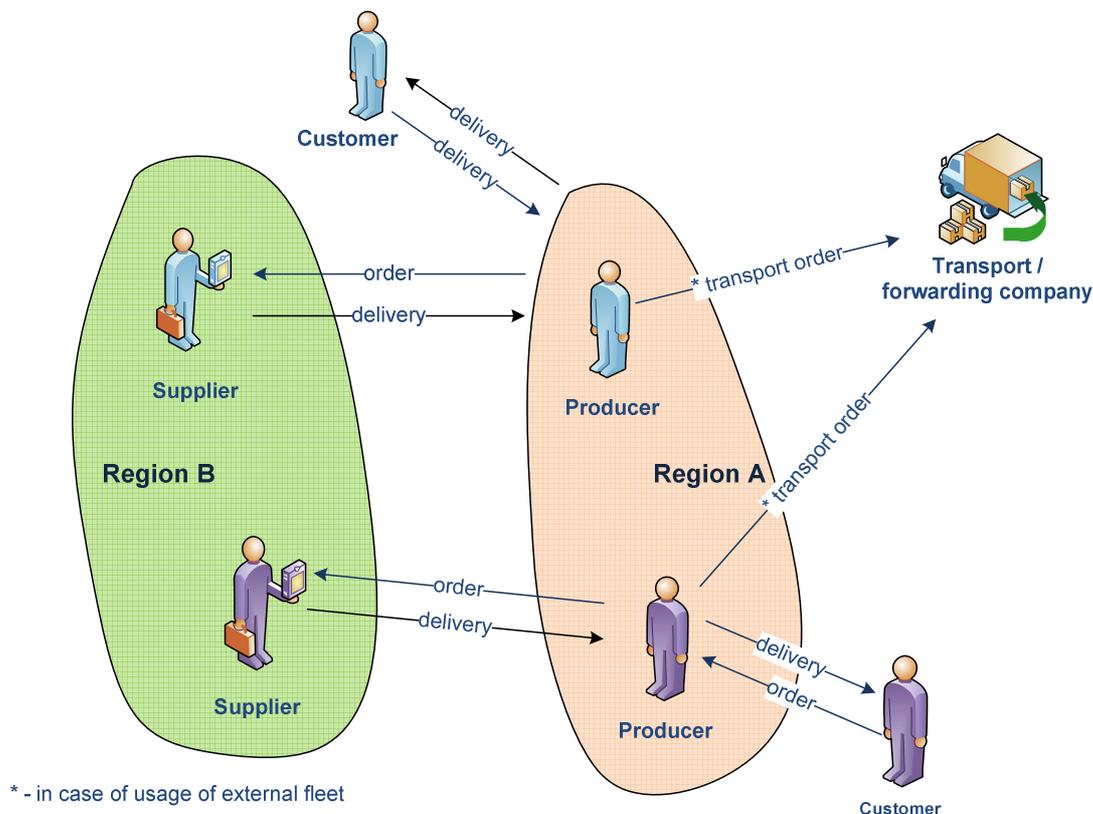
Regarding the above mentioned issues the paper aims at holistic presentation of the way of transport process rationalization based on the sustainable development concept.

The further part of the paper presents results of KASSETTS - European research project, which shows advantages of implementing some elements of the proposed concept by a group of companies in Italy.

## PRESENT MODEL OF TRANSPORT PROCESS ORGANISATION IN BUSINESS ACTIVITY

In traditional organisation models of the transport process, manufacturers or distributors concentrate on fulfilling everyday orders from customers and ordering goods from their suppliers. It is presented in the figure 4. Delivery and distribution of finished goods can be carried out with the use of

own transport means or a specialized transport/forwarding company [Rydzkowski, Wojewódzka-Król 2007].



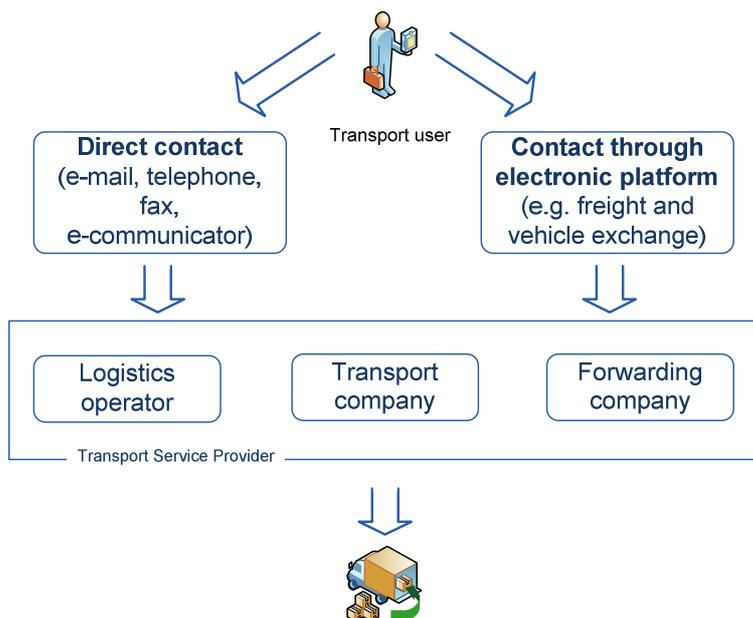
Source: Hajdul M, 2009

Fig. 4. Traditional way of organizing transport process  
Rys. 4. Tradycyjny sposób organizacji procesu transportowego

In case of own fleet companies plan and optimize delivery routes from suppliers and distribution routes to customers on their own. Delivery fulfillment and distribution are in many cases handled together with the use of one vehicle, although they are two different parts of the supply chain [Kordel 2002]. Such actions aim at transport cost rationalization and effective usage of available transport means. Thus, many times the distribution of finished goods within a region is realised first and only then are goods picked from the supplier. After that, the goods are transported to the company warehouse/plant. The actions aim at maximum truck loading capacity utilization, which results in minimization of transport costs.

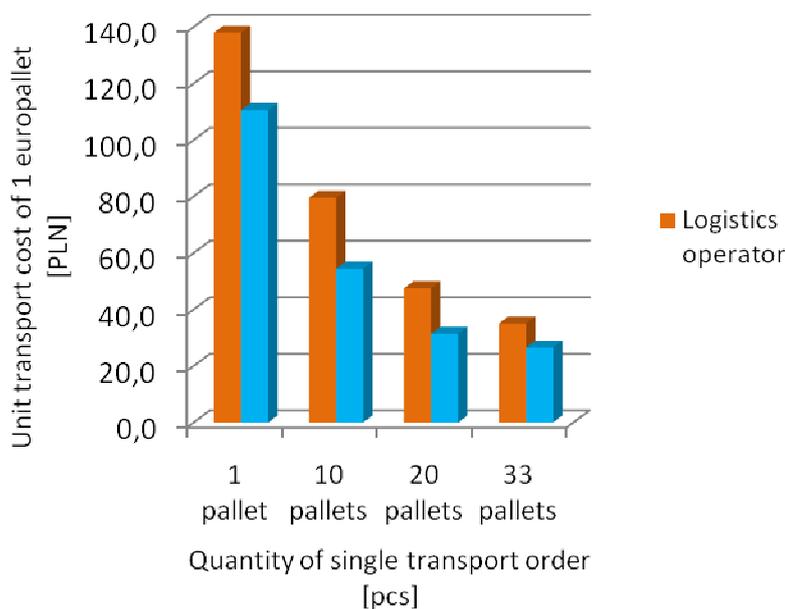
In case of lack or insufficiency of own fleet of trucks the company orders transport/forwarding services. It is favorable since the company only places transport orders and it is the forwarder or transport service provider that is responsible for organizing the process in the optimal way [Załoga, Milewski 2005]. Figure 5 presents selected way of communication between transport users and transport service providers.

Presented model of organization of transport processes has one significant disadvantage. The transport rate or the own transport cost depends directly on the size of load and our expectations regarding delivery time. The general rule is that transport companies have higher prices for larger delivery quantities (figure 6). Both in own transport and the ordered one the cost per weight unit declines with the increase of delivery weight [Coyle, Bardi, Langley 2002].



Source: Own study

Fig. 5. Way of communication with transport service providers  
Rys. 5. Metody komunikacji z dostawcami usług transportowych



Source: Own study based on data from DHL, OPEK, Siódemka, Schenker, Raben, FM Logistics, Wincanton, Delta, Masterlink, Agatrans, Spedimex

Fig. 6. Analysis of transport costs for selected transport orders on the route from Poznan to Świnoujście  
Rys. 6. Analiza kosztów transportowych wybranych zamówień transportowych na trasie Poznań-Świnoujście

Unfortunately, the current trend, i.e. frequent and small deliveries results in growing high transport costs. Furthermore, the number of delivery trucks is also raising which increases traffic congestion and, as a result, longer delivery times is another disadvantage.

## **ASSUMPTIONS OF THE MODEL OF COORDINATION OF TRANSPORT PROCESSES**

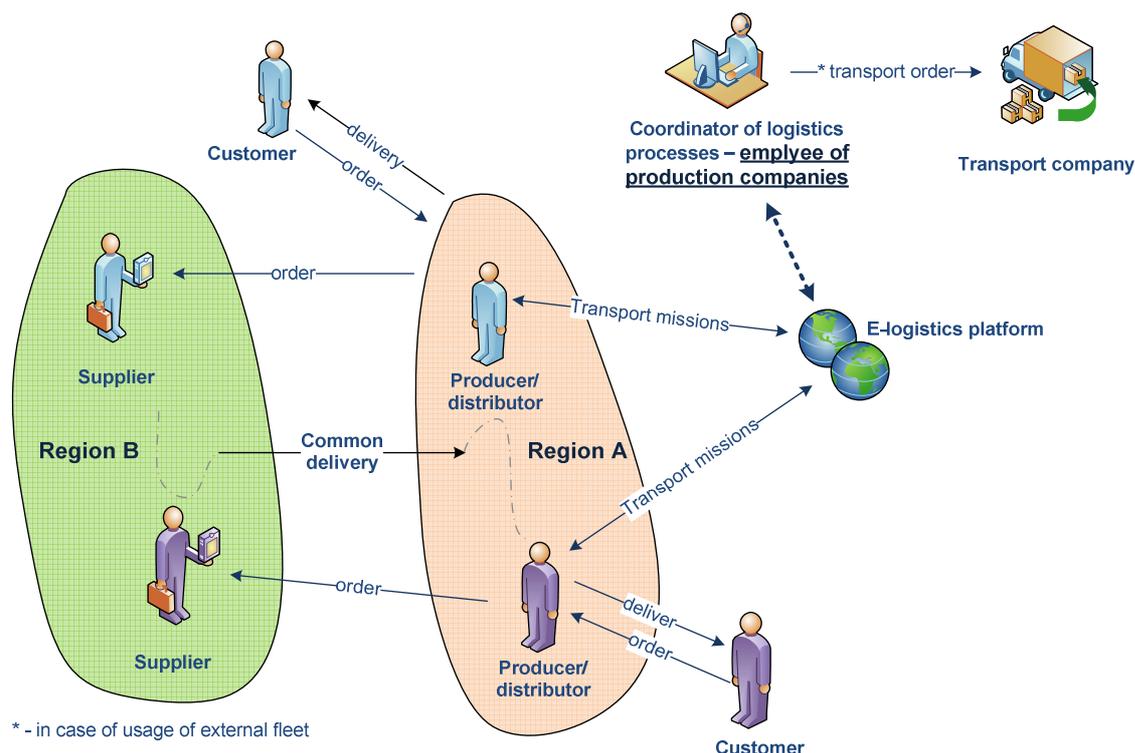
Companies that wish to develop and perform effectively in the long-term and not only achieve profits in the short-term should search for alternative solutions of transport process organisation. The concept based on sustainable development strategy is an example of alternative transport process organisation strategy in business activity. Not only does the strategy enable companies to perform on the basis of the traditional approach but also offers cooperation of companies from one region in the field of logistics process organization with the support of modern IT solutions. The assumptions of the concept proposed by the author are:

- Creation of the model, which allows enterprises to generate aggregated transport orders to use means of transport with bigger carrying capacity, as well as alternative to road modes of transport. This will result in reduction of transport costs and thereby will positively influence on increase of competitiveness of enterprises.
- Developing cooperation model for enterprises in order to organize joint transport processes.
- Drawing up a solution which enables co-modal organisation of transport processes.
- Evaluation of the model based on the KPI methodology, which allows to indicate benefits for all actors directly and indirectly involved in the transport chains - transport users, transport service providers, authorities, transport system of the region.

## **POSSIBILITIES OF COORDINATION OF TRANSPORT PROCESS WITHIN A GROUP OF COMPANIES**

If a company is convinced to have optimal transport processes in its current activity, they can start the next rationalization stage and cooperate with a group of companies in organizing common deliveries. The concept assumes that companies from the same region exchange information on planned points of origins and points of destinations for deliveries of finished goods (figure 7). The information flow is supported by an electronic information exchange platform. The involved companies jointly hire a person who coordinates transport processes on their behalf. One of main tasks of the coordinator is connecting routes in a way that maximizes the size of the shipped or delivered cargo (to or from certain destination). It helps to negotiate better prices with external transport service providers. Obviously, a representative of one of manufacturing companies with their own transport fleet might be a logistics process coordinator. The goal of such companies is to reduce total transport costs through better utilisation loading capacity.

The advantages of the above mentioned solution is being confirmed by transport costs analyses based on data from three manufacturing companies for a 400km-long route. There are two ways of performing the transport process. Firstly, shipping pallets through transport service provider and settling accounts for the number of pallets. The second way is to hire a dedicated truck and settle accounts based on the length of the route. The details are presented in table 1.



Source: Hajdul M., 2009

Fig. 7. Common organization of transport processes within companies from the same region

Rys. 7. Najczęściej spotykane metody organizacji transportu w obrębie przedsiębiorstw działających w tym samym regionie

Table 1. Analysis of transport cost for a hypothetical route (400 km length)  
Tabela 1. Analiza kosztów transportowych hipotetycznej trasy (długości 400 km)

Traditional way of organizing transport processes						
Shipper	Number of pallets [PCS]	Cooperation with logistics operator – transport costs depend on number of pallets		Cooperation with transport company – transport costs related with distance (km) and size of the truck		Number of used trucks [PCS]
		Total transport costs [EUR]	Transport costs of 1 pallet [EUR]	Total transport costs [EUR]	Transport costs of 1 pallet [EUR]	
Producer 1	18	229,5	10,8	190	10,5	3
Producer 2	5	122,5	24,5	89	17,75	
Producer 3	10	177,5	17,75	125	12,5	
Coordination of transport processes based on the concept of sustainable development						
P1+P2+P3	18+5+10=33	-	-	400 km*0,725= =290	35	1

Source: Own study

The table above shows precisely the profits from the solutions presented by the author. What is also worth paying attention to is that one truck is used instead of three ones which decreases road traffic congestion. Therefore, the solution eliminates disadvantages of the traditional method of transport process organization.

## EXAMPLE OF TRANSPORT PROCESS COORDINATION ACCORDING TO SUSTAINABLE DEVELOPMENT STRATEGY

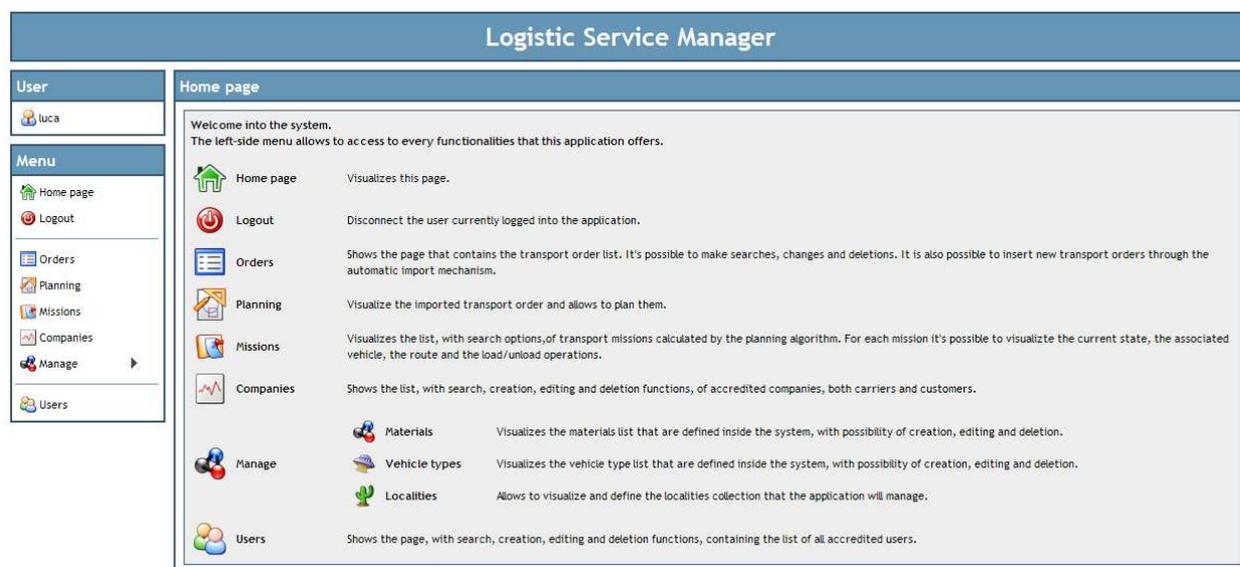
Selected elements of the presented transport process organization strategy are verified on real examples within the KASSETTS project (Knowledge-enabled Access of Central Europe SMEs to Efficient Transnational Transport Solutions) financed by the European Commission (Central Europe Programme). KASSETTS Project aims at supporting rationalization of specific transport processes and logistics actions that leads to the improvement of SMEs competitiveness and environment protection by creating an European logistics coordinator network using specific IT tools. Additionally, in order to support the information flow between subjects, an electronic information exchange platform is being developed. The author is co-responsible for developing planning algorithms and general concept of cooperation among enterprises within the project.

The current version of the tool enables the coordinator to pass on information from manufacturers to transport companies. Additionally, the solution also supports effective route planning.

The current functionalities are as followed [www.kassetts.eu]:

- Ordering - submitting daily transports and keeping their evidence and status.
- Planning - optimization of transport missions, effective route planning and utilization of logistics service providers.
- Reporting - transferring detailed information on used truck, costs and kilometers to the manufacturing company.

A screen of the main menu of the tool is presented in figure 8.



Source: Own study

Fig. 8. A screen of the electronic information exchange platform created within the KASSETTS project  
Rys. 8. Zrzut ekranu platformy elektronicznej wymiany informacji stworzonej w ramach projektu KASSETTS

While planning the tool takes into consideration constraints of logistics infrastructure in the point of origin and destination. Additionally, own available trucks and trucks of external transport service providers are taken into account. The algorithms also consider the characteristics of loading units. Transport cost minimization through increase of loading capacity and one-time transport of large quantities of goods is the optimization criterion.

The new concept of transport process organisation and the above described tool were first tested by Italian companies in the Emilia Romagna region. The manufacturing companies located in the region come across problems resulting from delivery frequency and limited contact with transport service providers. The companies jointly have hired a person who is in charge of coordinating transport processes. The person gathers transport orders every day and optimizes them within the supply chain. Transport missions are planned twice a day. Additionally, the coordinator periodically reports and issues pro-forma invoices which enables to control transport and service costs continuously.

The initial stage of the research shows that it is a simple way of making cost savings - in transport costs (ca. 20%), kilometers (almost 30%), or decreasing the number of individual transports 37%, as well as making time of the order fulfillment shorter [www.kassetts.eu]. The selected group of companies have appreciated the profits achieved in the testing stage and decided to use ICT as a supporting tool for their logistics activity.

Similar promotional attempts will be made within the KASSETTS project in Poland, Germany, Czech Republic, Slovakia, Slovenia and Hungary.

## CONCLUSIONS

It should be noticed on the example of Italian companies that many of them are more and more open to new solutions that bring profits to many units directly or indirectly involved in the supply chain. Firstly, profits are achieved by companies which reduce transport costs without reducing customer service level. Furthermore, the solution enables to reduce the number of used trucks which contributes to decreasing truck traffic. Thus, the average road transport speed does not decrease and companies can still fulfill deliveries within 24 hours. It is noticeable that the approach makes companies benefit from increased effectiveness both in the long- and short-term. Therefore, the approach complies with the sustainable development concept.

Another group that is indirectly involved in the supply chain are road users whose moving on the roads is made more difficult by growing traffic congestion. Therefore, the improvement of transport process organization in companies leading to the reduction of delivery trucks is also profitable for passenger car users.

The transport process organization strategy presented in the paper is also compatible with the current European Commission transport policy promoting transport process co-modality. The term stands for a separate or joint effective utilisation of various transport means in order to make the resource utilisation optimal and sustainable [KOM(2006) 336, COM(2006) 314]. "Optimal" should be understood in terms of both economic, financial, service level and environment protection aspects [COM(2006) 314].

To sum up, we should hope that real financial advantages and a perspective of a long-term development will convince some groups of small and medium enterprises to start rationalizing their transport processes according to presented three-stage-solution.

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## **MODEL KOORDYNACJI PROCESÓW TRANSPORTOWYCH W OPARCIU O KONCEPCJĘ ZRÓWNOWAŻONEGO ROZWOJU**

**STRESZCZENIE.** Rozwój zrównoważony oznacza możliwość zaspokajania bieżących potrzeb w sposób niewykluczający możliwości zaspokajania tych samych potrzeb w przyszłości. Jest to zdolność utrzymywania równowagi pomiędzy określonymi procesami lub stanami w obrębie systemu. W odniesieniu do działalności gospodarczej jest to zdolność utrzymywania równowagi pomiędzy trzema obszarami: ekonomicznym, ekologicznym i socjalnym. W pracy przedstawiono możliwości zastosowania koncepcji zrównoważonego rozwoju w organizacji procesów transportowych. Dodatkowo poddano dyskusji model koordynacji procesów transportowych z omówieniem jego zalet i wad.

**Słowa kluczowe:** efektywność, proces transportowy, współmodalność, rozwój zrównoważony, platforma elektroniczna.

## DAS MODELL DER KOORDINIERUNG DER TRANSPORT-PROZESSEN NACH DEM KONZEPT DER NACHHALTIGEN ENTWICKLUNG

**ZUSAMMENFASSUNG.** Die nachhaltige Entwicklung bedeutet, dass es möglich ist, den aktuellen Bedarf in der Weise, die nicht die Möglichkeit der Organisation des gleichen Bedarfs in der Zukunft beseitigt, zu organisieren. Es ist die Fähigkeit, ein Gleichgewicht zwischen einem bestimmten Prozess oder Zustand in einem System zu halten. Im Falle der geschäftlichen Aktivitäten ist es die Fähigkeit, ein Gleichgewicht zwischen drei Bereichen zu halten: wirtschaftliche, ökologische und soziale. In diesem Artikel wurde die Möglichkeit der Verwendung des Konzepts der nachhaltigen Entwicklung in der Organisation der Transport-Prozesse vorgestellt. Zusätzlich wurde das Modell der Koordinierung der Transport-Prozesse innerhalb der Unternehmen mit seinen Vor- und Nachteilen diskutiert.

**Codewörter:** Effektivität, Transport-Prozess, Komodalität, nachhaltige Entwicklung, elektronische Plattform.

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