LogForum

> Scientific Journal of Logistics <

http://www.logforum.net

e-ISSN 1734-459X

Scientific journal, issued quarterly
since 2005

The papers are published in English only, in four issues yearly. The journal is edited in the paper form and also presented on-line (www.logforum.net). Each publication is evaluated (double blind) by at least two independent Reviewers.

The ethical policy of LogForum journal follows the Committee on Publication Ethics (COPE) recommendations.

AIMS AND SCOPE

LogForum is a scientific journal created to be a global forum for an exchange of scientific achievements and implementations in the field of logistics.

The journal publishes reviewed papers, which paid special attention to the most important aspects of logistics, e.g.:

Logistics and Supply Chain Management

1. Sustainable, safe, secure supply chain and logistics processes organization,
2. Technologies, information systems and standards for interconnected logistics,
3. Corridors, hubs and logistics equipment in supply chain management,
4. Packaging, warehousing and transport problems.

Management science - theory and practice

1. Modeling, simulation and optimization of management processes,
2. Specific management solutions in various branches,
3. Logistics and management education.

The journal is tracked by: Web of Science Core Collection - Emerging Sources Citation Index, DOAJ, Business Source Premier (ebsco), Academic Search Complete/Business Source Complete (ebsco) Ulrichs WEB, Primo Central Index, HINARI, J-Gate, Electronic Journals Library (EZB), Scirus, BazEkon, EconBiz , Erih Plus, Socolar (China), ROAD Directory of Open Access scholarly Resources, University of California Libraries, Swiss University Library Network (RERO), Arianta, Baztech, CEJSH, Harvard Libraries, Index Copernicus, Bielefeld Academic Search Engine, Baidu, TRIS (Transportation Research Information Services), Cabell's International.

Contents

Volume 3 2007

Issue 1

January - March 2007

Issue 2

April - June 2007

Issue 3

July - September 2007

Issue 4

October - December 2007

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 1
No 1

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

ON THE WAY TOWARDS AN E-COACH FOR SUPPORTING IMPLEMENTATION AND REALISATION OF THE EFFICIENT CONSUMER RESPONSE CONCEPT

Gaby Neumann[1], Stanisław Krzyżaniak[2]

1) Otto-von-Guericke University of Magdeburg, Logistics Knowledge Management Group, Magdeburg, Germany
2) Institute of Logistics and Warehousing. Poznań, Poland

ABSTRACT. Efficient Consumer Response (ECR) is a concept for supply chain improvement using many methods related to supply chain management (SCM). To implement and run this concept in practice well-trained personnel are needed closely collaborating throughout the entire supply chain. The ECR e-coach realizes the idea of helping a person not to learn and gain knowledge directly, but in actively creating and successfully passing individual learning processes through guidance-on-demand (i.e. coaching) in a virtual environment (e-coaching). The paper presents the results of a project aiming to support the implementation of the ECR concept in Poland and Germany by providing an e-coach for understanding and implementing ECR. It briefly introduces didactics implications and design rationales taken into consideration, illustrates e-coach content and functionality as implemented, discusses results from prototype use and evaluation, and summarizes lessons learned with regard to trans-national, interdisciplinary collaboration and technological challenges to be mastered.

Key words: Efficient Consumer Response (ECR), Supply Chain Management, e-coach learning.

INTRODUCTION

Efficient Consumer Response (ECR) is a concept for supply chain improvement by collaboratively using appropriate methods of supply chain management. Due to the variety of problems in a supply chain ECR is expected to provide a solution to and because of the need to purposefully select from the many and diverse methods available to compose and apply them correctly for solving those problems, there is a strong need for well-trained human resources alongside the entire supply chain. To achieve this and ensure permanent updating of required competences, companies must be offered a comprehensive training support. From the didactics point of view this training support needs to be based upon a constructivist design, which assumes that in principle knowledge cannot be imparted by a teacher or trainer, but results from self-constructing ideas and concepts by the learner or trainee. The trainer supports this process by providing hints and feedback; his/her role changes from being a teacher towards acting as a coach. The task of such coach consists in non-directive questioning and helping coachers to analyse and address their own challenges rather than offering advice or direction. Against this background coaching is to be understood as helping a person in actively creating and successfully passing individual learning processes through guidance-on-demand [Neumann 2006].

E-coaching is coaching delivered over an electronic medium. It focuses on the same goals as regular coaching. Corresponding to the nature of ECR as being based on knowledge from different

Citation: Neumann G., Krzyżaniak St., 2007, On the way towards an e-coach for supporting implementation and realisation of the Efficient Consumer Response concept. LogForum 3, 1, 1
URL: http://www.logforum.net/vol3/issue1/no1
Accepted: 10.02.2007, on-line: 15.04.2007.

fields and dealing with various and diverse problems an e-coach to support understanding and implementation of the ECR concept needs to implement a matrix approach reflecting these two main perspectives, the knowledge-based and the problem-based one [Neumann and Krzyzaniak 2007]. First of all, the e-coach should help the coachee to identify his/her individual needs:

- Do I want to develop knowledge and skills in a certain ECR-related area heading to better performance in and ability of problem solving?
- Do I want to tackle a just encountered specific problem in the company or supply chain collaboration as a primary task?

These two reasons for accessing (taking advantage of) the e-coach may be interlinked and therefore may intertwine in the course of the coaching and learning process. The final result - in terms of gained knowledge and skills as well as an ability to identify and solve a problem - can be the same, but the stresses will be put in different ways. Taking this into consideration the ECR e-coach needs to consist of two functional components: a diagnosis system and a learning environment.

As presented by Neumann and Krzyzaniak [2007] the learning environment of an ECR e-coach is formed by a learning management system with a wide range of information and communication tools as well as high-quality multimedia learning material embedded in it. More specific such learning material needs to contain a sufficient number of modules from the following main categories:

- *Description-oriented learning modules* deliver knowledge on a specific aspect of ECR such as shrinkage or RFID technology (What is …?).
- *Problem-based learning modules* provide relevant knowledge for identifying, specifying and solving a particular problem, like shrinkage reduction or application of RFID technology in supply chains (How to …?).
- *Assessment modules* enable individual knowledge application and evaluation within tests/quizzes at different levels of difficulty with extended feedback being provided to the user.
- *Case study modules* support free knowledge application within an interactive supply chain scenario by running case studies at four levels of difficulty.

With this, customization and individualisation of a user's learning process and learning path according to his/her needs (resulting from current skills and knowledge level as well as the required target competences) become possible by purposefully selecting the suitable modules.

To illustrate the individual focus and related design constraints of the different module categories the following sections present already available ECR e-coach modules as well as results and lessons learned from first student evaluations. Furthermore, they address technical issues, such as special challenges for platform-independent implementation.

THE E-COACH LEARNING MODULES

Learning modules aim at supporting knowledge transfer on certain topics in an either description-oriented or problem-based way. The e-coach learning modules developed so far introduce into the topic of Efficient Consumer Response in general and take up current problems in supply chain management (see Table 1):

- The module "Introduction to ECR" covers the wide range of knowledge and information related to the Efficient Customer Response (ECR) concept. It aims to provide an overview on the topic, to support knowledge transfer on methods, tools, challenges and benefits of Efficient Consumer Response (ECR), and to fertilize implementation of ECR among business partners in supply chains.
- The module "Introduction to Shrinkage" embraces several issues which give an overview of the shrinkage problem in supply chains, such as general problems in stock keeping, definition of

shrinkage, sources of shrinkage and responsibility for shrinkage in the supply chain. The aim of this module is to support knowledge transfer about the shrinkage problem in supply chains and to raise awareness of this issue.

- The module "Introduction to RFID Technology" explains RFID technology, its components and application, but also problems or challenges resulting from the current state-of-development of this technology. With this, basic knowledge is to be achieved on what is behind the term RFID, how this technology works and what has to be taken into consideration when making use of it in practical application.
- The module "How to Reduce Shrinkage" focuses on the Shrinkage Reduction Roadmap including an introductory description of the policy, methods and measures. It wants to deliver knowledge and understanding on how to identify, prevent and reduce shrinkage in supply chains.
- The module "How to Apply RFID in Supply Chains" presents practical instructions, general guidelines and useful hints on when application of RFID technology in a supply chain might make sense, how appropriate components are selected and integrated in an application and how the supply chain can be run by use of RFID technology.

Table 1. The ECR e-coach learning modules
Tabela 1. Moduły kształcenia ECR metodą e-coach

Module	Type	Learning Goals	Contents
Introduction to ECR	D	Know basic terms on ECR Know ECR methods and tools Know problems and benefits of ECR	Challenges in supply chain collaboration Definition, objectives, benefits of ECR History and development of ECR ECR components The ECR Global Scorecard
Introduction to Shrinkage Reduction	D	Know about problems in stock keeping Know and be able to identify shrinkage Understand causes of shrinkage Have a basic idea on how to cope with shrinkage	Problems in stock keeping Definition, sources and effects of shrinkage Responsibilities and possibilities for coping with shrinkage Case studies
How to Reduce Shrinkage	P	Be able to develop a strategy for reducing shrinkage Know about the Shrinkage Reduction Roadmap and be able to apply it Be able to measure shrinkage	How to develop a shrinkage reduction policy The Shrinkage Reduction Roadmap How to measure shrinkage Case studies
Introduction to RFID Technology	D	Know basic terms related to RFID Know about RFID technology Know RFID components and applications Understand problems in using RFID	RFID technology (components, how it works, advantages, disadvantages) RFID applications (smart card, data verification, tracking & tracing etc.) Global RFID Deployment (standards, national/regional activities) RFID and Privacy & Security
How to Apply RFID in Supply Chains	P	Know about possibilities, problems and chances of applying RFID in supply chains Be able to introduce RFID to supply chain management Be able to design RFID technology Be able to run logistics processes and supply chains by use of RFID	Definition and components of RFID RFID in a particular supply chain context – yes or no? How to design RFID technology How to implement RFID in supply chain management How to run a logistics process or supply chain by use of RFID

Types of learning modules: D = descriptive module; P = problem-based module

With this, descriptive and problem-based modules are available to be selected and used according to the needs of a particular target group or individual user. Generally, the target audience of those learning modules might cover:

– students (at private or public schools or universities),
– attendees of ECR learning programmes,
– supply chain professionals, i.e. employees of manufacturers, retailers and service providers.

To achieve this, all modules are designed along the same lines and well-structured according to both logical steps of knowledge acquisition and context-dependency of knowledge units. Furthermore, requirements of platform-independent implementation have been met to allow embedding of one and the same module into a WebCT-based learning environment as well as into a Lotus Learning Space. Each module works on its own, but can also be combined with any other to form a particular course (learning path). For this, module content has been well-structured into topics which are respectively covered by separate web pages enriched with pictures and illustrated graphs, Macromedia Flash animations (see Figure 1), examples or multimedia quizzes. Application of common design rationales to all pages ensures a similar look within the modules, but also same navigation principles no matter which content or topic is currently represented. For course creation the link between independent learning modules is technically being realized through the infrastructure of the learning management system they are embedded in.

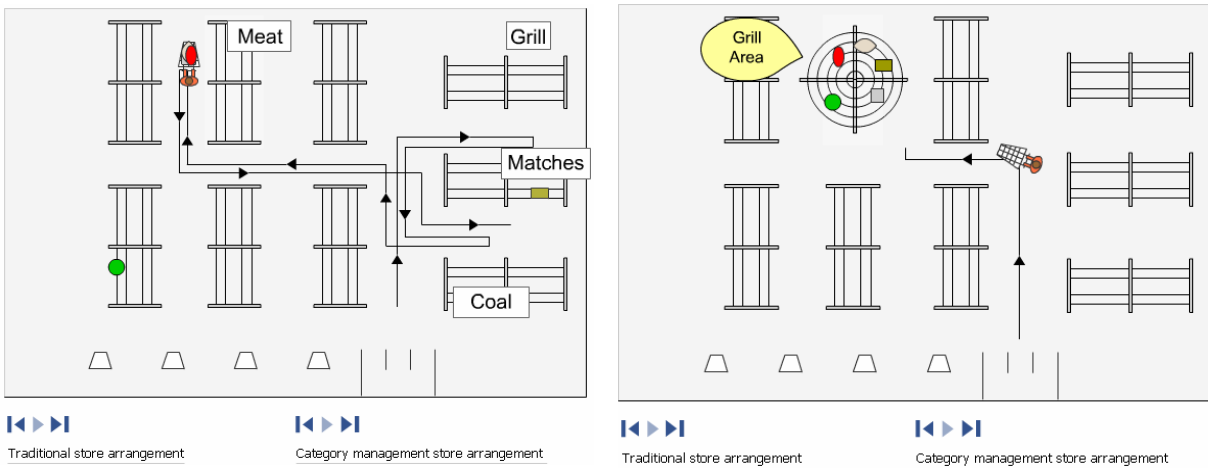


Fig. 1. Illustrating animations on the effects of Category Management (to the left: without CatMan; to the right: with CatMan)
Rys. 1. Zilustrowanie efektów Category Management (z lewej: bez CatMan, z prawej: przy zastosowania CatMan)

To provide context-related access to the topics (pages) a module always starts with a structured overview of its content. As Figure 2 shows for the module on "Introduction to ECR", this mindmap also provides interactive hyperlinks to the respective parts of the module and therefore allows easy-to-use navigation. On the contrary each of the pages contains a little mindmap logo being hyperlinked to the overview page for returning to the overall structure and/or easily jumping into another topic of interest. In general, the topics mentioned in the overview form the main learning path as it has been suggested by the module's author. Additional information, cases or illustrating animations can be reached from there via local hyperlinks (and a return path to the page this information has been called from) without leaving this standard learning path the user eventually might follow.

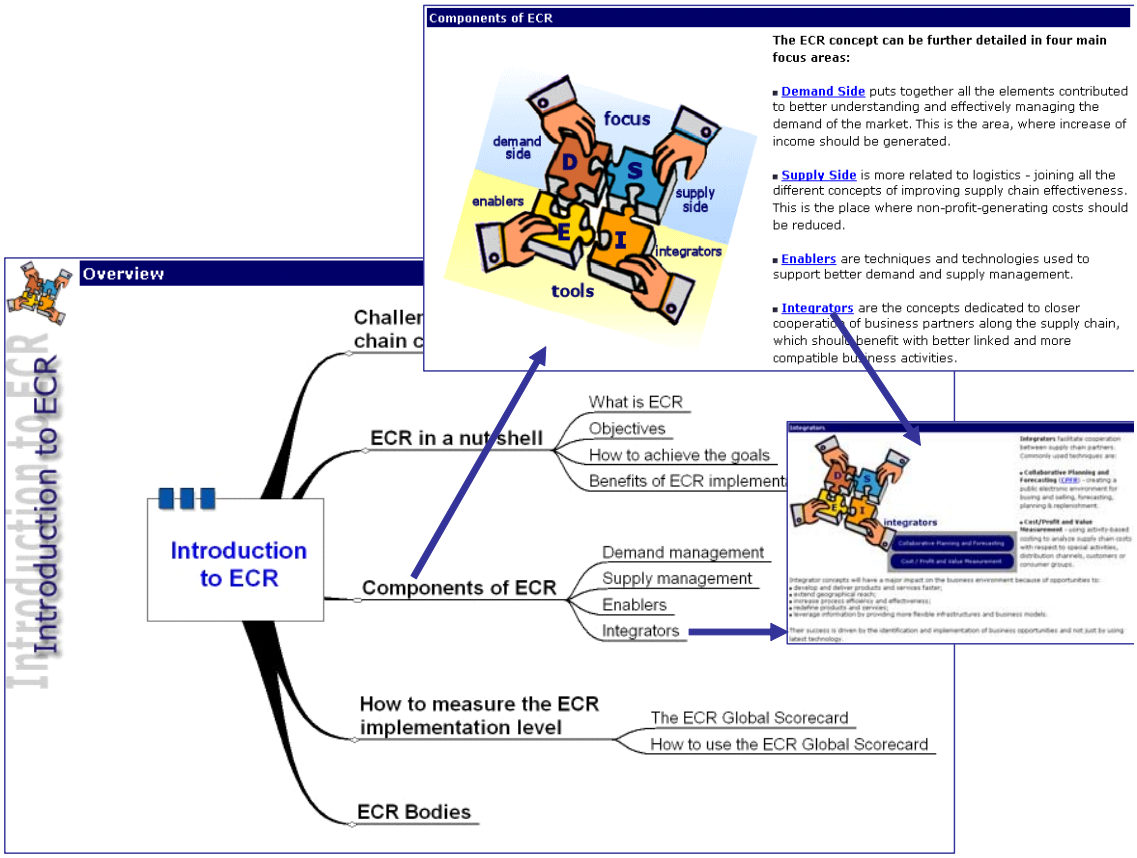


Fig. 2. Module 1 "Introduction to ECR"
Rys.2. Moduł 1 „Wprowadzenie do ECR”

THE E-COACH ASSESSMENT MODULES

For interactively applying gained knowledge and assessing any existent or achieved knowledge level on one's own some test questions, exercises and case studies have directly been embedded into the modules. In addition to this a separate assessment module implemented by use of Macromedia Authorware is available, too (see Figure 3).

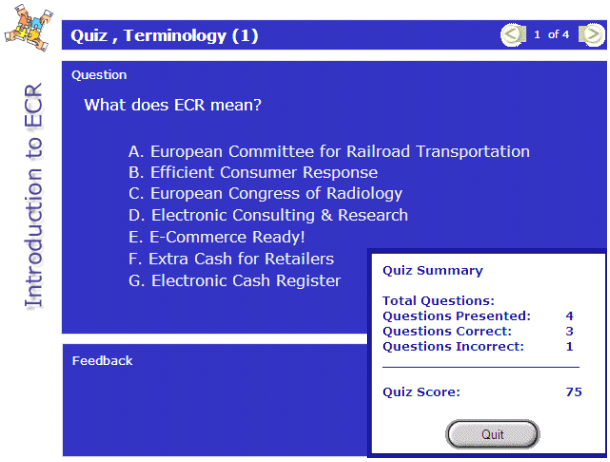


Fig. 3. Quiz example "What does ECR mean?”
Rys.3. Pytanie testowe „Co oznacza pojęcie ECR?”

This assessment module again and again creates new quizzes by combining on-the-fly questions of a varying level-of-difficulty and from different topic areas. A separate question bank implemented in Microsoft Excel pools all questions including their right and wrong answers as well as their specific feedback. Each question is additionally characterized according to its content by category, subject and topic information, whereas information on a question's level-of-difficulty and type support the processes of its selection and use. To create a new quiz, only as many alternative questions for a particular topic as wished need to be selected and embedded into the quiz frame (see Figure 4). If the user starts the assessment module, a number of questions is selected at random from the available alternatives and put into the pre-defined quiz structure. This way, every time a user re-starts the assessment module a quiz new to him/her appears. Assuming the question bank contains a sufficient number of questions, the own state-of-knowledge and conceptual understanding can repeatedly be tested without just re-producing what has been learned before.

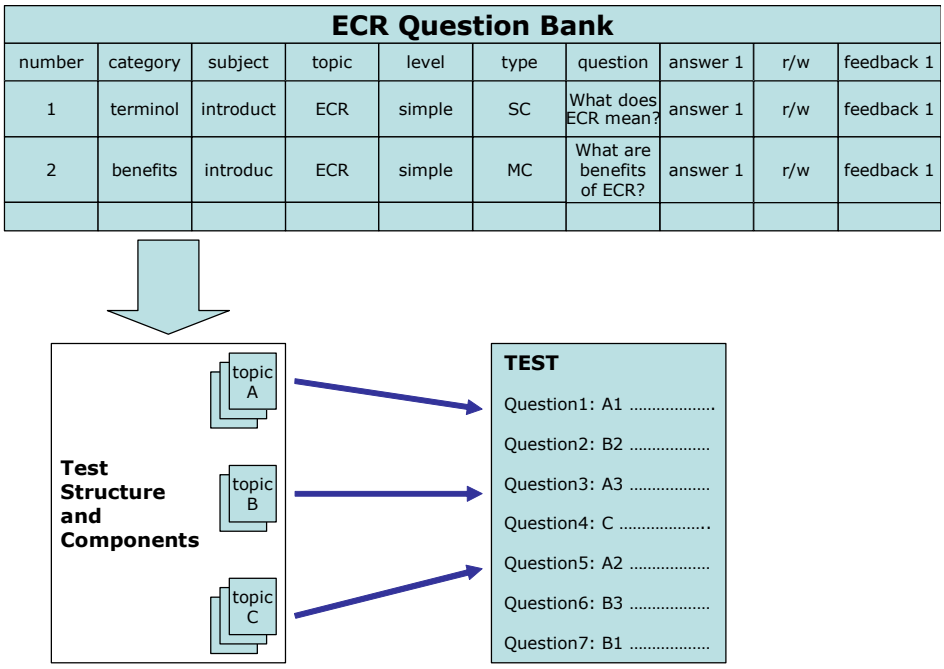


Fig. 4. The ECR question bank and quiz module
Rys.4. Moduł testu oraz bank pytań dotyczących ECR

THE E-COACH CASE STUDY MODULE

In contrast to the assessment module where a user answers questions within quizzes to give proof of conceptual knowledge, the case study module enables free knowledge application within an activity-oriented scenario. Here, the user has to get familiar with new situations and eventually deal with different problems. Thus, s/he is expected to demonstrate competences by understanding situations, applying methods and finding appropriate solutions in an effective and efficient way. To provide an experience as authentic as possible a fictitious supply chain of three partners - raw material supplier, manufacturer of potato chips and retailer with distribution centre and a number of shops - has been created.

Each partner has a public website and a private Intranet including various company-specific information and data (see Figure 5). They cover all aspects of the company from presenting its vision, mission, history, products and services (public information) to providing process descriptions, staff lists, resource data, performance data, customer/purchase orders, stock levels etc. (private information).

Fig. 5. Company-specific websites of the supply chain partners (to the left: the manufacturer; to the right: the retailer)
Rys. 5. Strony internetowe partnerów w łańcuchu dostaw skierowane do przedsiębiorstw (z lewej: wytwórcy, z prawej: detalisty)

This scenario serves as case development framework; a specific case study is finally created by attaching problems or tasks to the supply chain as a whole or any of the partners individually (see Figure 6).

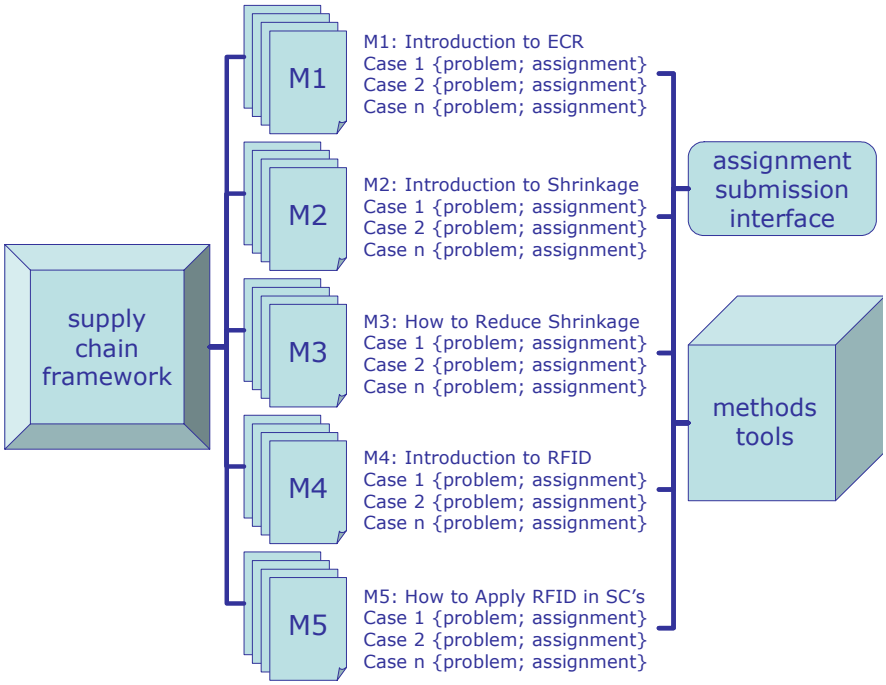


Fig. 6. How to create a case study within the case module
Rys.6. Jak stworzyć case study w oparciu o case moduł

Finally, case studies with different targets and varying levels of difficulty result from this, which can aim at:

i. *Characterizing a situation*. The user describes the situation in the supply chain or company e.g. by choosing from different descriptions presented. Feedback is returned directly on his/her decision.
ii. *Identifying problems or potential improvements*. A list of problems and potential improvements is presented to the user from which s/he chooses the ones s/he identified. Feedback is returned directly on his/her decision.

iii. *Recommending actions to solve problems*. The user chooses from a set of actions/methods the ones s/he recommends to use. The effects of his or her choices will be presented to him/her.
iv. *Applying methods to solve problems*. The user applies certain methods to solve the problems as identified and specified before by use of tools (EXCEL based or others) provided to choose from and work with. The results are assessed e.g. according to an exemplary solution.

It is obvious, that those different types of cases do require different methods to support the user (guidance-on-demand) and also different ways for gaining the user's results: whereas the first three types of case studies might force the user to answer questions or fill in a check list, a case study of the last category can only be performed within the e-coach when sophisticated tools (similar to those being used in real supply chains to apply the ECR concept for solving particular problems in collaboration) are available. Therefore, the project focused on implementing a framework and cases challenging the user in analysing the situation in any of the partner companies and the supply chain as a whole as well as identifying problems and potential improvements with them. Here, the user has to work selectively with the material available and delivers his/her results by answering multiple-choice and matching questions. This ability to get into a situation, see problems and their causes as well as link these findings with knowledge about best practices or suggestions from theory as it is demonstrated by the user here forms the pre-condition for any purposeful and promising problem solving at a later stage.

STUDENT EVALUATION OF THE "INTRODUCTION TO ECR" LEARNING MODULE

Evaluation process and results

To understand if and to what extend the e-coach learning environment supports individual learning processes as intended, a summative student evaluation of the learning modules has been carried out in correspondence with the progress of module implementation. Since the jointly developed "Introduction to ECR" learning module has been available first and in English language only, this module was the first one to be evaluated by a small group of Polish students from the Poznan School of Logistics with sufficient English knowledge, but without knowledge on the ECR concept (see Kopanska 2006). Based upon a guided learning process and a classical pre-/post-design, the evaluation process aimed at assessing the quality and effectiveness of the module (by use of a knowledge test containing 20 multiple-choice questions from four different areas) and at understanding student expectations in e-learning in general and the module in particular as well as experiences from learning with the module (via targeted surveys). So, each student completed an on-line survey on his/her prior experience with e-learning and expectations in the module and passed an electronic knowledge test on ECR basics before s/he got access to the learning material. After a given period of individual learning, all students answered the same questions again in a second knowledge test and provided feedback on the module's contents, structure, design and implementation within another survey.

Evaluation results from comparing student knowledge on ECR before and after the learning (see Figure 7) showed an average improvement of the total scores per student by approximately 22%. This result as well as an analysis of student expectations, feedback and comments in the surveys finally gave proof of the usefulness of the module's contents, structure and design, but also initiated further improvements of the materials, especially by increasing the amount of interactivity, vividness and clarity.

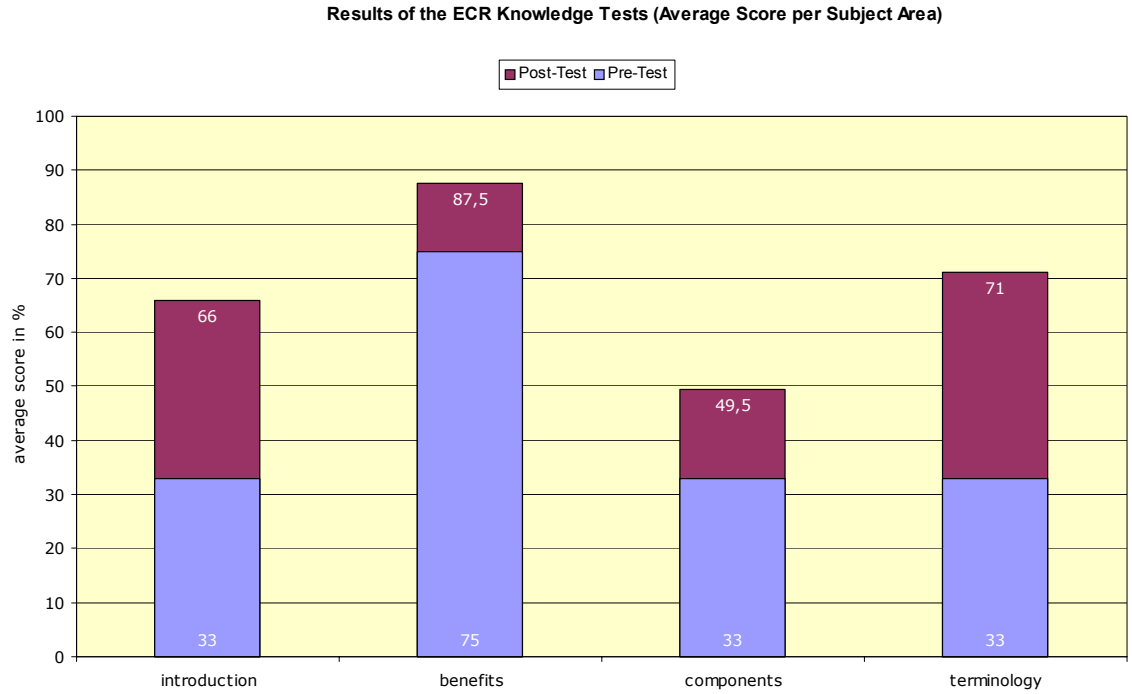


Fig. 7. Results from the ECR Knowledge Test with Polish Students (Learning module and evaluation in English language)

Rys. 7. Wyniki testu znajomości zagadnienia ECR wśród polskich studentów (moduł szkoleniowy oraz rozwinięcie w języku angielskim)

After translation of the module into local languages of the cooperating institutions, Polish and German, evaluation for the module has been re-run. Here, students from the University of Magdeburg worked with the same elements in German language, as students from Poznan did simultaneously with the Polish version. One of the key questions to be answered by this set-up was the influence of the language (home vs. foreign) on the learning outcomes. For this, evaluation design of this second stage was the same as in the first one with the same knowledge tests to be passed and surveys to be completed. The only difference was the language, because this time quizzes and surveys were provided in the respective local languages as the module was as well.

Here, evaluation again demonstrated a significant increase in the students' general knowledge about ECR by about 30% for the German students with some variations in the amount of increase between the different questions. As visualized in Figure 8, both phenomena were to be observed with regard to questions: whereas question no. 3 on which industries ECR did originate from (with three right and two wrong answers) had never been answered correctly, question no. 20 on what does FMCG mean (with Fast Moving Consumer Goods being the single correct answer) had only correct answers in both the pre- and the post-tests. Looking at the students and their individual knowledge increase (see Figure 9) we usually can observe a very successful development. Nevertheless, there are three exceptions from this: student 31 had not participated in the post-test and students 30 and 35 obviously did not learn well, since they had managed to even reduce their scores in the post-test compared to the pre-test with special problems in the terminology-related part. But these are exceptions, indeed, and should not be taken into further consideration when deriving lessons learned.

Instead, this gave a clear indication on the varying levels of difficulty of the questions on one hand and of the individual learning capabilities of the students on the other. The slight increase in the knowledge increments between the first evaluation stage (in English language) and second evaluation stage (in the local language, i.e. German in this case) might also be understood as indicator for the influence of language skills on the learning outcomes. Student feedback provided by the surveys

contained a variety of positive comments and critical views at the same time. The latter was expressed much clearer than in the first evaluation stage, which might have been caused by the fact that the German students were well experienced in e-learning whereas the Polish ones had had no prior access to e-learning material beforehand.

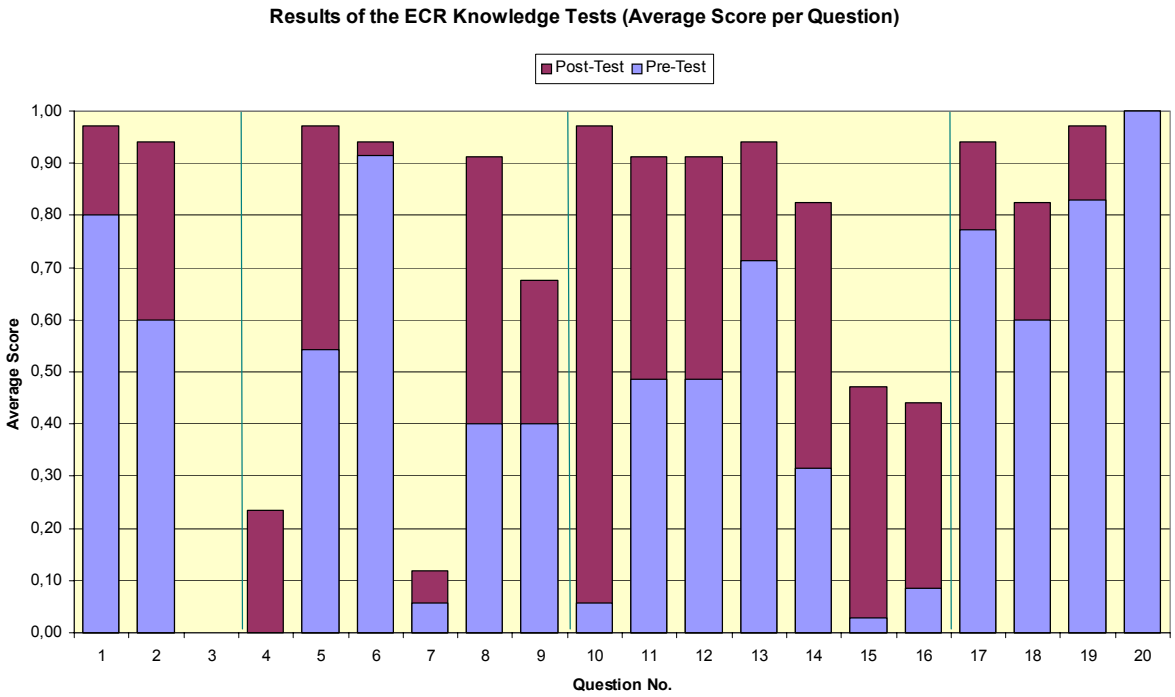


Fig. 8. Results of the ECR Knowledge Test with German Students (Learning module and evaluation in German language)
Rys. 8. Wyniki testu znajomości zagadnienia ECR wśród niemieckich studentów (moduł szkoleniowy oraz rozwinięcie w języku niemieckim)

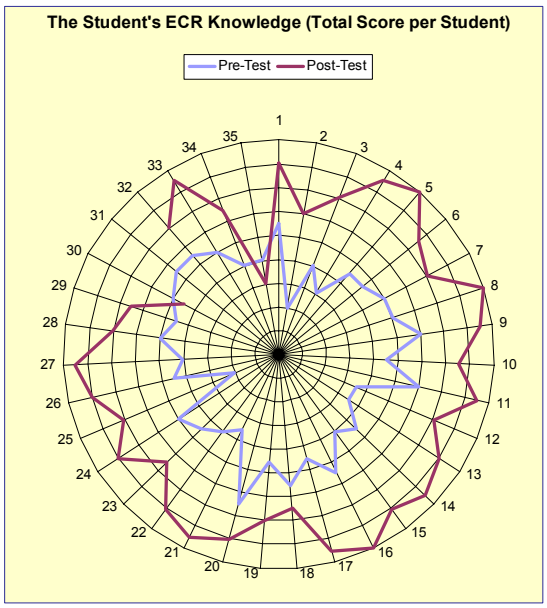


Fig. 9. Results of the ECR Knowledge Test with German Students (Learning module and evaluation in German language)
Rys. 9. Wyniki testu znajomości zagadnienia ECR wśród niemieckich studentów (moduł szkoleniowy oraz rozwinięcie w języku niemieckim)

Lessons learned from student evaluation

In general, both evaluation processes confirmed that:

- the learning module is useful for reaching the intended learning goals and
- the quality of the content is satisfying.

At the same time, one has to notice that there is a strong need for enriching the content with more animations and simulations as the most relevant tools of computer-based learning.

Consequently, a concept and approach for module refinement is to be seen as the most significant outcome of the evaluation. Thanks to numerous remarks by the students and conclusions resulting from analysing quantitative and qualitative evaluation results a set of practical hints for improving the learning module could be derived. Examples of student recommendations are:

- Include more animations, simulations, exercises, workshops and project work,
- Show deployment of mentioned tools on the basis of practical solutions, supported by examples of existing companies,
- Apply simple language of narration,
- Give extensive descriptions of newly introduced issues,
- Place a glossary.

SUMMARY AND CONCLUSIONS

The ECR e-coach can be seen as a valuable support for all those who already have a certain level of knowledge in the field of supply chains and supply chain management, but who wish to update and develop this knowledge and competences towards the Efficient Consumer Response concept. Therefore the target group comprises students, of course, but the ECR e-coach much more addresses practitioners employed in companies where ECR (or at least some of its components) have just been, are being or will soon be implemented.

The e-coach learning, assessment and case study modules as presented in this paper form the core part of a learning environment coaching functionality might be applied to. Here, platform-independent implementation and cooperative multilingual development by distributed authors provided a special challenge.

Although ECR was found to be attractively foiled where advantages of e-coaching could be demonstrated in the most spectacular way, the developed aide can easily be extended towards many other logistics issues, leading to a holistic educational tool enhancing competences and skills of logisticians of different levels of responsibility. Nevertheless, application of the pedagogical principle of coaching to an emerging field of knowledge and competence like Efficient Consumer Response within a web-based environment delivers a number of challenges to be faced. First of all, coaching (and e-coaching all the more) is more than just guided learning. It requires to personalize learning and to stay in close contact with the learner. Forwarding those tasks to a technical system can only be successful if (i) learning materials are designed in an appropriate way and (ii) true coaching functionality in the form of a sophisticated diagnosis component is provided. The process of developing and implementing the ECR e-coach took both aspects into consideration and mastered the challenges by selecting those fields of knowledge that represent some crucial problems in today's supply chains on one hand and creating well-structured, attractive multimedia learning modules in English, German and Polish languages on the other. By use of a classical pre-/post-design with surveys and knowledge tests evaluation results finally gave proof of the usefulness of the learning modules' contents, structure and design, but also initiated further improvements of the materials, especially by increasing the amount of interactivity, vividness and clarity.

ACKNOWLEDGEMENT

The paper presents results of a project jointly run by the Otto-von-Guericke University of Magdeburg (Germany) and the Institute of Logistics and Warehousing in Poznan (Poland) in 2004 and 2005. This project was kindly funded by DAAD under the Project-based Personnel Exchange Programme.

REFERENCES

Kopanska J., 2006, Evaluation of the "Introduction to ECR" Learning Module. In: MSL - Magdeburger Schriften zur Logistik 23 (2006), pp. 37-45.

Neumann G., 2006, E-Coaching - a Constructivist Approach to Professional Education and Training in Logistics. In: MSL - Magdeburger Schriften zur Logistik 23 (2006), pp. 17-25.

Neumann G., Krzyżaniak ST., 2007, E-Coaching - an efficient measure of professional development for SCM solutions. LogForum 3,1,1.

NA DRODZE DO E-COACHINGU DLA WSPARCIA WDRAŻANIA I STOSOWANIA KONCEPCJI ECR

STRESZCZENIE. ECR to koncepcja poprawy funkcjonowania łańcucha, w której znajduje zastosowanie szereg metod pokrewnych zarządzaniu łańcuchem dostaw (SCM). Dla wdrożenia i praktycznego stosowania tej koncepcji niezbędne jest posiadanie dobrze wykształconej kadry, ściśle współpracującej w całym łańcuchu dostaw. E-coaching dotyczący ECR to idea pomocy tym osobom nie tylko w uczeniu się i zdobywaniu wiedzy, ale stworzenie możliwości aktywnego kreowania i pomyślnego stosowania procesów uczenia się w ramach indywidualnego toku kształcenia w środowisku wirtualnym (e-coaching). Artykuł przedstawia rezultaty projektu, który ma na celu wdrożenie koncepcji ECR w Polsce i w Niemczech poprzez wprowadzenie tej formy kształcenia dla zrozumienia i stosowania ECR. Przedstawione zostały zależności dydaktyczne oraz założenia, krótko przedstawia istotę i funkcjonalność tej formy nauki, omawia wyniki zastosowania prototypu oraz prezentuje wnioski w zakresie potrzebnej współpracy interdyscyplinarnej oraz potrzeb natury technicznej.

Słowa kluczowe: Efektywna obsługa klienta (ECR), zarządzanie łańcuchem dostaw.

AUF DEM WEG ZU EINEM E-COACH ZUR UNTERSTÜTZUNG DER UMSETZUNG UND EINFÜHRUNG DES EFFICIENT CONSUMER RESPONSE KONZEPTES

ZUSAMMENFASSUNG. Efficient Consumer Response (ECR) ist ein Verbesserungskonzept für Supply Chains, das viele Methoden aus dem Supply Chain Management (SCM) nutzt. Um dieses Konzept in der Praxis umzusetzen und zu betreiben, sind gut ausgebildete Mitarbeiter erforderlich, die entlang der gesamten Supply Chain eng zusammenarbeiten. Der ECR-E-Coach setzt die Idee um, einer Person nicht direkt beim Lernen und Wissenserwerb zu helfen, sondern diese stattdessen beim aktiven Kreieren und erfolgreichen Absolvieren individueller Lernprozesse durch bedarfsgerechtes Führen (d. h. Coaching) in einer virtuellen Umgebung (E-Coaching) zu unterstützen.
Der Beitrag präsentiert die Ergebnisse eines Projektes, das die ECR-Einführung in Polen und Deutschland mit einem E-Coach für das Verstehen und Umsetzen von ECR unterstützen will. Es werden didaktische Implikationen und zu berücksichtigende Gestaltungsgrundlagen kurz eingeführt, der umgesetzte Inhalt und die realisierte Funktionalität des E-

Coaches illustriert, Ergebnisse aus der prototypischen Nutzung und Evaluation diskutiert sowie Erfahrungen und Erkenntnisse in Bezug auf die transnationale, interdisziplinäre Zusammenarbeit und die dabei zu meisternden technischen Herausforderungen zusammengefasst.

Codewörter: Efficient Consumer Response (ECR), Supply Chain Management, e-coach learning.

Jun.-Prof. Dr.-Ing Gaby Neumann
Otto-von-Guericke-University of Magdeburg
Logistics Knowledge Management Group
Magdeburg, Germany
e-mail: gaby.neumann@mb.uni-magdeburg.de

PhD Eng Stanisław Krzyżaniak
Institute of Logistics and Warehousing
ul. Estkowskiego 6
61-755 Poznań, Polska
tel. +48 61 850 49 02
e-mail: Stanislaw.Krzyzaniak@ilim.poznan.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 1
No 2

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

E-COACHING - AN EFFICIENT MEASURE OF PROFESSIONAL DEVELOPMENT FOR SCM SOLUTIONS

Gaby Neumann[1], Stanisław Krzyżaniak[2]

1) Otto-von-Guericke University of Magdeburg, Logistics Knowledge Management Group, Magdeburg, Germany
2) Higher School of Logistics, Poznan, Poland

ABSTRACT. Contemporary supply chains, operating the environment of the global economy, require that development and updating of knowledge, expertise, competences and skills possessed by professionals - logistics managers, keep pace with the development of new concepts, solutions and enabling technologies. At the same time a lot of employees are changing their job profiles, facing new challenges. It is evident that logistics and supply chain management belong to these areas of human activities where a persistent, lifelong education is a must. Traditional ways of training are very often replaced by more sophisticated measures. Coaching, applied both to individual and to teams, is one of the most effective. At the same time rapid development of IT solutions contributes to IT-supported (mainly web-based) distance learning. Numerous examples of successful implementation of e-learning courses now open way to introduction of e-coaching. The paper presents contemporary challenges of supply chains management and the resulting educational needs. Then, based on the introduction of coaching and its technological support, it presents the e-coach idea on the example of Efficient Consumer Response, one of the supply management concepts particularly suitable for implementation of e-coaching.

Key words: Supply Chain Management, e-learning, logistics managers.

SUPPLY CHAIN MANAGEMENT PROBLEMS AND SOLUTIONS

During the last decades, supply chain management has been both an important and a productive aim of corporations. By working to coordinate the production, shipment, and delivery of the goods required to meet their business needs, companies have been able to more easily meet the demands of their customers.

Effective supply chain management solves many of the problems encountered by businesses today. First, the vendors involved in the chain will actually have a clearer idea of what the buyer needs and can then adequately provide for these needs. Slow response times and delays in project start dates also become less frequent because the automated supply chain helps shave the time off of the order placement and fulfilment process. Furthermore, Internet-enabled supply chains generally result in lower costs for all parties involved because when secure relationships are established and when the supply and demand for products is in alignment, the total prices paid by organizations are generally much lower [Lewandowska 2005]. Even though most companies do realize that better supply chain management can benefit their bottom line, too many of them are leery about pursuing modernization and efficiency fully. However, the value exists for companies who wish to make the changes necessary to achieve it.

Citation: Neumann G.,Krzyżaniak St,. 2007, E-Coaching - an efficient measure of professional development for SCM solutions. LogForum 3, 1, 2
URL: http://www.logforum.net/vol3/issue1/no2
Accepted: 10.02.2007, on-line: 15.04.2007.

In terms of supply chain optimization traditional supply chain management is characterized by focusing on independent links that fulfil their own specific task, and seeking for optimization of each link independently. However, this can result in inconsistency when one link adopts a strategy, which conflicts with the strategy adopted by the previous or next link. The results are high logistic costs and low consumer service levels, which eventually can result in less competitive power for every link and thus for the whole chain. Despite the fact that most of the companies are optimizing their links in the chain, practice proves that this is not sufficient. The market is becoming more dynamical and that also counts for relationships with suppliers and consumers. Therefore modern companies must also have an eye for logistic developments outside the walls of their own company. This is where Efficient Consumer Response (ECR) plays an important part.

Efficient Consumer Response is a global movement in the consumer goods industry. The ECR Europe Executive Board expresses the ECR vision as: "working together to fulfil consumer wishes better, faster and at less cost". ECR is thus a realization of a simple, fast and consumer driven system, in which all links of the logistic chain work together, in order to satisfy consumer needs with the lowest possible cost. ECR has a few starting points. Firstly the definition shows that consumer demand plays an important part. The chain has to ensure continual improvement of consumer satisfaction, products, and quality. Secondly, the definition also shows that maximum efficiency of the total logistic chain is required. The realization of the two starting points cannot be done without accurate information, which must be available when needed. To keep the costs low, it is preferred that this information and communication is paperless. [Lewandowska 2006].

To implement and run this concept in practice well-trained personnel are needed closely collaborating throughout the entire supply chain. Taking into account these strong needs for education and training on SCM issues at different levels, sophisticated modules and courses for both training-on-the-job and initial professional education are required. Due to the fact that nowadays supply chains in nearly all sectors are of European or even global nature, these education and training programmes need to be organised and offered across Europe. The easiest and best way to cope with these different requirements seems to be an e-learning (self-learning) approach. Here, rapidly developing information and communication technology provides an ever-increasing variety of e-learning scenarios.

But although a lot is already available, e-learning is not yet a common scenario in logistics and supply chain management education and training - neither in an academic nor business setting. This is mainly caused by the way how those offers were designed: standard learning patterns were implemented; modern pedagogical concepts were poorly taken into consideration; special challenges of problem-based logistics learning were hardly ever addressed. Even lifelong learning is merely a frequently used buzzword; suitable learning offers, methods and tools supporting it are still rare. In addition to this, technical basis and available IT infrastructure vary considerably across Europe. Whereas situation in some countries meets very high technical standards not just at universities or in companies, but in private households as well, in some other countries conditions are still characterized by many limitations, for example poor telecommunication infrastructure, high costs of internet access and low availability of funds on IT. As a result, in these countries only a few academic centres and other educational institutions are offering pilot programs of e-learning courses.

In order to overcome these limitations and to provide wide-area support for logistics and supply chain management education rapidly changing technology needs to be subject of ongoing research and development in learning content and goal definition as well as logistics pedagogy. For this, ECR has been adopted as an exemplary area where the idea of e-coaching can be developed and implemented.

FROM TEACHING TO COACHING

Learning in general is about the acquisition of knowledge or skills. The purpose of acquiring knowledge on one hand and skills on the other differs [Pahl 2004]:

- Knowledge acquisition refers to declarative knowledge, i.e. facts. The objective of the learner is to be able to reason about knowledge. The style of learning is often classical studying, usually referred to by the term learning.
- Skills acquisition denotes to procedural knowledge, i.e. instructions. The objective of the learner is to be able to perform instructions and procedures. The style of learning is often training.

Jonassen (1991) distinguishes three stages of knowledge acquisition (see Figure 1). In initial knowledge acquisition the learners study individually with materials that are goal-based (i.e. learners can study to meet clear goals) and structured in small steps (i.e. contents are divided into steps and indexed to allow step-by-step learning to beginners and selective learning to more advanced learners). At the level of advanced knowledge acquisition, instructors have difficulties in structuring the contents, so situated learning is recommended. The learners should be given the work and challenged to use the skills from the initial knowledge acquisition stage while proceeding. For being able to assist the learners in this way of knowledge acquisition teaching assistants or more advanced students acting as supporters in the learning process of course need to have acquired the respective knowledge beforehand.

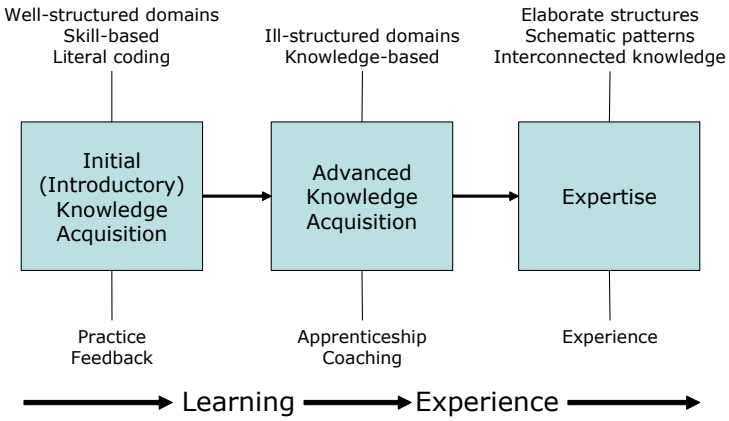


Fig. 1. Three stages of knowledge acquisition [Jonassen 1991]
Rys. 1. Trzy etapy opanowywania wiedzy [Jonassen 1991]

From the didactics point of view this training support needs to be based upon a constructivist design, which assumes that in principle knowledge cannot be imparted by a teacher or trainer, but results from self-constructing ideas and concepts by the learner or trainee. The trainer supports this process by providing hints and feedback; his/her role changes from being a teacher towards acting as a coach. The task of such coach consists in non-directive questioning and helping coachees to analyse and address their own challenges rather than offering advice or direction.

Through coaching meta-level information capturing a master's advice and feedback regarding knowledge, activity, and other learning actions is communicated. The pedagogical framework for this is formulated by the cognitive apprenticeship theory [Collins et al. 1989]: in general an apprentice is a learner who is coached by a master to perform a specific task. Based on this, the theory transfers the traditional apprenticeship model as known from crafts, trade and industry to the cognitive domain. More precise, cognitive apprenticeship aims at externalising processes that are usually carried out internally. This approach works with methods like modelling, coaching, scaffolding, articulation, reflection and exploration.

Against this background coaching is to be understood as helping a person in actively creating and successfully passing individual learning processes through guidance-on-demand [Neumann 2006]. It is a highly focused process that unlocks potential and maximizes performance at both the individual and organizational levels. It helps people gain clarity, remove self-imposed limitations and increase their

self-reliance, so they can better leverage their strengths and help others to do the same. Coaching helps individuals to develop critical insight, bringing a new sense of purpose to their actions. It helps them to see where they are, where they want to go to, and how to get there. It stirs them to contribute more. Coaching is a formal system that results in positive, lasting change.

TECHNOLOGICAL SUPPORT OF COACHING IN PROFESSIONAL TRAINING

There have been many terms to describe the use of technology for learning, but most are either antiquated or no longer appropriate for a digital world. Nowadays, e-learning is the term used to describe web-based learning scenarios enabling anyone to learn anywhere at anytime. It refers to the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance [Rosenberg 2001].

In contrast to e-learning, e-coaching is coaching delivered over an electronic medium, i.e. the master's role of the apprenticeship model as described in the previous section is replaced, for example, by an intelligent agent. It focuses on the same goals as regular coaching. A coach's goal would be to facilitate client growth and potential by assisting them in identifying needs, developing goals, building strategies to meet these goals, and providing support and encouragement in order to ensure these goals may be met. E-learning by itself addresses more the use of technology for teaching, where e-coaching has the power to represent a 'teacher' in the process.

Consequently, coaching systems differ from instructional (e-learning) systems that only present subject matter (domain knowledge) and that only check whether the student has understood the presented material. Coaching systems are computer programs that provide an environment for learners to acquire skills in applying domain knowledge and that assess and correct learners in their performance. In a coaching system the coachee performs a task and the system (the e-coach) interprets the performance of a student, i.e. it monitors discrepancies between intended results and actual results. If a discrepancy is identified this is viewed as an error or inefficiency, a deviation from what should be the case. Errors are assumed to have causes, and the identification of causes of errors is called diagnosis. The functional components distinguished are:

- An environment to enable the task to be learned or trained;
- A monitoring component to observe and interpret the student's behaviour while s/he is performing the task and to identify that there is a deviation;
- A diagnoser to identify the cause of the deviation;
- A coach to assist and instruct the student;
- A student model.

Muntjewerff and DeTombe [2004] describe the example of an e-coaching system called e-See - an instructional environment for training an essential part of legal problem solving: the construction of a case description involving the selection and ascertaining of facts from a real life dispute. In e-See the student is facilitated and encouraged to work in a systematic way, the chances to miss or leave something out are nil, the student does not have to manage his or her information and s/he does not have to keep track since the coach takes care of this. Furthermore, a distinction is made between the environment and the coach. The environment defines or instantiates some problem or goal to be achieved and specifies (makes explicit) the conditions (situation) in which the problem is to be solved or this goal is to be achieved. The coach focuses on the learning or training of the skill to be acquired. It may vary on task performance that is required or allowed and, related, on the tutorial style from constrained to totally free. In the constrained setting there is an explicit setting of the task. This task is differentiated into a task-directed problem or exercise, the goal is stated and the sub-tasks that have to be carried out are traced. In the more free setting a situation only is presented to the student and the coaching system asks him or her to explore the environment on the basis of this situation without explicitly setting a task. The coach either appearing in the form of textual feedback and hints or as

a pedagogical agent embedded in the environment provides support in two different types: support on demand and immediate feedback.

Pre-condition is the application of constructivism and implementation of the cognitive apprenticeship model in a coaching system. Those coaching systems may differ in three main factors: (i) the degree of similarity of the environment presented to train or learn the task in comparison with the real environment; (ii) the degree of freedom the student has in performing the task; (iii) the degree to which a coaching system is able to 'understand' what the student is doing and what his/her results mean. Here, it is the main task of the coach to encourage and support individual knowledge construction processes with the learner, but not really to control them. More precisely, a coach should be responsible for activating the learner, initiate a (natural and individual) learning process, and create meta-cognition and tolerance with regard to other perspectives [Holzinger 2001]. Furthermore, the coach (i.e. the expert or a system) offers support in case of difficulties (i.e. scaffolding), provides hints, feedback and recommendations, and eventually takes over certain steps for solving the given problem. However, the coach only appears when explicitly being called by the learner (i.e. like a help system) and the scaffolding is gradually fading as the learner proceeds. So, coaching aims to develop heuristic strategies through establishing a culture of expertise and with this goes far beyond pure e-learning as typically provided in virtual learning environments.

THE IDEA AND VISION OF AN SCM E-COACH ON THE EXAMPLE OF THE ECR CONCEPT

Taking into consideration both aspects, i.e. the need for training support on the implementation and execution of the ECR concept as well as the chance a coaching approach and especially e-coaching offers, implementation of ECR strategies in Poland and Germany was supposed to be supported by providing an e-coach for understanding and implementing ECR [Neumann et al. 2006]. This ECR e-coach will be a unique supporter for the gaining, training and application of ECR knowledge and competence. For this, it is based upon high-quality multimedia learning material, interactive assessment procedures and a library of terms and methods, examples and best practices, and guidelines for efficiently, effectively and successfully implementing ECR strategies into supply chains. These elements are composed to form attractive e-learning modules on the ECR topic in English, German and Polish languages. Due to their well-structured design they can be built in the learning management system of local preference (i.e. Lotus Learning Space, WebCT, Moodle, etc.) to meet specific needs of the different target groups of both university students (undergraduates as well as postgraduates) and logistics professionals (training-on-the-job). Introduction of the e-coach into traditional education and training programmes will enable to apply a blended learning methodology for the specific target group and learning content.

But the e-coach is not just a framework for delivering learning material and accompanying learning processes. It also provides additional coaching functionality for the pre-learning process assisting the user in identifying both his/her individual learning needs and the subject matter or context they are settled in. With this, special focus is put on increasing the active role of a learner in the learning process and especially his/her responsibility for the design and success of the learning. Instead of learning what a teacher has decided to be learned, the learner is supported in understanding what the practical problem is s/he might have and which knowledge on theories, methods, procedures, best practices etc. might be of help to deal with the problem and finally solve it. This specifies the subject area and topics to be mastered. Furthermore, and even if an experienced practitioner would be able to self-identify the context of a problem him/herself, in a second step the e-coach requires and supports self-reflection of own knowledge and competence in these fields. In the end, a learning process is created that is tailor-made to the individual needs of the learner and customized for his/her personal level of understanding and competence.

This methodological support describes the difference between the coaching and a teaching/training approach. Using information and communication technologies as well as intelligent case-based

reasoning in this process allows decoupling human coaches from somehow being permanently on call. Thus, the ECR e-coach will be a personal coach available anywhere and anytime to react on individual needs for support. With this the e-coach goes far beyond what is already available across Europe to support ECR-related training, e.g. under the framework of the ECR Europe General Learning Programme [Penning and Karli 2004] which currently comprises a variety of traditional class-room based courses and seminars (http://www.ecrnet.org) only. Consequently, a learner is required to be on-the-spot for participating in the workshops and gain condensed knowledge on a certain aspect of ECR. The ECR e-coach will of course not replace those offers in total, but it is to be understood as an additional opportunity to refresh or extend knowledge directly in the context of a specific problem s/he has to deal with in his/her professional environment (training-on-the-job). Furthermore, it will allow university students to get in touch with ECR-related topics even when their home universities do not offer special courses on ECR or just mention this concept within supply chain education of different focus.

HOW THE ECR E-COACH IS SUPPOSED TO WORK

Corresponding to the nature of ECR as being based on knowledge from different fields and dealing with various and diverse problems the ECR e-coach implements a matrix approach reflecting these two main basic perspectives. First of all, the e-coach should help the coachee to identify his/her individual needs:

- developing knowledge and skills in a certain ECR-related area heading to better performance in and ability of problem solving, or
- tackling a just encountered specific problem in the company or supply chain collaboration as a primary task.

These two reasons for accessing (taking advantage of) the e-coach may be interlinked and therefore may intertwine in the course of the coaching and learning process. The final result - in terms of gained knowledge and skills as well as an ability to identify and solve a problem - can be the same, but the stresses will be put in different ways. Taking this into consideration the ECR e-coach needs to consist of two functional components: a diagnosis system and a learning environment.

A well structured and comprehensive diagnosis system forms the key part for starting the learning process (see Figure 2). As already explained above it helps in identifying and specifying individual learning needs and thus in initiating and self-creating a personalized learning process. For this, the diagnosis system is composed of different types of testing tools leading - in an automatic way - to the following conclusions:

- Which problem in supply chain management do I have to deal with, when observing particular symptoms in my own company or supply chain?
- What is the particular field of knowledge - the learning context - my personal interests/needs are settled down in?
- What is my specific learning goal: gaining knowledge or solving a problem?
- What is my initial state of knowledge or competence level regarding my personal learning context and goal?

Depending on the outcomes of the diagnosis process the coached person is guided on either a knowledge-oriented or rather a problem-oriented path of learning modules matching with his/her learning context and level (see Figure 3). As shown in Figure 2, a knowledge-oriented path (A) focuses on a particular aspect or subject area of ECR and allows gaining relatively wide-area knowledge in this field (but perhaps at varying levels of detail). Following such a path also helps to answer questions like:

- Which are the problems this particular knowledge is relevant for?

– If I go through those modules which kind of problems I can better deal with afterwards?

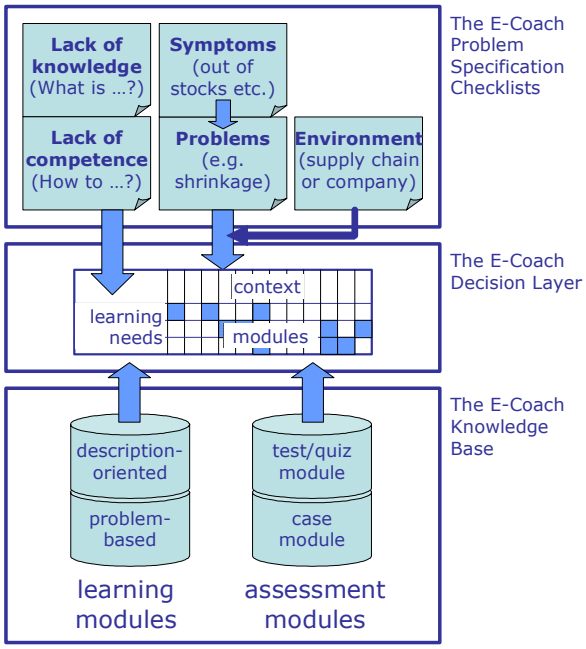


Fig. 2. The ECR e-coach structure
Rys. 2. Struktura e-kształcenie w obszarze ECR

This way, any knowledge-oriented path also contributes to strengthen problem-solving competence related to the implementation of ECR in a supply chain. In difference to this a problem-oriented path (B) clearly aims at developing much more specific problem-solving competence by providing instructions and methodical knowledge on how to solve a particular problem. It especially helps to answer questions like:

– Knowledge from which fields might be of help to solve my particular problem?
– In which directions I might think to find a solution to my particular problem?

In the end, those modules which might belong to a particular path corresponding to the individual needs are identified each of them dealing with certain aspects of understanding and implementing Efficient Consumer Response in supply chains. Step (C) in the diagnosis process then decides about what a user should be recommended:

– Am I able to solve a respective problem related to the identified aspect of ECR? => If so, we, for example, might propose to go for examination of knowledge or certification of competence.
– Do I need to know more about this particular aspect of ECR? => If so, we would initiate a learning process and propose a learning path for this, which is offered and guided-on-demand by the e-coach's learning environment.

The learning environment of the ECR e-coach is formed by a learning management system with a number of modules as well as a wide range of information and communication tools embedded in it. To ensure functionality as described above the modules belong to the following main categories:

– Description-oriented modules deliver knowledge on a specific aspect of ECR such as shrinkage or RFID technology (What is …?).
– Problem-based modules provide relevant knowledge for identifying, specifying and solving a particular problem, like shrinkage reduction or application of RFID technology in supply chains (How to …?).

– Assessment modules enable individual knowledge application and evaluation within tests/quizzes at different levels of difficulty with extended feedback being provided to the user.

– A case study module supports free knowledge application within an interactive supply chain scenario by running case studies at four levels of difficulty.

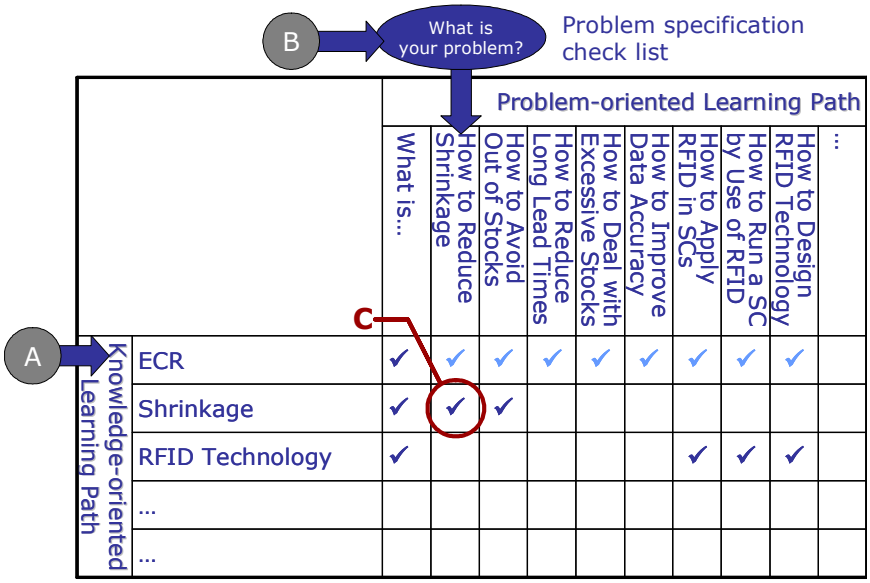


Fig. 3. How the ECR e-coach works
Rys. 3. Jak działa e-kształcenie w obszarze ECR

With this, customization and individualisation of a user's learning process and learning path according to his/her needs (resulting from current skills and knowledge level as well as the required target competences) become possible by purposefully selecting the suitable modules.

A similar amount of flexibility and sensitivity to user needs will also be provided by the diagnosis system. Generally, the diagnosis process (which from the practical point of view can be based on a kind of a questionnaire or even check list) will dynamically self-adapt to the user in the course of responding to the questions depending on the answers given. This means there are no fixed standard set and sequence of questions to be answered, but a step-by-step selection and presentation of questions following the authoring-on-the-fly principle instead. In some case also some additional or even "double check" questions may be asked. It is obvious that in the case where rather problem-oriented needs have been identified the questioning process will be longer and more sophisticated to get the right picture on the exact nature and complexity of the problem and to configure the most appropriate path through the matrix of modules and/or their particular components. In practice the outcome of this pre-learning and identification process will be a set of tags set along the learning path defining subsequent steps and measures checking and testing achieved results and thus verifying originally defined learning paths. This eventually can lead to a dynamic reconfiguration of the learning path; the procedure for this is included in the e-coach as well. Furthermore, the results of the intermediate tests will be used not only for reconfiguration, but also for repeating a certain module or suggesting/initiating additional learning loops.

This general approach determines the ECR e-coach functionality. As it has been said, the most characteristic feature of the presented concept is its matrix structure (as depicted in Figures 2 and 3). With this, it supports both, the knowledge- and the problem-oriented approach within a customizable procedure. The crucial challenge for bringing the e-coach concept to life consists in implementing its matrix-based coaching functionality:

- Structure and sub-structure knowledge on ECR-related aspects and problems in modules.
- Define all relevant links between particular modules.
- Develop a reliable diagnostic system helping a user to identify his/her weak points and suggest suitable modules.

SUMMARY AND CONCLUSIONS

The nature of contemporary economy characterised by global sourcing and markets causes that supply chains and logistics networks play a more and more important role. Effective supply chain management has become a critical factor in the successful delivery of goods to the customers. There are many concepts and solutions well developed and known on the theoretical level which - if and when successfully and fully implemented - might significantly improve the performance of companies involved in the process, thus helping all of them (as supply chain links) compete on the market. Furthermore there are enabling technologies available, with ICT being the most important one, which make implementation of these concepts realistic and feasible. So, why there are so relatively few examples of best practices in SCM, why implementations are partial, limited to selected elements of new concepts and strategies? Why, even a seemingly successful ECR concept faces a number of problems and obstacles when it comes to full, practical implementation? It seems that these failures or at least limited success rates result from the lack of awareness as well as skills and competences with employees (both on managerial and operational levels), responsible for successful implementation and efficient performance of particular SCM concepts and solutions.

It is widely recognised that life-long learning becomes a must in the contemporary world, especially where technology is a driving force. A number of various courses, training sessions, studies and workshops are being offered nowadays to companies covering both: job-related and soft skills. At the same time new educational concepts for professionals are developed and offered to employers and employees. One of them is coaching which consists in configuring individual training and even educational paths - for individuals and groups of employees - based on recognised gaps in knowledge, skills and competences indicating individual educational needs. It is evident that applying the pedagogical principle of coaching to the supply chain field can be a very efficient way to significantly improve competencies.

But it is also evident that in many branches it is extremely hard for employees to attend regular courses, which usually require time devotion, travelling, and means - i.e. in general temporary quitting of one's professional duties. This applies to logisticians as well and is particularly troublesome, thus in some instances - especially in case of small enterprises - simply unacceptable. The idea of distant learning comes here as a good alternative to traditional means of education. Nowadays "distant learning" is supported by ICT solutions and internet (web-based) education has been arousing higher and higher interest for some time. Numerous e-courses offered by many training centres and universities are available in Europe these days - also in the field of logistics and supply chain management. E-coaching seems to be the next logical step in the process of educational transformation.

The concept of an e-coach presented in this paper gives a general idea on how such tool could be designed. Efficient Consumer Response - an SCM concept, which seems exceptionally interesting as a subject for testing the e-coach approach - has been selected by the authors for more detailed presentation on how such an SCM e-coach might work. The presented concept seems realistic and feasible; its starting point should be a set of modules: description-oriented, problem based and assessment-focused ones, ready to be interlined in the e-coach matrix system.

REFERENCES

Collins A., Brown J. S., Newman S. E., 1989, Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In: L. B. Resnick (ed.), Knowing, learning, and instruction. Hillsdale, NJ: Lawrence Erlbaum Associates, pp. 453-494.

Holzinger A., 2001, Basiswissen Multimedia. Bd. 2. Lernen: kognitive Grundlagen multimedialer Informationssysteme. Würzburg: Vogel.

Jonassen D. H., 1991. Evaluating Constructivistic Learning. Educational Technology, 31(9), pp. 28-33.

Lewandowska J., 2005, Determinants and Instruments of Supply Chain Effectiveness Creation in the FMCG Sector. Doctoral thesis, University of Economics, Poznań.

Lewandowska J., 2006, ECR as a Concept for Supply Chain Functioning. In: MSL - Magdeburger Schriften zur Logistik 23, pp. 3-16.

Muntjewerff A. J., DeTombe D.J., 2004, A Generic Environment for Integrating Streaming Video in Legal Education e-See. In: Proceedings of ED-MEDIA World Conference on Educational Multimedia and Hypermedia, pp. 527-532.

Neumann G., 2006, E-Coaching - a Constructivist Approach to Professional Education and Training in Logistics. In: MSL - Magdeburger Schriften zur Logistik 23, pp. 17-25.

Neumann G., Krzyzaniak S., Lewandowska J, Boruta M., 2006, E-Coach for Understanding and Implementing Efficient Consumer Response in Supply Chains. In: MSL - Magdeburger Schriften zur Logistik 23, pp. 27-36.

Pahl C., 2004, A Taxonomy for Interactive Educational Multimedia. In: Proceedings of ED-MEDIA World Conference on Educational Multimedia and Hypermedia, pp. 610-617.

Penning S., Karli B., 2004, General Learning Programme. Guiding Principles. ECR Europe 2004.

Rosenberg M. J., 2001, E-Learning. Strategies for Delivering Knowledge in the Digital Age. New York: Mc Graw-Hill.

E-COACHING - SKUTECZNE WSPARCIE ROZWOJU ZAWODOWEGO W OBSZARZE ZARZĄDZANIA ŁAŃCUCHEM DOSTAW

STRESZCZENIE. Nowoczesne łańcuchy dostaw, działające w gospodarce globalnej, wymagają ciągłego uaktualniania wiedzy, doświadczenia i umiejętności pracowników - menadżerów logistyki w zakresie rozwoju nowych koncepcji, rozwiązań i możliwych do zastosowania technologii. Jednocześnie wielu pracowników zmienia profil zawodowy, podejmując nowe wyzwania. Jest oczywiste, że zarządzanie łańcuchem dostaw to jeden z obszarów, gdzie konieczne jest stałe aktualizowanie wiedzy przez cały okres pracy zawodowej. Tradycyjne metody nauki są zastępowane przez bardziej nowoczesne. Coaching, zarówno w przypadku poszczególnych osób, jak i grup, jest jedną z najbardziej efektywnych. Jednocześnie szybki rozwój technologii informatycznych przyczynia się do rozpowszechniania opartego na rozwiązaniach internetowych nauczania na odległość. Wiele przykładów pomyślnego wdrożenia tej techniki kształcenia otwiera drogę do wprowadzania e-coachingu. Artykuł prezentuje aktualne wyzwania stawiane zarządzaniu łańcuchem dostaw i wynikające z nich potrzeby edukacyjne. Następnie, opierając się na zaprezentowanych na wstępie zasad coachingu i jego technicznego wsparcia, przedstawia ideę kształcenia metodą e-coach na przykładzie koncepcji ECR, ponieważ wydaje się ona szczególnie interesująca z punktu widzenia zastosowania tej formy kształcenia.

Słowa kluczowe: zarządzanie łańcuchem dostaw, nauczanie na odległość, menedżerowie logistyki.

Neumann G.,Krzyżaniak St,. 2007, E-Coaching - an efficient measure of professional development for SCM solutions. LogForum 3, 1, 2.
URL: http://www.logforum.net/vol3/issue1/no2

E-COACHING - EINE EFFIZIENTE MAßNAHME FÜR DIE MITARBEITERENTWICKLUNG IM SUPPLY CHAIN MANAGEMENT

ZUSAMMENFASSUNG. Moderne Supply Chains in einer globalen Wirtschaft machen es erforderlich, Wissen, Fachkenntnisse, Kompetenzen und Fähigkeiten der Logistikmanager im Gleichschritt mit der Entwicklung immer neuer Konzepte, Lösungen und unterstützender Technologien herauszubilden und zu aktualisieren. Gleichzeitig verändern sich für viele Mitarbeiter die Tätigkeitsfelder; sie sehen sich neuen Herausforderungen gegenübergestellt. Es ist offensichtlich, dass Logistik und Supply Chain Management damit zu den Bereichen menschlicher Aktivität gehören, in denen fortgesetztes lebenslanges Lernen ein Muss ist. Die traditionelle Weiterbildung wird dabei sehr häufig durch anspruchsvollere Maßnahmen ersetzt, unter denen das Coaching sowohl des Einzelnen als auch eines Teams eine der wirksamsten darstellt. Die rapide Weiterentwicklung der IT-Lösungen ermöglicht mehr und mehr IT-gestütztes (zumeist web-basiertes) Fernlernen; die Vielzahl erfolgreicher E-Learning-Implementationen öffnet den Weg zur Einführung des E-Coaching.
Der Beitrag präsentiert aktuelle Herausforderungen an das Supply Chain Management und die daraus resultierenden Aus- und Weiterbildungsbedürfnisse. Nach einer Einführung in das Coaching und seine technische Unterstützung wird die Idee eines E-Coaches für das Gebiet des Efficient Consumer Response exemplarisch vorgestellt, da dieses Konzept des Supply Chain Management als besonders geeignet für die Umsetzung des E-Coaching-Ansatzes anzusehen ist.

Codewörter: Supply Chain Management, E-learning, Logistikmanager.

Jun.-Prof. Dr.-Ing Gaby Neumann
Otto-von-Guericke-University of Magdeburg
Logistics Knowledge Management Group
Magdeburg, Germany
e-mail: gaby.neumann@mb.uni-magdeburg.de

PhD Eng Stanisław Krzyżaniak
Higher School of Logistics
ul. Estkowskiego 6
61-755 Poznań, Polska
tel. +48 61 850 49 02
e-mail: Stanislaw.Krzyzaniak@ilim.poznan.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 1
No 3

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

REICO SPEDITION FOCUSES RFID ON THE BACKTRACKING OF FOOD

Marcel Janke[1], Keith Thorne[1], Theodor Rimmele[2], Thomas Lübbe[2]

[1)] University of Applied Sciences, Wildau, Germany, [2)] ReiCo Spedition, Nunsdorf, Germany

ABSTRACT. The German logistics company ReiCo Spedition in Nunsdorf (Zossen, Brandenburg) has successfully implemented and tested a system to backtrack goods dispatched through the transport chains of two large food suppliers - Nordmilch and Frischdienst, together with the Technische Fachhochschule Wildau (University of Applied Sciences Wildau). The pilot project called RÜFILOG - "Backtracking through the application of RFID-Technology in Transport Logistics for small and medium-sized enterprises for cool and fresh goods" is promoted by the support of the Stiftung Industrieforschung (Foundation for Industrial Development). The European Union regulation No. 178/2002, which came into force on the 1st January 2005, created the need for an efficient procedure for the backtracking of goods to, and from ReiCo.

Key words: RFID, transport logistics, traceability, information system, identification.

SELECTED TRANSPORT CHAINS

In the first transport chain which begins from Nordmilch, through ReiCo, to the end customer, complete pallets, loaded with the articles UHT-milk or UHT-cocoa, are the primarily transported goods. In the second transport chain, which is operated in co-operation with Frischdienst, fresh fish, with so-called "Düsseldorfer" pallets (half pallets), is transported. The UHT-milk and UHT-cocoa, articles were selected as the test articles as they are, on the one-hand, unproblematic to handle and on the other hand represent a challenge for the use of the RFID technology, as liquids and metals can impair the collection of information via RFID. Additionally the transport chain represents a large part of the incoming and outgoing transport flows of ReiCo. The reason for the inclusion of fresh fish into the project is due to the temperature sensitivity of the product and its very short use-by period.

WHY RFID IS SUITABLE TO SOLVE THIS PROBLEM

The problem of backtracking goods through a transport chain is one that can be solved in many different ways, for example through manually documenting flow of goods, or through the use of barcodes. For the RÜFILOG Project, it was decided to utilise the relatively new RFID technology as the solution to the problem. The reasons for this are numerous. RFID allows the development of partly automated or fully automated systems, with little need for human interaction. RFID can potentially hold a large amount of data, which can make tracking of goods easier, and, when fully developed as

Citation: Janke M., Thorne K., Rimmele T., Lübbe T., 2007, ReiCo Spedition focuses RFID on the backtracking of food. LogForum 3, 1, 3
URL: http://www.logforum.net/vol3/issue1/no3
Accepted: 10.02.2007, on-line: 15.04.2007.

part of the RÜFILOG project, can also be utilised as a medium to help with warehouse management, stock control and inventory taking, to name but a few possible applications of this technology. Although barcodes can be used to perform many of the above tasks, it has some fundamental differences to RFID technology, which ultimately rules it out as a possible solution for the problem this project is attempting to solve:

Table 1. SWOT Analysis of RFID vs. Barcode technology
Tabela 1. Analiza SWOT technologii RFID w porównania z systemem kodów kreskowych

	RFID	**Barcode**
Strengths	Increased efficiency. Higher information storage. Automated stock control. Very durable. Does not need to be "line of sight". RFID Tags can be reusable.	Mature, widely used technology. Highly standardised (EAN/UCC). Cost effective, relatively cheap.
Weaknesses	New technology, not widely accepted. No formalised industry standards. Expensive. Possible interference from other electrical devices. Possible interference of reading RFID transponder due to proximity to metal objects. Not tamper proof.	Not very durable. Direct line-of-sight required for reading. Not tamper proof. Limited amount of information storage.
Opportunities	Can provide new methods for the transporting and storage of goods, for example, intelligent stock management. A lot of possibility for growth. Prices will fall as technology becomes more common. Can provide competitive advantage over others that still use barcode. Frequent new development of RFID technology. Industry standards are being put in place.	Ability to couple with RFID technology.
Threats	Industry and public acceptance. Possible security and privacy implications. Technology not yet secure against tampering and scanning by third parties. Lack of standards. As tags become more advanced, possibility of virus or malware software being introduced.	Could possibly be replaced by RFID technology in the future. Not tamper proof.

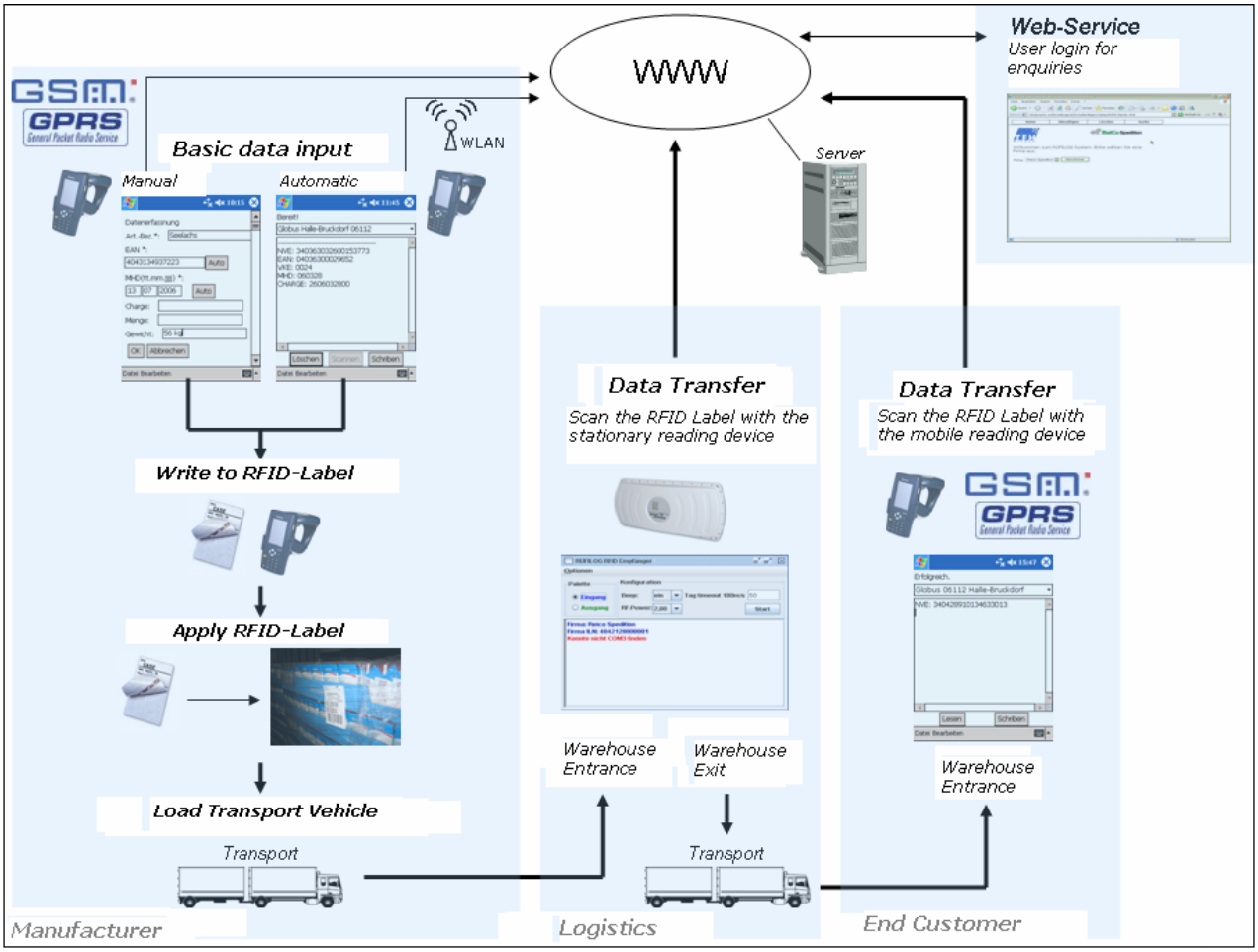
IT CONCEPT TO ENSURE THE BACKTRACKING OF GOODS

The hub of the RÜFILOG System is the RÜFILOG Web Server. This acts as the central data storage and the main data processing points for all partners involved in the transport chain. All information gathered from other sources is transmitted back to the central server via the http protocol, where it is processed and stored in a database. The RÜFILOG Web Server is a flexible, open-ended IT system, which has potentially unlimited room for expansion, which ensures that other partners and further, longer, more complex transport chains can be included into easily into the system.

In order to ensure that all partners involved in the RÜFILOG System can have quick and easy access to the information stored on the central server, the database can be accessed through an Internet based user interface. Secured through a user login process, which ensure that sensitive information cannot be seen by those without the proper access, qualified users can view, edit and delete information related to their transport chains, as well as perform searches on goods and pallets stored in the database, the results of which display the entire transport chain for the returned items, from manufacturer to retailer.

The information that is stored in the RÜFILOG Web Server can be gathered through a variety of ways, for example through the scanning of pallet barcodes using hand-held mobile devices, manually

added the information via the web server portal, or through the connection of the RÜFILOG Web Server to an existing Warehouse Management System.



Source: Intermec Technologies, Deister Electronic, Own design

Fig. 1. Overview Functional
Rys. 1. Schemat przepływu

Thus, to accomplish the successful backtracking of goods within a transport chain, a robust, adaptable IT solution must be developed that utilises the advantages provided by modern RFID technology, including the use of mobile RFID readers, WLAN and GPRS, coupled with ease of use and open availability of information to all those involved in the supply chain. A mixture of this new RFID hardware technology, supported by a strong Java web server, can provide a firm base on which to build a solid, multi-functional, IT application.

HOW DOES THE OVERALL SYSTEM FUNCTION AND WHERE IS RFID USED EXACTLY

With the pre-project technical tests it turned out that the selection of suitable technical components containing RFID technology would play a central role. At present there are numerous RFID systems which can be used for a task such as this that can be found on the market. Within the range of stationary devices, the decision fell to a system from Deister Electronics, specifically their UDL-500, which works in the UHF band and with its compactness, efficiency and functionality for development within the RÜFILOG system it was almost ideally suited. In the range of mobile devices, the selection

was narrowed down to the joint system from Intermec, comprising a 700 series mobile computer with an integrated bar code reader and the IP4 RFID reading device. This system works likewise in the UHF-band and is multi-protocol-capable, which means that it can read and write to transponders both of the ISO Standard 18000-6B range and the Philips UCODE 1.19 range. In the project two different device configurations where tested, which differ in communication techniques. One system communicated with the central RÜFILOG Server via the Internet over WLAN, the other could send data directly to the server via a GPRS interface.

In the selecting of the RFID label, it was made certain that both the stationary reader and the mobile devices could be developed with an acceptable level of communication with the appropriate label. In laboratory tests the UHF-RFID Label from Intermec with the ISO 18000-6 specification proved suitable. For the future has been recommended that the label should be changed to the new standard of EPC Class 1 Gen 2 since this label has a higher range.

During the software development of the control interface for the mobile device, attention was paid to making it as simple and intuitive as possible for user operations. Therefore a substantial part of the component is the status screen of the mobile collection device, which displays the most important actions and information to the user. Thus the user can always see whether their actions were successful or whether some complications arose.

TEST APPLICATION

In the Nordmilch transport chain, the data for the backtracking is collected with a hand barcode scanner (integrated in the mobile device) and is sent over a WLAN interface via the internet to the information system. Afterwards the NVE (Nummer der Versandeinheit, the German equivalent of the SSCC, or Serial Shipping Container Code) data is written to an RFID-label on the associated dispatch unit. Thus the collected dispatch units are stored in the information system as outgoing goods of the manufacturer.

Source: Nordmilch eG

Fig. 2. Scanning a pallet bar-code with a hand-held mobile computer
Rys. 2. Skanowanie etykiety z kodem kreskowym przy użyciu terminala przenośnego

If the dispatch units are then dispatched, in this case to ReiCo Spedition, the goods are then registered at the warehouse entrance. In addition at ReiCo Spedition, the stationary RFID reading device is placed directly by the in/out-going ramps of the warehouse. As soon as the dispatch unit with an RFID label approaches the reader, an acoustic and optical signal is given. This signal signifies that

the dispatch unit has passed this reader and identification of the goods in the warehouse entrance has taken place.

The receiving software is configured in such a way that in the case that a double reading is taken, only one data record is accepted, and all others are ignored. Through the information system it is viewable where this dispatch unit can be found in the transport area and who transported it. The warehouse exit routine follows the same principle as the warehouse entrance. The documented information regarding the path of the dispatch unit can be reconstructed with the help of the information system and can be used for research and control purposes.

In the case of Frischdienst Berlin, the process of the first version turned out some-what differently. Identification systems such as bar codes or their equivalents do not exist here. The collectable data of the commodity is accessible only via a delivery note, which is on conventional paper as plain language. In order to be able to collect the article data, a form for the mobile device was developed, into which all of the necessary information is entered. This part is somewhat complex in regards to entering the data, but is necessary if the relevant data is to be collected for backtracking purposes. A second version of the data collection software for the mobile device already exists. It makes possible the selection of default articles that are related to a chosen manufacturer, so that errors are avoided during input. Since in this transport chain no NVE exists, a unique NVE number is automatically generated, which is then written to the RFID-Label of the associated dispatch unit. Future transport and goods collection processes are more likely to follow the Nordmilch transport chain.

RESULTS

ReiCo Spedition, as partners of the research development project, promises itself a substantial reduction of search and investigation times and a closer connection to the customer due to the service offered. Beyond that a competition advantage exists by the advertisement of integrated contract logistics services.

Further, ReiCo Spedition sees that the labeled products can be completely back-tracked, from the place of manufacture, to the place where they will be sold on the shelves, whereby further multilayered advantages can result:

- Continuous transport status from acceptance up to the distribution.
- Transparent and permanent Temperature and Quality control.
- Automatic transport location - Security components.
- Automatic loading aid management - Pallets.
- Automatic empties control and management (E2-Boxes, H1-Pallets etc.).
- Automatic transport collection in the logistics program as well as transport accounting.
- Automated evaluations etc.

After the initial costs of purchasing equipment, and once RFID-Label reach an optimum price (the cost of RFID-Labels, although expensive now, is generally considered to drop to around 0.05€ within the next two years), a SME company could see a return on their investment of nearly 80% after 2 years, with an amortisation of the investment after just over 2 years.

Implementing the RÜFILOG System or, indeed, any other type of RFID system, into other small or medium sized transport companies would require an investment not only in terms of money, but also in the training of staff and the readjustment of internal processes in order to accommodate the new system. However, as shown above, these initial costs could be mostly recouped within 2 years, with the added possibility of increased revenue due to increased efficiency and more satisfied customers.

RESUME

Through the RÜFILOG project, it has been proven that the use of RFID technology within a transport chain can provide real benefits including greater efficiency, less user-interaction and, of course, faster traceability of goods that have passed through the transport chain. However, this has only been the first phase in the development of the RÜFILOG system, and although the current system can already prove the benefits of RFID technology, there is more than can be done to improve the capability and the usability of the system and the hardware.

Although the current cost of RFID technology is high in relation to existing methods, such as barcodes, with international companies such as Wal-Mart or Gillette pushing for greater use of RFID, then the prediction is that the cost of the hardware and the transponders will fall to levels more in line with the resources available to small and medium enterprises.

The hope is that through the high acceptance of the project by potential customers, in co-operation with the projects exclusive partner - Technische Fachhochschule Wildau - the test phase will shortly be completed and gradually the investments, as well as the subsequent, necessary development of the software, which will provide a higher level of automation for the benefit to the customer and will allow the project to be converted to a larger, genuine enterprise.

REFERENCES

Finkenzeller K., 2002, RFID-Handbuch. Hanser Fachbuchverlag, München.

Oelfke W., 2002, Güterverkehr-Spedition-Logistik. Bildungsverlag Eins, s.199, Troisdorf.

Ten Hompel M., 2005, Software in der Logistik 2005. Huss Verlag, München.

Dodel H., Häupler D., 2004, Satellitennavigation. Verlag Moderne Industrie Buch AG & Co. KG., Landsberg.

Eberspächer J., et al., 2001, GSM Global System for Mobile Communication. Verlag Teubner GmbH, Stuttgart.

ECR Schwerpunkt, Lebensmittelzeitung, 2005, LZ 35 vom 2.September 2005, s. 72.

FTK Forschungsinstitut für Telekommunikation, 2004, Beratungszentrum für eLogistik; Funkschau Ausgabe 13/2004.

Gale T., et al., 2006, The Impact of RFID on Supply Chain Performance, http://som.utdallas.edu/c4isn/documents/c4isn-Impact-RFID-SC-Perform.pdf

Geiger A., et al., 2006, RFID-Technology, http://road.uww.edu/road/bramorst/250738/RFID%20Outline%20-%20Group%205.doc

IDENT, Automatische Chargenverfolgung, Ausgabe 05/2006, s.18/19

IDENT, UHF, Ausgabe 01/2006, s.40

IDENT, RFID-Drucker, Ausgabe 03/2005, s.24

IDENT, Kennzeichnung von Produkten, Ausgabe 03/2005, s.30

IDENT, Aktuelle Situation der RFID Standards für die Logistik, Ident Jahrbuch 2004, s.48 - s.53

Kreitner R., 2005, Innovationen der Zukunft. Studienarbeit FH München, 2005.

RFID im Blick, Polymerelektronik. Ausgabe 09/2006, s.6

RFID im Blick, Hunold, M.: Quantensprung für den Handel. Ausgabe 07-08/2006, s.26

RFID im Blick, Philips entwickelt HF-Polymerchip. Ausgabe 03/2006, s.6

RFID im Blick, Fälschungssicherheit durch EPC. Ausgabe 03/2006, s.8

RFID im Blick, "Wir sind noch nicht so weit". Ausgabe 03/2006, s. 28

RFID im Blick, Engmaschiges Sicherheitsnetz. Ausgabe 02/2006, s. 26

RFID im Blick, Logistik: Bessere Zusammenarbeit auf Distanz. Ausgabe 06/2005, s. 12

ROI-Berechnung: Angefertigte Modellrechnung zur Wirtschaftlichkeit innerhalb des Projektes RÜFILOG, 2006

Rosenbrock K.-H., 2004, Präsentation RFID and Communication Services, http://portal.etsi.org/docbox/ERM/open/RFIDWorkshop/RFID_03%20Karl%20Heinz%20Rosenbrock_ETSI.ppt

Schiller J., 2000, Mobilkommunikation. Verlag Addison-Wesley, s.141, München.

Verordnung EG 178/2002, EU, Brüssel, 2002.

ŚLEDZENIE TOWARÓW PRZY ZASTOSOWANIU RFID W SPEDYCJI REICO

STRESZCZENIE. Niemiecka firma logistyczna ReiCo Spedition z Nunsdorf (Zossen, Brandenburgia) we współpracy z Wyższą Szkołą Techniczną w Wildau z sukcesem wdrożyła i przetestowała system śledzenia dystrybuowanych towarów, należących do dwóch dużych dostawców żywności: Nordmilch i Frischdienst. Projekt pilotowy pod nazwą RÜFILOG - "Śledzenie żywności mrożonej i świeżej w transporcie, w małych i średnich przedsiębiorstwach przy zastosowaniu technologii RFID" jest realizowany pod patronatem Fundacji Rozwoju Przemysłu. Europejska dyrektywa nr 178/2002, obowiązująca od 1 stycznia 2005 r., stworzyła potrzebę istnienia efektywnej procedury śledzenia towarów, przewożonych przez firmę ReiCo.

Słowa kluczowe: RFID, logistyka transportu, śledzenie towarów, system informacyjny, identyfikacja.

RFID IN DER RÜCKVERFOLGUNG VON WARENSTRÖMEN BEI REICO

ZUSAMMENFASSUNG. Die Rückverfolgung von Warenströmen ist spätestens seit der gesetzlichen Vorgabe der EU (in Kraft seit 1. Januar 2005) durch die Richtlinie 178/2002 vorgeschrieben. Alle Unternehmen, die an einer Lieferkette beteiligt sind, d.h. vom Hersteller über Logistikdienstleister bis zum Endkunden, sind verpflichtet diese Warenflüsse zurück zu verfolgen und zu dokumentieren. Dies kann konventionell mit Papier und Bleistift oder mit Hilfe von innovativen Technologien durchgeführt werden. Mit dem Projekt RÜFILOG wurde eine Lösung geschaffen, die Rückverfolgung vom Hersteller zum Kunden und retrograd vom Kunden zum Hersteller mit neuen Technologien wie RFID und einem webbasierten Informationssystem sicherzustellen. Die Lösung sieht vor, die gesammelten warenbezogenen Rückverfolgbarkeitsdaten der Beteiligten in einem Schadensfall (z.B. verdorbener Jogurt) in kürzester Zeit abrufbar zu halten und als Dokumentation an die, falls gefordert, zuständige Behörde zu übergeben. Damit werden die Such- und Recherchezeiten verringert und zeitnah alle betroffenen Produkte identifiziert. Bei konventioneller Dokumentation kann eine Recherche nur mit hohem zeitlichem, personellem und finanziellem Aufwand bewältigt werden, was bei lückenhafter Dokumentation zu erheblichen Folgen für die Unternehmen führen kann.

Codewörter: RFID, Transportlogistik, Rückverfolgbarkeit, Informationssystem, Identifikation.

Marcel Janke, Keith Thorne
University of Applied Sciences Wildau
Bahnhofstrasse 1
D-15745 Wildau, Germany

Theodor Rimmele, Thomas Lübbe
ReiCo Spedition GmbH & Co. KG
Gewerbegebiet
D-15806
Zossen OT Nunsdorf

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 1
No 4

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

OUTSOURCING AS A FORM OF PARTNERSHIP RELATIONS

Ewa Płaczek, Jacek Szołtysek

The Karol Adamiecki University of Economics in Katowice, Poland

ABSTRACT. Modern economy forces business entities to enter into different types of agreements (relations), which on one hand enable to meet growing customer needs and on the other hand - to produce goods or provide services on a high level and with low costs. An example of such a relation is outsourcing. It enables to achieve the abovementioned goals thanks to offering a well-tailored and competent products or services to institutional customers. The authors of the article consider outsourcing as a form of a partnership relation, indicate its features and describe a model of a relation as well as the directions of adjusting entities' organizational structures to effective cooperation within outsourcing.

Key words: outsourcing, Supply Chain Management, partnership.

Irrespective of the line of business, companies' business activities are based on realization of particular goals. It is possible thanks to various forms of cooperation that may be established. Nowadays, companies' activities are based on two types of relations: competition and cooperation.

Competition results from the essence of the market economy. It is a process that helps market participants makes better offers (in terms of price and other attributes) than their competition's.

Relations based on cooperation occur when partners can offer each other the resources and skills they seek for. Cooperation agreement is always preceded by negotiations [Marek 1999]. Cooperation between companies may be realized through:

- full cooperation,
- limited cooperation.

Full cooperation is connected with serious costs incurred by the companies. Each company must teach their partner, thus possibly strengthening their potential competition. However, the advantages of such a form of exchange make full cooperation much more desirable then the one that limits cooperation.

Limited cooperation occurs when the cooperation may be imposed by means of a legal agreement or under a threat of sanctions. In full cooperation both sides cooperate in order to achieve their common goal, reacting flexibly and sharing their skills and information.

Another type of partnership relations is being a customer of third-party providers, which is called outsourcing.

Outsourcing, also known as "subcontracting", "make or buy", "externalization" or "partenariat", derives from the English language and is a neologism of the words "outsider-resource-using", which means that the responsibility for the resources is shifted to third-parties. Such a form of cooperation

Citation: Sergeev Płaczek E., Szołtysek J., 2007, Outsourcing as a form of partnership relations. LogForum 3,1,4
URL: http://www.logforum.net/vol3/issue1/no4
Accepted: 10.02.2007, on-line: 30.03.2007.

may occur at every company level, state level or within international relations. It may take a traditional form, a form of simple cooperation between companies or a form of a partnership which may lead to "joint ventures" that require direct investments of the partner (subcontractor).

Outsourcing is above all a concept of reducing costs of goods and services offered to customers. It consists in using the services and/or half-finished goods offered by an external provider. It is a form of cooperation which is characterized by strong cooperative relations between the deliverer and the customer - exchange of information on technology and IT. There is no competition between the companies. Outsourcing may have various forms depending on the circumstances and the situation of the customer:

- the activity may be structural or depend on an economic situation (temporary use of free productive powers),
- the customer does not have means or intentions to buy certain equipment or technology (know-how) and looks for external partners [Nalepka 1999].

However, in all cases, the customer orders realization of certain tasks accordingly to certain directives. The act of ordering services or products causes a translocation of the executive processes of certain functions outside the company into the partner's structures. It makes its activity more cost-effective [Dembińska-Cyran 1996].

Neither new nor rare is the cooperation between companies in business practice. For many years companies have been cooperating with each other in different ways. However, in the last few years a tendency for partnership may be observed.

Partnership should be understood as formation of business relationships between all links of the supply chain, which are based on trust, sharing of risks and benefits and which lead to synergy effects and competitive advantage [Kotarbiński 1972].

Partnership is also:

- a necessity of good communication between the partners. It is connected with reliable information exchange and openness in sharing information, which results in understanding of the partner and their current situation,
- meetings for information exchange - what should be improved, what should be changed etc.
- awareness of having the same goals, bilateral willingness to improve the processes,
- equality of treatment of all partners,
- readiness for changes,
- openness of customers of logistics providers in the field of costs - understanding the need of costly development (for example investments in IT), which leads to higher service level,
- creation of common teams that search for ways of cost reduction, just distribution of profits [Konecka 2000].

When taking time into consideration, we have short-term partnerships (operational) and long-term partnerships (strategic).

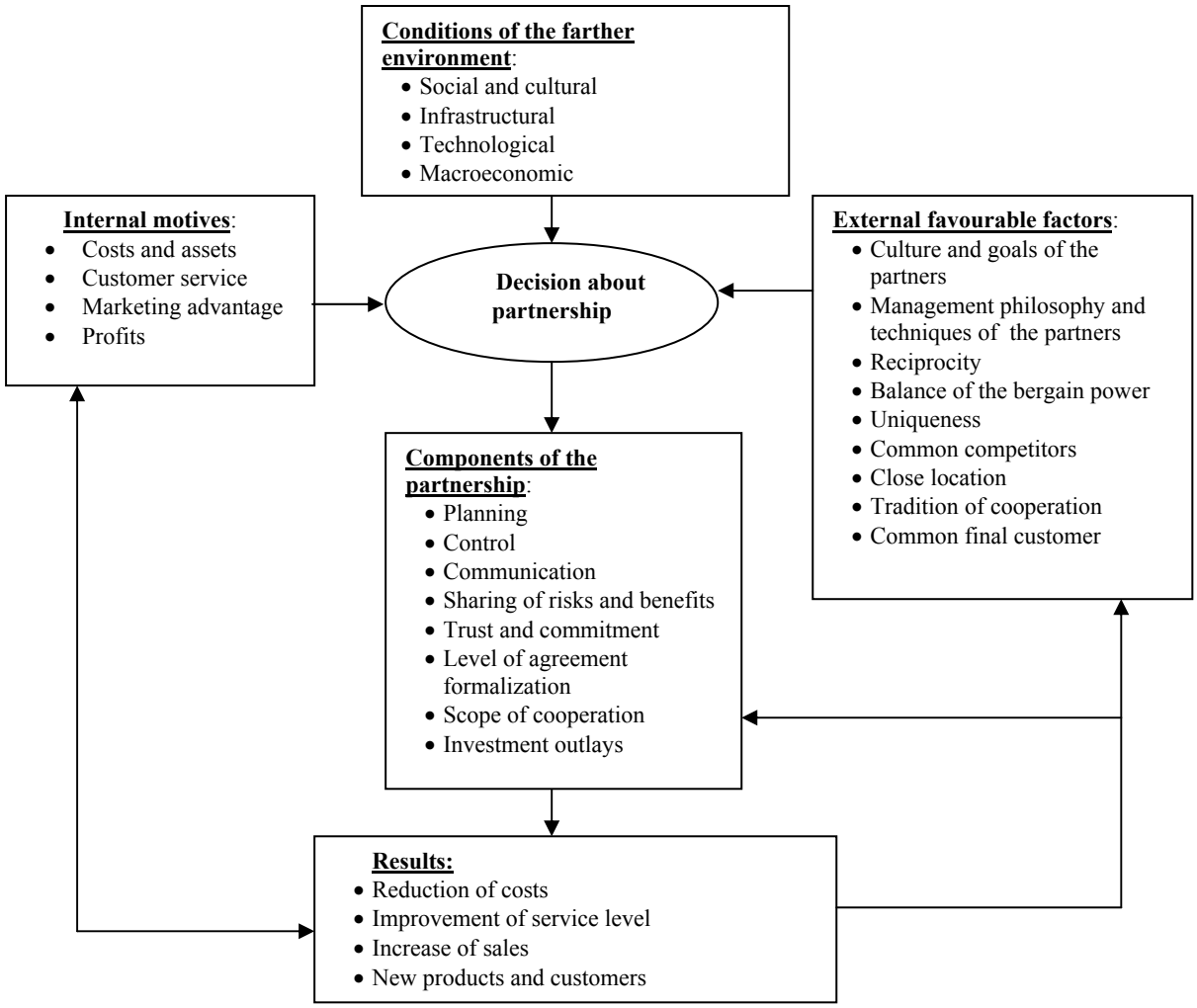
Repeated transactions favour strengthening of short-term contacts between the companies' employees who are responsible for different functional areas. Frequent contacts and understanding of problems of different functional areas of the partners are the basis of time and space integration of the processes inside and between the cooperating companies.

Positive effects of short-term functional cooperation and integration of processes result in prolongation of cooperation. If the long-term partnership (many years') has an essential influence on the goals and the way of their realization, it is correct to call it strategic partnership [Witkowski 2003].

Strategic partnership consists in wide and long cooperation based on trust, sharing of risks and benefits. It means undertaking common investment and organizational enterprises which help achieve different individual goals. The goals are minor to the common goals which are supposed to help achieve competitive advantage and create value [Witkowski 2003].

Outsourcing is a classical example of a partnership relation. They (partnership relations) are characterized by:

- engagement of top management of both sides,
- long-term agreements,
- free flow of information on product development plans, marketing strategy, planned delivery schedules, production capacities and technology (agreements and contracts must be entered into exceptionally precisely, particularly in case of making advanced technology available to the partners) etc.,
- coordinated planning systems of deliverers and customers,
- continuous monitoring of the cooperation's results,
- implementation of new technologies that help maintain and improve the relations - such as certification of deliverers, implementation of electronic data interchange, including deliverers in the designing process [Monczka and Morgan, 1994].



Source: Witkowski 2003.

Fig. 1. A model of partnership relations
Rys. 1. Model układów partnerskich

While taking a decision about partnership, companies must evaluate the strength of internal and external factors that have an influence on future cooperation. A model and procedures created by D.M. Lambert, M.A. Emmelhainz and J.T. Gardner (Fig. 1) is a tool that helps to decide.

The results achieved thanks to partnership relations are rarely the same for all partners. Moreover, a change of motives and external conditions of the partnership can make it ineffective for both sides. In many cases rational partnership may be constrained not only in respect of time but also in respect of the number of entities involved in the management systems. Establishment of a high-level partnership is often a multi-stage, long lasting and costly process. Additionally, it may be effectively developed only with limited number of key product and service providers [Witkowski 2003].

High level of interdependence of companies is particularly significant while establishing effective relations between partners. It may result from the market position of the partners, uniqueness of their products or services, high costs or lack of alternative purchasing sources or distribution channels. If only one of the partners is influenced by the abovementioned factors, they become a hostage who must take the advantage of their contractor's bargain power seriously.

In order to achieve expected results of cooperation some rules of the partnership philosophy must be complied with. The philosophy consists in accepting common challenges, searching for the lowest total costs, sharing common culture of permanent progress, taking long-term views, endeavouring to discover real, in-depth cause-effect relations, mutual trust, team work and exchanging technical and management knowledge and skills.

However, benefiting from partnership depends on the way of organization of mutual relations which consists in: accepting the fact that partnership relations sometimes require not complying with some norms and standard practices of the company, keeping in contact with the same people, sufficient validation of persons responsible for the contacts, respecting verbal agreements and creating an atmosphere of mutual trust, assuring formal and informal information flow, making the activities clear, establishing one authority for taking important decisions.

To sum up - partnership means building a relation between companies. The relation is built on mutual trust and the sides equally share the risks and benefits connected with the cooperation. When taking the exchange of goods into consideration, partnership may form relations with suppliers, agents, customers and relations inside a company. It requires continuous adjusting of organizational structures and changes in understanding of the role and scope of influence of each functional area: purchasing, research, technology department etc. The changes should encompass:

- creation of project structures,
- development of horizontal communication,
- elimination of the reasons for not being open to others' influence,
- creation of formalized information flow systems,
- creation of conditions for frequent and informal meetings for information exchange,
- sharing of information [Brilman 2002].

The experience of many companies which are taking advantage of outsourcing shows that partnership has a positive impact on logistics process effectiveness [Flejterski et al. 2005].

REFERENCES

Brilman J., 2002, Modern concepts and methods of management, PWE Warsaw, pp. 435.

Dembińska-Cyran I., 1996, Outsourcing as a tool of lean management, Economies and Organization of Enterprise, pp 4.

Marek S. et al. Elements of corporate theory, Foundation for the University of Szczecin, Szczecin 1999, pp. 113.

Flejterski S., Panasiuk A., Perenc J., Rosa G., 2005, The contemporary economics of services, Polish Scientific Publishers PWN, Warsaw, pp. 225.

Konecka B., 2000, Partnership in logistics supply chain, The Echoes of Spedpol, 11/2000, pp. 13.

Kotarbiński T., 1972, The ABC of practicality, Polish Scientific Publishers PWN, Warsaw 1972, pp. 62-63.

Monczka M., Morgan J., 1994, Strategic alliances carry supplier relationships beyond good partnerships, Purchasing, August 18, 1994, pp.58.

Nalepka A., Restructuring of the company. The outline of the problem, Polish Scientific Publishers PWN, Warsaw 1999, pp.133-134.

Witkowski J., 2003, Supply chain management, Polish Economic Publishers PWE, Warsaw, pp.34-39.

OUTSOURCING JAKO FORMA UKŁADÓW PARTNERSKICH

STRESZCZENIE. Współczesna gospodarka wymusza na podmiotach gospodarujących zawiązywanie różnego rodzaju porozumień (układów), umożliwiających z jednej strony zaspokojenie rosnących potrzeb odbiorców, zaś z drugiej strony - produkcji bądź świadczenia usług na wysokim poziomie i z niskimi kosztami. Jedną z form takich porozumień jest doskonale znany outsourcing. Umożliwia on osiągnięcie wymienionych uprzednio celów dzięki zaoferowaniu przez podmioty doskonale skrojonego zgodnie z kluczowymi kompetencjami produktu bądź usługi odbiorcom instytucjonalnym. W prezentowanym artykule autorzy prowadzą rozważania na temat outsourcingu jako formy układu partnerskiego, wskazując na jego cechy, opisując model układu oraz kierunki dostosowywania struktur organizacyjnych podmiotu do efektywnej współpracy w ramach outsourcingu.

Słowa kluczowe: outsourcing, zarządzanie łańcuchem dostaw, partnerstwo.

OUTSOURCING ALS FORM DER PARTNERSCHAFTBEZIEUNGEN

ZUSAMMENFASSUNG. Die gegenwärtige Wirtschaft erfordert von den Unternehmen die Bildung verschiedener Kooperationsvereinbarungen, die einerseits die Erfüllung der immer steigenden Kundenbedürfnisse, andererseits die Produktion oder Erbringung von Dienstleistungen auf hoehem Niveau und zu geringen Kosten ermöglichen. Eine der Formen solcher Kooperationsvereinbarungen ist das Outsourcing. Dieses ermöglicht die Erzielung der vorgenannten Ziele, dadurch dass die Unternehmen massgeschneiderte Produkte oder Dienstleistungen gemäß ihren Kernkompetenzen anbieten können. Die Autoren erörtern das Outsourcing als Form der Partnerschaftsbeziehungen und weisen auf dessen Eigenschaften hin, beschreiben das Modell Beziehungen der sowie die Richtungen der Anpassung der Organisationsstrukturen des Unternehmens auf eine effektive Zusammenarbeit im Rahmen des Outsourcing.

Codewörter: Outsourcing, Lieferkettenmanagement, Partnerschaft.

dr Ewa Płaczek
dr hab. inż. Jacek Szołtysek
The Karol Adamiecki University of Economics in Katowice
ul. Bogucicka 14
40-227 Katowice
Tel +48/32 257 7302
e-mail: zle@ae.katowice.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 1
No 5

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

THE IMPACT OF CURRENT DEVELOPMENTS ON THE BAGGAGE FLOW AT AIRPORTS AND DERIVED TRENDS IN AIRPORT LOGISTICS

Tobias Erxleben, Lars Sallwey

Projektlogistik GmbH, Wildau, Germany

ABSTRACT. In the last years civil aviation has developed more and more to a means of mass transportation and is thereby identified with an immense cost pressure. This development becomes apparent by the strong growth of the Low Cost Carrier market segment. The rising market altogether and the special requirements derived from the low-cost segment cause an adjustment of the baggage flow at airports.

Key words: baggage handling, luggage handling, baggage, airport logistics, aviation logistics, baggage dispatch.

INTRODUCTION AND DEPICTION OF NECESSARY OPTIMIZATION IN THE LOGISTIC PROCESS

Traffic in international aviation is constantly increasing during the last years. In Europe it will rise the double within 20 years. Hence it follows that the 8 million flights of 2000 will grow up to 16 million flights per year in 2020 [cp. Eurocontrol 2005]. As a consequence aircrafts like the Airbus A380 will be used more and more for long-distance flights. Parallel a second trend is foreseeable. A research of DLR and ADV points out the immense rising of the Low Cost Carrier market.

The 128 routes, which exist in July 2003, grew up to 426 routes within 3 years.

The rising market altogether and the special requirements derived from the low-cost segment cause an adjustment of the baggage flow at airports particular in security and speed.

Citation: Erxleben T., Sallwey L, 2007,The impact of current developments on the baggage flow at airports and derived trends in airport logistics. LogForum 3, 1, 5
URL: http://www.logforum.net/vol3/issue1/no5
Accepted: 10.02.2007, on-line: 15.04.2007.

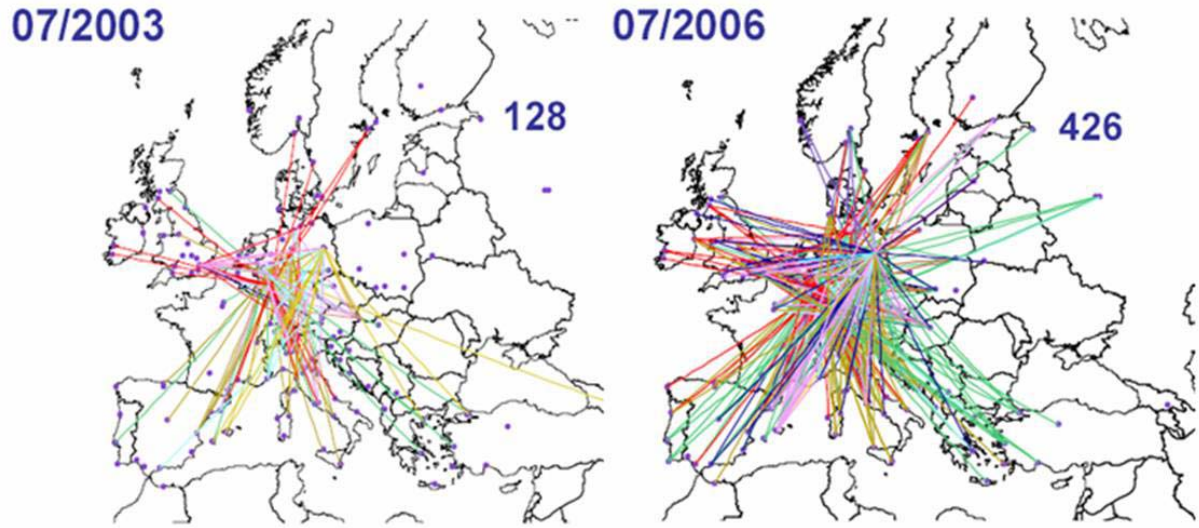


Fig. 1. Expansion of the Low Cost Carrier network [DLR and ADV 2006]
Rys. 1. Ekspansja sieci tanich przewoźników [DLR i ADV 2006]

DESCRIPTION OF BAGGAGE HANDLING IN THE CURRENT PROCESS

On the one hand there are passengers and on the other hand there are baggage flows at the airports. After the passenger passed the check-in the baggage is in charge of the airport. From this point the airport logistic has the task to sort baggage depending on its destination and arrange the cargo for each aircraft. The process has to satisfy high safety requirements. Technical solutions for baggage handling differ from airport to airport. Baggage may be loaded manually at airports with fewer throughputs and with automated means especially at new designed ones with high throughput. The process consists of baggage transport into the make-up room in combination with the security check. Before reaching the make-up room, baggage is sorted after its destination. Employees who work in the make-up room move baggage from conveyors to carts and baggage containers for the transport to the aircraft. Automation of security checks and sortation is already possible and used at some airports for a few years, since there exist well-engineered solutions at the market. In contrast to this the automated turnover from make-up room conveyors to the means of transport is currently developed and tested. The solution developed by Projektlogistik GmbH is called "FEBhand" [Hentschel, Erxleben 2006] and offers an interesting approach for this point.

As explained earlier, either baggage in carts or containers are moved on the apron. Even if loading of containers implicates advantages, since the baggage is bundled, however not all types of aircraft are able to transport containers. Furthermore this type of transaction demands the availability of empty containers at the airport to guarantee a fast exchange. That causes high costs and hence it follows that especially Low Cost Airlines avoid using containers. The earlier explained increasing Low Cost Carrier market at intra Europe flights causes growth in transporting loose baggage.

The disadvantage of transporting loose baggage compared with loading containers is mainly the piece by piece handling. It is split down to single pieces directly in front of the ramp to be moved into the aircraft. Inside the cargo compartment, ramp agents have to move and position baggage.

Fig. 2. Manual turnover of baggage from a baggage cart to a conveyor [Baden-Airpark 2005]
Rys. 2. Ręczny przeładunek bagażu z wózka bagażowego na podajnik [Baden-Airpark 2005]

Figure 2 shows the unloading of baggage carts exemplarily. The weight of some baggage pieces can reach up to 85 lb. Aircrafts are loaded with 100 or 150 pieces of baggage and the physical dimensions of equipment, such as carts, belt loaders, and the cargo compartments, force ramp agents into awkward and hazardous postures when handling baggage. The immense force becomes obvious, when it is compared with the guidelines in most industries. There the weights are strictly limited to 40 lb if that it is handled in optimal postures.

Furthermore conditions can be particularly stressful because of the short turnaround times. Turnaround is defined as the time between the arriving of the aircraft at the dispatch position and leaving it for getting to the runway. During the turnaround an aircraft is simultaneously getting fuelled, cleaned and the baggage is unloaded and loaded. Moreover catering is arranged and new passengers enter the aircraft after the arriving ones left it. Most Low Cost Airlines restrict this time to 20 minutes. One ramp agent moves about 18 tn of baggage per shift, because of the fast sequenced dispatch.

After unloading and loading the aircraft, the arriving containers are transported to the terminal. At first the loose baggage has to be moved into the carts and then it is transported to the terminal. Afterwards a loading agent moves baggage from containers or carts to a conveyor, which transports it inside the terminal. This motion is done in the same awkward and hazardous postures like handling baggage at the aircraft. The passengers take their piece of baggage and leave the airport.

POTENTIALS FOR IMPROVING THE CURRENT PROCESS AND RESULTING REQUIREMENTS FOR NEW BAGGAGE FLOW SOLUTIONS

Obvious problems in the current process of loose baggage handling are the hazardous postures for the agents and long waiting times until the arriving passenger gets its baggage. The following approaches may solve both problems.

The baggage flow process can be redesigned in the way that transition points are reduced or the number of agents is being raised up. Both options are not implementable. The separation of baggage at the aircraft as well as at the terminal can not be avoided. To raise the number of ramp agents in front of the aircraft does not fasten the process, because the agent inside the cargo compartment is the bottleneck. A time advantage would be to raise the number of agents at the terminal, but exposure on the agents would stay high.

The next option is an automated baggage flow, which makes handling more ergonomic and speeds up unloading carts at the terminal.

Identification of solutions implicates different requirements of involved trades and controlling bodies that are displayed in figure 3.

Involved trades are the airport, the ground service providers, the airline and the Luftfahrt-Bundesamt (LBA). Derived technical requirements are ecological, security relevant and result from the process. In addition to the technical fulfillment of requirements, profitability is a condition precedent.

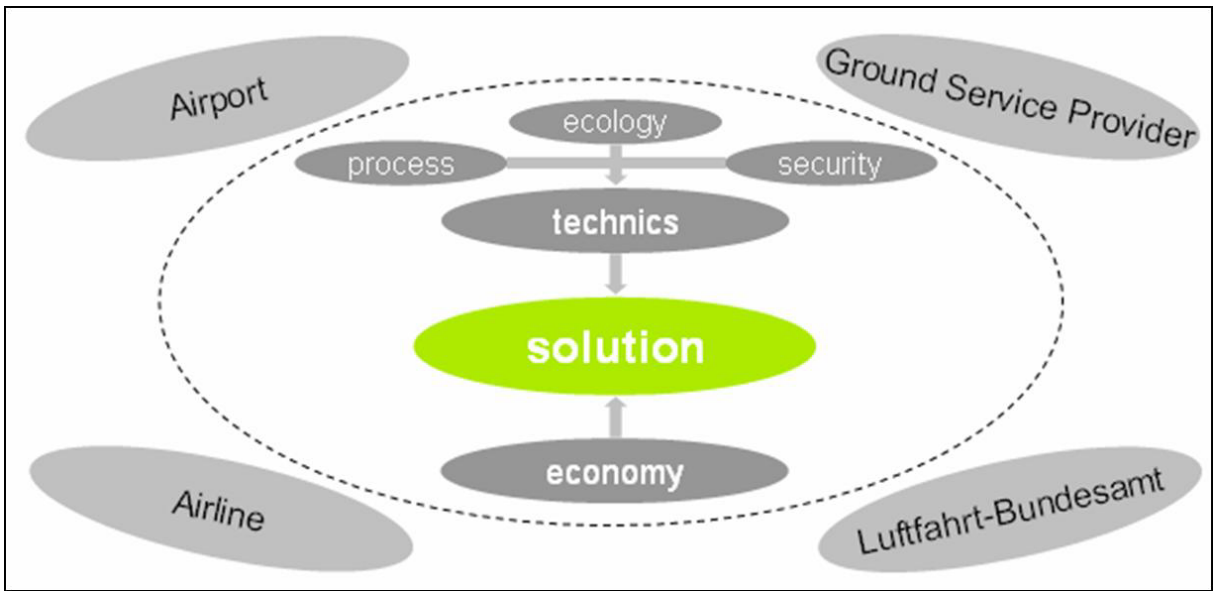


Fig. 3. Requirements for a solution
Rys. 3. Wymagania dla rozwiązania

The most important technical and economical basic conditions are listed below.

Technical requirements

Requirements result from baggage and process interfaces.

Baggage is classified into free allowanced and bulky baggage. Furthermore differences within these categories can be detected. An example for bulky baggage is a small and light umbrella as well as a bulky and large bicycle. Free baggage allowance is defined, but these definitions differ from

airline to airline. Volumes from 10 to 250 liter and weights up to 90 lb may occur. A minimum weight is not specified. Surface property and form stability reach from non-slipping and compressible materials like synthetic rubber to metal materials that are absolutely robust and slippy. The load sharing inside the baggage is not identifiable for ramp agents and can cause injuries because of wrong handling.

Defined interfaces of the process are the make-up room, where baggage is moved to the carts or containers, the aircraft and the baggage claim area, where the arriving passenger gets its baggage. Aircrafts differ insignificant. The primary considered Low Cost Airlines usually use aircrafts with a passenger capacity of 100 or 200 and a coherent cargo compartment. The fast turnaround does not make it necessary to supply the aircraft with electric power and hence it follows that the possible solution can not access electric energy. The dispatch area is small and the solution has to share the available space with equipment like the passenger stairway and the catering car. So the required space has to be smaller or stay the same as in the current state. The beltloader, which is used currently, could be substituted by the solution.

Make-up rooms differ from airport to airport especially in their automation level. Similarity can be detected in the little space. A possible solution, which encounters with the make-up room, has to fulfil the derived requirements.

The baggage claim area offers good potentials for an optimisation. Problems like energy supply and limited space exist to a lesser extent than at the aircraft interface. Merely the turnover from baggage carts to the conveyor of the terminal has to be done. Conveyor dimensions differ from airport to airport and the solution has to show compatibility.

Economic requirements

If the solution is technical realizable, economic requirements decide about the market opportunity and limit thereby technical scope. Furthermore it is assumed that a solution, that improves working conditions for the agents, but is more expensive than the current state, will be hard to be accepted by the airports.

Technical solutions of baggage flow on the apron are nearly constant for the last decades, because the cost pressure is immense. The robust and low-priced baggage carts in combination with 3 or 4 loading agents present an optimal cost situation. All in all the economic requirements can be summarized in an amortization period less than 2 years. The calculation of the amortization period implicates acquisition costs, implementation costs and running expenses, which are compared with the current solution.

EXPOSITION OF A POSSIBLE SOLUTION

Figure 3 shows a solution, which results from an intensive analysis of the current process and the derived requirements.

The obviously biggest problem for a technical solution is the separation of baggage. Currently 3 or 5 baggage carts in are pulled by a tractor. The train set drives past the beltloader and a ramp agent unloads the carts one after another. The bottleneck of the presented solution is the beltloader, because it measures nearly about 25 or 30 inches and the long side of the cart measures about 100 inches. When pushing, pulling or dumping the baggage, it may get jammed. To avoid this, the baggage compartment of the cart may turn its small side towards the beltloader. When the compartment measures 40 inches, the overhang is merely 4 or 8 inches and the risk of accumulation is minimized. Baggage is stacked up to 40 inches inside the compartment. This would be too much baggage at once for the agent inside the aircraft and hence it follows that this height has to be reduced. To fulfil this demand, the cart has a scraper, which just leaves an opening of 16 inches height. That is enough for a usual piece of baggage. If the force on the scraper gets too much, it opens and avoids damaging the baggage.

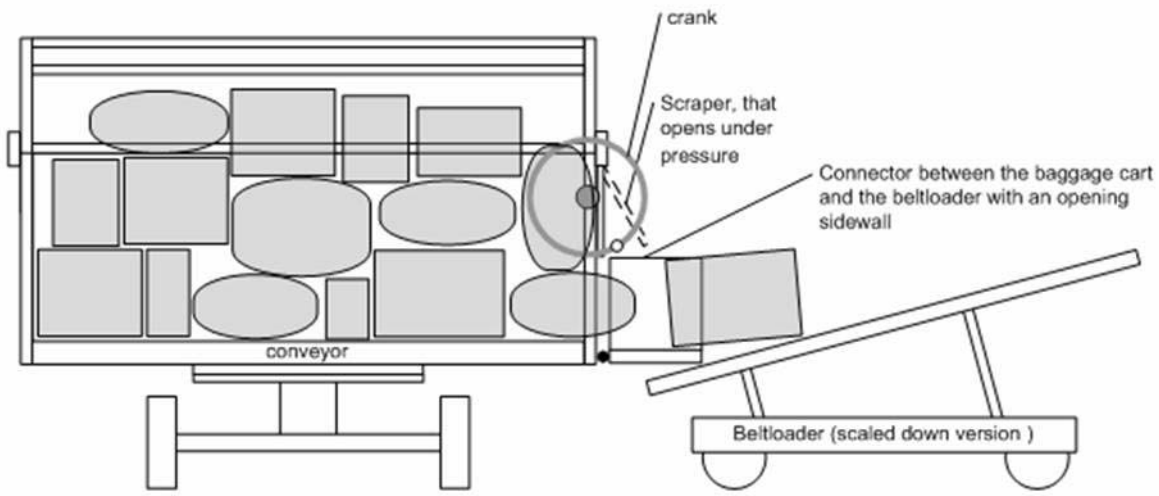


Fig. 4. Rotatable baggage cart with a conveyor
Rys. 4. Obrotowe wózki bagażowe z przenośnikiem

Baggage gets out of the cart by a conveyor that covers the whole bottom of the compartment of the cart. The force from the conveyor exerts only directly on the lower baggage layer and is comparable with dumping the load. The conveyor has an advantage in comparison with dumping the baggage, because it is better to power without electrical energy and is the solution that is less technical complex. The conveyor would be powered by a crank which is turned manually. Unloading the cart at the terminal may be powered by electrical energy instead of turning the crank.

Already the substitution of heavy lifting and rotating motions with turning a crank improves working conditions for ramp agents and leads to higher performance effectiveness. Lifting weights has only an efficiency of 5 or 10 percent, meanwhile turning a crank has efficiency over 20 percent [cp. Müller, Franz 1952].

SUMMARY

Based on the fact that this solution is technical realizable, the question comes up, whether the airport, the ground service provider and finally the ramp agents will accept it. Acquisition costs as well as running cost are likely to be higher than in the current situation.

On the other hand the solution avoids awkward and hazardous working conditions and speeds up unloading baggage at the terminal without raising the number of agents.

The quantity of needed agents would stick to 3 or 4 with the same skills compared to the current state.

The chances resulting from the approach are recognized by the Projektlogistik GmbH from Brandenburg and the development is supported by the European Fund for Regional Development and the Ministry of Economic Affairs Brandenburg.

REFERENCES

Eurocontrol, 2005, Traffic and Delay, http://www.eurocontrol.int/corporate/public/standard_page cb_traffic_delays.html, 02/2007.

Deutsches Zentrum für Luft- und Raumfahrt und Arbeitsgemeinschaft Deutscher Verkehrsflughäfen, 2006, Der aktuelle Low Cost Carrier Markt in Deutschland.

Hentschel, B., Erxleben, T., 2006, Jahrbuch Logistik 2006, free Beratung GmbH, 142-145.

Baden-Airpark, 2005, http://www.badenairpark.de, 02/2005.

Müller, E.A., Franz, H., 1952, Energieverbrauchsmessungen bei beruflicher Arbeit mit einer verbesserten Respirationsgasuhr. Arbeitsphysiologie 14, Springer, 499.

AKTUALNE TENDENCJE W SFERZE OBSŁUGI BAGAŻU NA LOTNISKACH - WYMAGANIA DOTYCZĄCE PRZEPŁYWU MATERIAŁU

STRESZCZENIE. Lotnictwo cywilne rozwija się coraz bardziej w kierunku masowego transportu pasażerskiego. Efektem tego stanu rzeczy jest to, że omawiana gałąź transportu znajduje się pod rosnącą presją kosztów. Tendencja ta jest coraz bardziej wyraźna dzięki silnemu wzrostowi segmentu rynku, jakim są tanie linie lotnicze. Dynamika rynku i specjalne wymagania przewoźników niskobudżetowych wymagają dostosowania procesu przepływu materiału na lotniskach.

Słowa kluczowe: obsługa bagażu na lotniskach, przeładunek bagażu, bagaż lotniczy, logistyka w portach lotniczych, odprawa bagażu

MATERIALFLUSSANFORDERUNGEN DURCH AKTUELLE ENTWICKLUNGEN IM GEPÄCKHANDLING AUF FLUGHÄFEN UND AKTUELLE TRENDS

ZUSAMMENFASSUNG. Dem Trend der letzten Jahre zur Folge entwickelt sich die zivile Luftfahrt immer mehr zu einem Massentransportmittel und ist damit einem immensen Kostendruck ausgesetzt. Diese Entwicklung wird unter anderem durch das starke Wachstum des Marktsegments der Low Cost Carrier deutlich. Das Marktwachstum insgesamt und die speziellen Anforderungen aus dem Low Cost Segment bedingen eine Anpassung der Materialflüsse auf den Flughäfen.

Codewörter: Gepäckhandling, Gepäckumschlag, Fluggepäck, Flughafenlogistik, Gepäcklogistik, Gepäckabfertigung.

---

mgr inż. Dipl.-Wirtsch.-Ing. (FH) Tobias Erxleben
Lars Sallwey
Projektlogistik GmbH
Planung, Entwicklung und Realisierung von Logistik-Systemen
Bahnhofstr. 1 / Halle VII
D-15745 Wildau, Germany
e-mail: Projektlogistik_GmbH@t-online.de

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 2
No 1

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

GENETIC ALGORITHMS FOR 3D PACKAGING PROBLEMS IN FOOD INDUSTRY

Semih Ötleş, Mustafa Murat Inceoglu, Korhan Karabulut, Ata Önal

Ege University, Izmir, Turkey

ABSTRACT. Packaging problems arise in many industries. Nowadays, with ever growing international trade, transportation costs directly affect the profits. Efficient packing is very important because even reduction a few wasted cm^3s of a container can save a lot of money. This work is about a sample packaging problem in food industry. A previously introduced general-purpose method called DBLF (deepest bottom left fill) is applied to a set of problems and the results are presented. Up to 98% utilization is obtained.

Key words: packing, container, transportation.

INTRODUCTION

Containerization in food industry is a system of intermodal cargo. Cargo is a term used to denote foods and other products or produce being transported generally for commercial gain, usually on a ship, plane, train or lorry. Advances in transportation technology of food industry have made it possible for shippers to deliver perishable food products to purchasers thousands of miles away with no substantial loss in freshness and quality and at lower and lower costs.

The usage of containers shows the complementarity between freight transportation modes by offering a higher fluidity to movements and a standardization of loads. Its rectangular shape is can easily be handled, making the container a convenient tool for transhipment activities. There are three common standard lengths, 20 ft, 40 ft and 45 ft. Container capacity (of ships, ports, etc) is measured in twenty-foot equivalent units (TEU). A TEU is a measure of containerized cargo equal to one standard 20 ft (length) x 8.5 ft (height) container (approx. 40.92 m^3). Most containers today are of the 40-ft variety and thus are 2 TEU. 45-ft containers are also designed 2 TEU. Two TEU are referred to as one FEU (forty-foot equivalent unit). These two terms of measurement are used interchangeably. High-cube containers have a height of 9.5 ft, while half-height containers, used for heavy loads, have a height of 4.25 ft. It can transport a wide variety of foods ranging from raw materials (rye, wheat), manufactured foods to frozen food products. There are specialized containers for transporting liquids (oils) and perishable food products (called "reefers" which now account for 50 % of all refrigerated cargo being transported).

Optimization of containers built in distribution across cartons, pallets and trailers gives the freedom to lower the shipping costs per unit by loading more cargo per container or trailer. By optimizing the loads, the organization can ship fewer loads using more efficient loading patterns. By optimizing the

Citation: Ötleş S., 2007, Genetic algorithms for 3D packaging problems in food industry. LogForum 3, 2, 1
URL: http://www.logforum.net/vol3/issue2/no1
Accepted: 16.04.2007, on-line: 15.06.2007.

load patterns, the costs associated to damaged cargo can be eliminated. Companies are increasily looking for tools that will help them optimize distribution performance. Generally, all described algorithms carry out (repetitively) first the statistically optimized preliminary sortings (with some additional aid of a kind if so called "genetic algorithms", and than a quick geometric procedure for compact arrangement of the formed queue of 2D rectangular parts (or 3D boxes) of arbitrary sizes into the 2D sheet (3D container) under the condition known as "bottom left" rule i.e. minimizing x, y, z - coordinates in consequence for each next part in the queue, or under any analogous rule. In this paper, a hybrid genetic algorithm (GA) was used for container loading for industrial food products.

GENETIC ALGORITHMS

Genetic algorithms are general-purpose artificial intelligence methods based on the simulation of the natural evolution. Genetic algorithms are first introduced by Holland in 1975 [Holland, 1975] and are studied by many researchers. The building blocks or elements in genetic algorithms are "individuals" which are candidate solutions for a problem. Each of the individuals is called either a "genotype" [Holland, 1975] or a "chromosome" [Schaffer and Eshelman, 1987].

A genetic algorithm is an iterative process and is composed of several steps. Generally, a random initialization is step is required. Then a "fitness score" is assigned to each individual according to how good it fits as a solution to the problem. A "fitter" or better individual is given a higher score. Then, each individual is given a chance to "reproduce". While fitter individuals have higher chances to reproduce, less fitting elements still have a smaller chance. Several individuals are selected randomly from the new population to mate through a process called "crossover". This produces new children (or off-springs) with some features inherited from each parent. After recombination, a mutation operator can be applied. Each bit in the population can be mutated (flipped) with a low probability generally smaller than 1%.

A good GA will converge to an optimal solution after several iterations. Genetic algorithms are not guaranteed to find the global optimum solution to a problem but they are generally good at finding "acceptably good" solutions to problems "acceptably quickly" [Beasley et.al., 1993].

Typical applications of genetic algorithms are numerical function optimization, scheduling, game playing, adaptive control, transportation problems, travelling salesman problems, bin packing, time tabling, etc.

DBLF AND 3D BIN PACKING

Bottom Left (BL) and Bottom Left with Fill (BLF) methods are used in 2D bin packing. In BL, introduced by Jakobs [Jakobs, 1996], each item is moved as far as possible to the bottom of the object and then as far as possible to the left. BL is relatively a fast algorithm with complexity $O(n^2)$. The major disadvantage of the method is; empty areas in the layout are generated. Hopper (Hopper, 2000), to overcome this disadvantage, develops the BLF algorithm. This algorithm allocates each object to the lowest possible region of the bin thus fills the empty areas in the layout. The major disadvantage of this algorithm is its $O(n^3)$ complexity.

Deepest BLF is an extension of the BLF method to cover 3D bin packing problems [Karabulut and Inceoglu, 2004]. An object is moved to the deepest available position (smallest z value) in the layout, and then as far as possible to the bottom (smallest y value) and then as far as possible left (smallest x value).

Since the complexity of the BLF algorithm is high, a computer efficient implementation of this algorithm is needed. Below is the Deepest BLF algorithm used in this work.

In the beginning, the empty list has only one empty volume with dimensions same as the bin. As the algorithm iterates, new empty volumes are added to the list. The next box from the list is chosen to

work on. Then each position in the list is checked to see if the current box fits in. If the empty volume is large enough, the position is checked for intersection with other boxes that were placed before. This check is needed because for an efficient implementation, all the volumes in list are not up to date. If there is no intersection at the chosen position, the box is inserted at this position and is iterated to the deepest bottom left position. Then the position list is updated and checked to see if there is any unnecessary position. In the final step, the new list is sorted in deepest bottom left order. Then the next box is taken from the list and the same selection procedure is repeated. Also as an additional constraint, the boxes are not allowed to rotate.

repeat
get next box
repeat
get next position *from the empty volumes list*
check if the empty volume is large enough
if assigned empty volume is ***large enough***
intersection test *with all boxes that could intersect at that position*
stopped *when* ***intersection is detected***
if ***intersection true***
update *size of the empty volume at this position*
if ***intersection false***
insert box *at this position*
iterate box *into a deepest bottom-left position*
update position list *by removing the inserted box's volume from that position*
delete *unnecessary positions from list*
sort *list of positions in deepest bottom left order*
until ***all positions are tried AND intersection is true***
until ***all boxes placed***

Alg. 1. The deepest BLF algorithm in pseudo code
Alg. 1. Najgłębszy algorytm BLF w pseudokodzie

RESULTS

DBLF algorithm has been written in C++ programming language on Windows operating system and has been tested on Pentium-4 based computer. This computer has 2.4 Ghz processor and 1024 Mbytes memory. In order to facilitate data entering, a user interface has been developed (Figure 1).

This computer program has been tested various 20' and 40' container types and has been optimized to load milk, fruit juice and butter boxes into container. This program has been used DBLF algorithm to load boxes into container. The highest point of the boxes has been compared the highest point of the container and decided to stop or continue to program. In this case, the boundary value of the problem is the minimal volume of the container is 90% full.

In Table 1, various 20', 40' containers and their dimensions are shown.

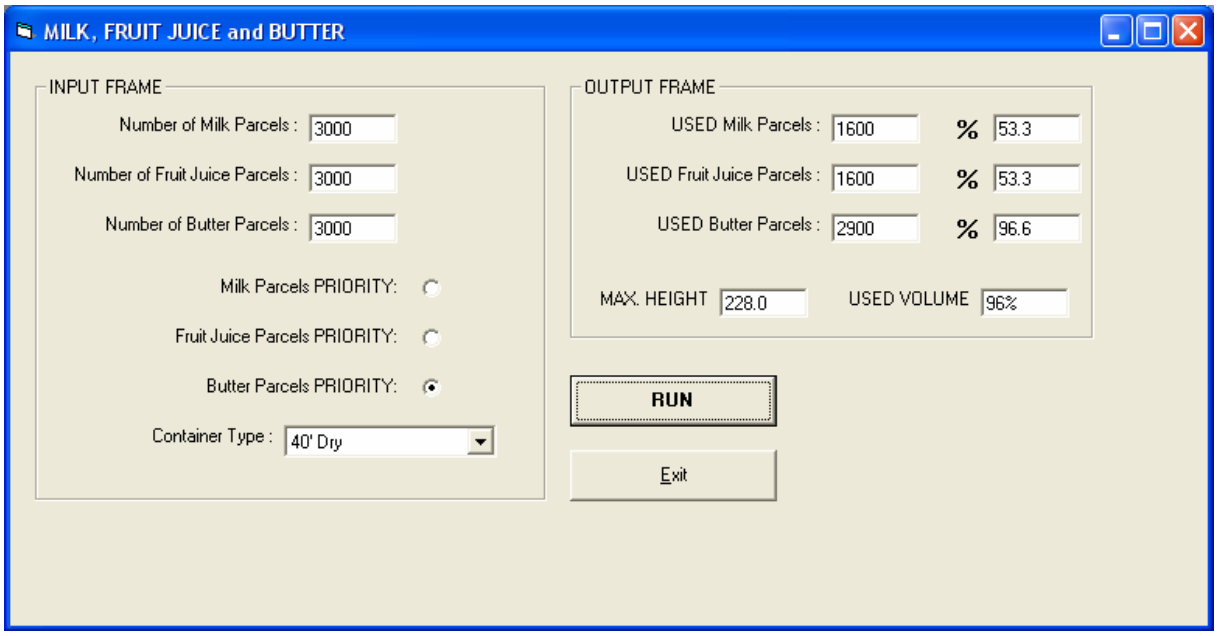


Fig. 1. User interface
Rys. 1. Interfejs użytkownika

Table 1. Various 20', 40' containers and their dimensions
Tabela 1. Typu kontenerów 20’ i 40’ i ich wymiary

	Length (cm)	Width (cm)	Height (cm)
20’ Dry Container	591.9	234.0	238.0
20’ Open Top Container	591.9	234.0	228.6
20’ Flat Rack Container	570.2	243.8	232.7
40’ Dry Container	1205.1	234.0	238.0
40’ Open Top Container	1240.3	233.8	227.2
40’ Flat Rack Container	1182.0	218.4	209.5
40’ High Cube Container	1205.6	234.7	268.4

In Table 2, milk, fruit juice, butter boxes and their dimensions are shown.

Table 2. Milk, fruit juice, butter boxes and their dimensions
Tabela 2. Wymiary opakowań mleka, soku owocowego i masła

	Length (cm)	Width (cm)	Height (cm)
Milk (1 lt)	19.5	35.5	20.0
Fruit Juice (1 lt)	23.0	29.5	20.5
Butter	38.0	20.0	8.0

Firstly, computer program has been run for 2000 milk, 2000 fruit juice and 2000 butter boxes. This program has a priority-based selection mechanism that the user can select a special box (for example fruit juice boxes) to fill the container volume in order of priorities. In Table 3, for 20' container has 238.0 cm maximum height has been used, first line has butter boxes priority results, second line has fruit juice boxes priority results and last line has milk boxes priority results are shown. In this table (for example first line), 80% of butter boxes for butter boxes priority are filled to container and 98% of the container volume has been used.

Table 3. Experimental Results for 20' Dry Container
Tabela 3. Wyniku eksperymentu dla 20'suchego kontenera

	Milk	Selection Ratio	Fruit Juice	Selection Ratio	Butter	Selection Ratio	Max. Height (cm)	Used Volume
Butter boxes priority	750	37.5%	800	40.0%	1600	80%	236.0	98%
Fruit-juice boxes priority	500	25.0%	1400	70.0%	700	35.0%	233.0	96%
Milk boxes priority	1500	75.0%	400	25.0%	700	35.0%	237.5	96%

In order to reduce the amount of computer running time, boxes have been filled groups of 50. In another experiment, computer program has been run for 3000 milk, 3000 fruit juice and 3000 butter boxes using 40' dry container. The results are shown in Table 4.

In Table 3 and Table 4, the maximal number of butter, fruit-juice and milk boxes are located to the container. This program has been filled firstly milk boxes (for example, milk boxes has priority) and than the smallest boxes (for example, butter boxes) has been located to the container.

Table 4. Experimental Results for 40' Dry Container
Tabela 4. Wyniku eksperymentu dla 40'suchego kontenera

	Milk	Selection Ratio	Fruit Juice	Selection Ratio	Butter	Selection Ratio	Max. Height (cm)	Used Volume
Butter boxes priority	1600	53.3%	1600	53.3%	2900	96.6%	228.0	96%
Fruit-juice boxes priority	1100	36.6%	2400	80.0%	2200	73.3%	233.0	95%
Milk boxes priority	2500	83.3%	1200	40.0%	1400	46.6%	236.5	92%

DISCUSSION

In this study, a genetic algorithm has been developed for milk, fruit-juice and butter boxes located into 7 different types of containers. Genetic algorithm has been used deepest bottom left fill (DBLF) method. Up to 98% utilization is obtained and container volumes are at least 92% filled of boxes.

REFERENCES

Beasley D., Bull D.R., Martin R.R., 1993. An Overview of Genetic Algorithms: Part 1, Fundamentals. University Computing, 15(2), 58-69.

Holland J.H., 1975. Adaptation in Natural and Artificial Systems, MIT Press.

Hopper E., 2000. Two-dimensional Packing Utilising Evolutionary Algorithms and other Meta-Heuristic Methods. A Thesis submitted to University of Wales for the Degree of Doctor of Philosophy.

Jakobs S., 1996. On Genetic Algorithms for the Packing of Polygons. European Journal of Operational Research, 88, 165-181.

Karabulut K., Inceoglu M.M., 2004. A Hybrid Genetic Algorithm for Packing in 3D with Deepest Bottom Left with Fill Method. Lecture Notes in Computer Science, 3261, 441-450.

Schaffer J.D., Eshelman L., 1987. Some Effects of Selection Procedures on Hyper-plane Sampling by Genetic Algorithms. Genetic Algorithms and Simulated Annealing.

ALGORYTMY ROZWIĄZAŃ DLA PROBLEMÓW PAKOWANIA PRZESTRZENNEGO W PRZEMYŚLE SPOŻYWCZYM

STRESZCZENIE. Problemy związane z pakowaniem występują w wielu gałęziach przemysłu. Obecnie, przy coraz istotniejszym udziale handlu międzynarodowego, koszty transportu bezpośrednio wpływają na zyski. Efektywne pakowanie jest bardzo ważne, gdyż redukcja nawet kilku zbędnych cm^3 kontenera może zaoszczędzić wiele pieniędzy. Praca przedstawia przykładowy problem związany z pakowaniem w przemyśle spożywczym. Wcześniej już omawiana metoda DBLF (wypełniane najgłębiej na dole od lewej) została zastosowana i jak przedstawiają uzyskane wyniku, uzyskano wykorzystanie przestrzeni aż do 98%.

Słowa kluczowe: pakowanie, kontener, transport.

ALGORITHMEN FÜR DIE PROBLEMLÖSUNG IM BEREICH DER DES 3D PACKAGING IM LEBENSMITTELINDUSTRIE

ZUSAMMENFASSUNG. Probleme des Verpackens treten in vielen Industriezweigen auf. Aktuell, bei dem wachsenden Anteil des internationalen Warenverkehrs werden Gewinne durch Transportkosten direkt beeinflußt. Effektives Verpacken ist daher von großer Bedeutung, denn durch die Reduzierung von sogar einigen unnötigen cm^3 des Containers kann viel Geld erspart werden. Die vorher erörterte DBLF Methode wurde implementiert und - wie dies die ermittelten Ergebnisse nachweisen - die Nutzung des Containerraums sogar bis auf 98 % erreicht.

Codewörter: Verpacken, Container, Transport.

Semih Ötleş,
Department of Food Engineering
Ege University
Bornova 35100 Izmir, Turkey
e-mail: semih.otles@ege.edu.tr

Mustafa Murat Inceoglu, Korhan Karabulut, Ata Önal
Dept. of Computer Eng.
Ege University
Bornova 35100 Izmir, Turkey

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 2
No 2

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

MEZOECONOMIC DIMENSION OF SUPPLY CHAINS

Anna Łupicka

The Poznań University of Economics, Poznań, Poland

ABSTRACT. Until recently representatives of economics specialized in examining microeconomic and macroeconomic problems. In the 20th century new areas of analysis, appointed by locating objects which they concern turned up at the economic system as a whole taken hold. At least at present a trial attempt is filling the leading part still widely comprehended systemizm let for distinguishing levels of economical analysis. Situating chains of supplies on the appropriate level of economical analysis is an important problem.

Key words: mezosystem, supply chains, economical analysis.

Together with made choice of theoretical referring bases to the relation in chains of supplies determining the level of economical analysis of supply chains is essential. Different views, currents, paradigms or conceptions are focusing the attention around different research fields. Until recently representatives of economics specialized in examining microeconomic and macroeconomic problems. In the 20th century new areas of analysis, appointed by locating objects which they concern turned up at the economic system as a whole taken hold. At least at present a trial attempt is filling the leading part still widely comprehended systemizm let for distinguishing levels of economical analysis. Still three additional levels of analysis were distinguished: puny-micro, mezo and global. A focus of interest of the macroeconomics constitutes behaving economies as wholes. Such problems are subject to an examination as: the total production of goods and services, the pace of the rise in the production, the inflation, the unemployment, the excitement, the recession, the balance of payments and the currency exchange rate. Microeconomics, called also a theory of prices, is dealing with however mainly behaving of households, enterprises and markets, on which both categories of subjects are acting. He directed H.'s Leibenstein attention to the existence of the puny-micro level. One in the conventional microtheory assumes that a household and an enterprise are basic decision-makers and participants of economic living. H. Lebenstein is holding a view that such an assumption will be real when the household and the enterprise are single subjects. An enterprise and households are molecular structures and wanting to examine keeping them oneself it is necessary research the organization and structures of their atomic parts. In that case Leibenstein distinguishes additional, with respect to the conventional microeconomics, level of examinations puny-micro level and is calling it the atomic microeconomics.

Above the macroeconomic level additionally a global level is distinguished. On this level a scope of processes of the globalization is examined assuming that a world economy is a layout of communicating tubes and therefore many-sided influences are being observed in the spatial plan and among diverse influences - a size of production, with stores, the population, the natural environment, the technique, the organization and the politics. In the contemporary economy relations between individual elements of chains of supplies often surrender to the globalization. Managing the global

Citation: Łupicka A., 2007, Mezoeconomic dimension of supply chains. LogForum 3, 2, 2.
URL: http://www.logforum.net/vol3/issue2/no2
Accepted: 10.04.2007, on-line: 25.06.2007.

supply chain consists in combining effects of all chain links of supplies in order to transform raw materials and half-finished products into finished articles and delivering of them together with the service to hands of the customer. It results from the fact that the market more and more often includes entire world rather than exclusively one economy. This way so supply chains are demonstrating the universal tendency of crossing national borders what is resulting in fundamental alterations of relations appearing in these systems, like

1. Expanding mutual relationships by more dense tying together systems of information forwarders of goods by,
2. In order to protect bring hauliers and increasing offices and accurate agencies,
3. To the pressure on the necessity of permanent tracking international flows of products imported,
4. Increasing requirements of the fitness of connections in order to provide with supplies for markets located in the distant parts of the world by.

Explaining individual levels of economical analysis one should refer for comprehending the competitiveness. As the notion applied in the theory the competitiveness is displaying the peculiar property: abstractness. Comprehending the competitiveness doesn't refer directly to concrete occurrences in the determined place and the time. So it isn't connected with the determined context. It is very important in the building site of the economic theory because it lets generalize individual events and situations, signs shared properties of given events and the situation. Also so-called comprehending the system competitiveness is appearing in literature. Four levels are deciding the system competitiveness: meta, macro, mezo and microeconomic.

With cannon of economics locating a main focus of interest on the level mezo there is a theory of the structure of the business. As regards lines of enquiry in mezoeconomy, it is main with task of the one subdiscipline examining all economic systems put on the indirect level between the economy of the country and the level of single enterprises and the institution. Analyses referring to the business are one of essential directions of interests.

A focus of interest of the theory of the structure of the business best determines the so-called Baina paradigm: structure-behaviour-effectiveness that is connections between the structure of the trade market, proceedings of enterprises and the effectiveness.

In the context of the development and achievements of the theory of the structure of the business some authors are saying the thesis about coming into existence and emerging just so-called mezoeconomy. With feature mezoeconomy diverging from perceiving the relation between economic subjects is exclusively in categories of the competition. He is turning for the cooperation, cooperation, as ways to the attention of regulation of behaviours in frames of mezosystems. With systems most often distinguished in mezoeconomic examinations there are a business and a region. At work the author is focusing mainly on problems concerning the business. As part of classification of models of the self-regulation of the business two methodological attitudes, the comprehensive approach and the system approach are distinguished. However it isn't accurate, more appropriate distinguishing is giving entertaining one another to the criterion referring to character of behaviours of subjects belonging to the business. A determination of behaviours of subjects means the criterion through surroundings. From this point of view it is possible to distinguish two extreme situations.

1. total determinism of behaviours of subjects through surroundings (in it business),
2. total authoritarianism of behaviours of subjects.

If we cushion the roughness of establishments meeting both situations it is possible to distinguish two prospects:

1. prospect of surrounding the adaptation of the natural business to conditions,
2. prospect which is putting analysis of strategic aspects in the focus of attention.

For action of the natural mechanism of selection strategic behaviours of economic subjects which in determined situations are able to dominate it are overlapping each other. This approach is immediate in its conception for managing supply chain which in the business to themselves companies forming the given chain seized the adaptation process in. It is possible to say supply chains are anchored in the given business and through integration of economic processes they form the web of the interrelation. In its pure figure the idea of creating and functioning of farm nets consists in competing and formal or unofficial cooperation of many companies, between which the great confidence exists and there are no subordinating distinct relations. According to A. Sulejewicz strategically the comprehended network is a configuration walking away from the classical hierarchy of managing, letting for elastic shaping the relation between certain - not necessarily determined from above - with number of elements, to more loose-fitting forms of connections, the lower commitment of the financial capital or different stores of the company. Networks or "clasters" (according to describing Porter) are often built on Japanese "keiretsu" patterns. The network seriously is modifying character of interorganizational connections and is posing a challenge for strategic managing groups of enterprises. On this base it is possible to describe logistic networks the being of being formed.

According to J. Witkowski through the logistic network it is possible to understand the group of independent competing and cooperating to the purpose of the improvement companies of efficiency of both the effectiveness of the flow of products and the information accompanying them according to expectations of customers.

The given definition of logistic networks is appropriate to the definition of the integrated supply chain according to Christopher's M.. The author states, that at present universally used " expression integrated supply chain, should be replaced by managing the demand chain in order to reflect the fact that the chain should be steered by the customer, rather than by suppliers. In the process the " chain" word should be replaced with " network" expression, because we usually deal with many suppliers, suppliers of suppliers and many customers and customers of customers which will be creating the huge system. Mezosystem which is characterized by many features it is possible to take back also to supply chains among others the existence of strategic groups, entering by barriers and leaving, the degree of the concentration, straining competitive and cooperative processes and the fact that subjects in the business influence price decisions of single enterprises.

REFERENCES

Dornbusch R., Fischer S., 1981, Macroeconomics, New York, w: M. Gorynia, Poziomy analizy w naukach ekonomicznych, Ekonomista 1993/3, 505.

Gołembska E., Szymczak M., 2000, Logistyka międzynarodowa, Wyd. Akademii Ekon. w Poznaniu, Poznań, 33.

Gorynia M., Jankowska B., Maślak E., 2000 branża jako przedmiot badań w ekonomii, Gospodarka Narodowa 3/2000, 40.

Lebenstein H., 1985, Ekonomia atomistyczna versus ekonomia molekularna, w: Ponad ekonomią, PWN Warszawa, 287.

Miller L. R., 1993, Intermediate Microeconomics. Theory, Issues, Applicatios, New York 1982 w: Gorynia M., Poziomy analizy w naukach ekonomicznych, Ekonomista 1993/3, 505.

Sulejewicz A., 1997, Partnerstwo strategiczne: modelowanie współpracy przedsiębiorstw. SGH, Warszawa, 48.

Witkowski J., 2000, Logistyka w organizacjach sieciowych, Gosp. Materiałowa i Logistyka, 7-8, 168.

WYMIAR MEZOEKONOMICZNY ŁAŃCUCHA DOSTAW

STRESZCZENIE. Do niedawna przedstawiciele ekonomii specjalizowali się w badaniu zagadnień mikroekonomicznych i makroekonomicznych. W dwudziestym wieku pojawiły się nowe obszary analizy, wyznaczone przez sytuowanie obiektów, których dotyczą, w całościowo ujmowanym systemie gospodarczym. Chociaż obecnie rolę pierwszoplanową zajmuje podejście procesowe to jednak szeroko pojęty systemizm pozwolił na wyróżnienie poziomów analizy ekonomicznej. Ważnym zagadnieniem jest usytuowanie łańcuchów dostaw na odpowiednim poziomie analizy ekonomicznej.

Słowa kluczowe: mezosystem, łańcuchy dostaw, analiza ekonomiczna.

MESOÖKONOMISCHE DIMENSION DER LIEFERKETTE

ZUSAMMENFASSUNG. Bis vor kurzem haben sich Vertreter der Oekonomie auf die Forschung der makro- und mikroökonomischen Probleme spezialisiert. In dem 20. Jahrhundert sind neue Bereiche der Analyse aufgetreten, ermittelt durch die Plazierung der betroffenen Objekte im komplexem Wirtschaftssystem. Wenn auch aktuell das prozessorientierte Denken im Vordergrund steht, so ermöglicht der Systemismus die Niveaus der ökonomischen Analyse. Eine wichtige Frage ist die Plazierung der Lieferketten auf dem entsprechenden Niveau der ökonomischen Analyse.

Codewörter: Mesosystem, Lieferketten, ökonomische Analyse.

dr Anna Łupicka
Akademia Ekonomiczna w Poznaniu
Katedra Transportu i Logistyki
al. Niepodległości 10,
60-967 Poznań, Polska
e-mail: anna.lupicka@ae.poznan.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 2
No 3

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

TRANSPORT INTERMODALNY W POLSCE

Leszek Mindur [1] Jerzy Wronka [2]

1) Wyższa Szkoła Logistyki, Poznań, Polska
2) Uniwersytet Szczeciński, Szczecin, Polska

STRESZCZENIE. Artykuł składa się z wprowadzenia, trzech części oraz podsumowania. Część pierwsza poświęcona jest ocenie transportu intermodalnego w Polsce. W części drugiej określono cele i kierunki rozwoju transportu intermodalnego. Część trzecia prezentuje podstawowe uwarunkowania realizacji celu strategicznego i celów podstawowych rozwoju transportu intermodalnego. W podsumowaniu ujęto generalne wnioski wynikające z analizy stanu istniejącego oraz wskazano na niezbędne przedsięwzięcia w celu poprawy istniejącego stanu transportu intermodalnego w Polsce.

Słowa kluczowe: transport intermodalny, system transportu, centra logistyczne.

WPROWADZENIE

Od kilku lat odnotowuje się na polskim rynku transportowym wahania tempa wzrostu oraz brak stałego i dynamicznego rozwoju przewozów kombinowanych na skutek pogarszającej się jakości usług kolejowych, wzrostu czasu obsługi jednostek intermodalnych na terminalach, w tym również i w portach morskich, pogłębiającej się niekonkurencyjności cenowej transportu w stosunku do transportu samochodowego oraz braku kompleksowych i efektywnych instrumentów polityki transportowej państwa, wspierających transport kombinowany.

Główne przesłanki rozwoju transportu kombinowanego/intermodalnego w Polsce [Anonim 2004]:

- polityka transportowa UE jest ukierunkowana na rozwój proekologicznych rodzajów transportu,
- Polska jest położona na skrzyżowaniu głównych europejskich korytarzy transportowych,
- ma miejsce wzrost wymiany międzynarodowej, generujący zwiększenie popytu na przewozy międzynarodowe, szczególnie w tranzycie,
- następuje spadek popytu na przewozy masowe na korzyść towarów wysoko przetworzonych o wysokiej podatności na technologie transportu kombinowanego,
- poważne rezerwy zdolności przewozowej transportu kolejowego - co oznacza duże możliwości przejęcia przez kolej części przewozów z transportu drogowego w systemie technologii transportu.
- sieć drogowa wymaga znacznych nakładów inwestycyjnych [Wronka 2002].

Cytowanie: Mindur L., Wronka J., 2007, Transport intermodalny w Polsce. LogForum 3, 2, 3
URL: http://www.logforum.net/vol3/issue2/no3
Zatwierdzono: 30.05.2007, on-line: 25.06.2007.

OCENA ROZWOJU TRANSPORTU INTERMODALNEGO W POLSCE

Do głównych uczestników rynku transportu kombinowanego/ intermodalnego w Polsce należą: PKP CARGO S.A., Spedcont, Polcont, Polzug, Trade Trans, Cargosped oraz porty morskie, w tym przede wszystkim Bałtycki Terminal Kontenerowy w porcie Gdynia.

Działalność PKP CARGO S.A. koncentruje się na przewozie - w komunikacji międzynarodowej i krajowej - kontenerów, naczep i nawozi wymiennych, na zlecenie firm spedycyjnych i operatorów transportu kombinowanego oraz we własnym zakresie. Przewozy intermodalnych jednostek transportowych (UTI) realizowane są w systemie przewozów całopociągowych (60% przewozów intermodalnych ogółem) oraz rozproszonych (40%) w komunikacji międzynarodowej jak i krajowej.

Wielkość i strukturę przewozów intermodalnych wykonanych transportem kolejowym przedstawiają tabele 1 i 2 oraz rysunki 1 i 2.

Tabela 1 Wielkość przewozów kombinowanych realizowanych przez PKP CARGO S.A.
Table 1. Volumes carried by intermodal transport of PKP CARGO S.A.

Lata	Jednostki ładunkowe w przeliczeniu na TEU w tys.	% wzrostu do ubiegłego roku	Tonaż (w tys. ton)	% wzrostu do ubiegłego roku	% ogółu przewozów PKP Cargo S.A.
1995	138,2	20,0	1 361,7	15,0	0,6
1996	195,6	42,0	1 654,8	21,0	0,7
1997	255,9	31,0	2 125,1	28,0	0,9
1998	316,9	23,0	2 401,9	13,0	1,2
1999	257,3	-19,0	1 751,2	-27,0	0,9
2000	272,9	6,0	2 079,4	18,7	1,1
2001	224,6	-17,7	1 968,6	-5,3	1,2
2002	254,5	13,3	2 190,5	11,3	1,4
2003	304,8	19,8	2 301,1	5,0	1,5
2004	358,9	17,7	2 516,5	9,3	1,6
2005	355,6	-0,7	2 404,5	-4,5	1,7

Źródło: obliczenia własne na podstawie materiałów źródłowych PKP Cargo S.A.

W roku 2003 spółka PKP Cargo S.A. przewiozła 192 171 sztuk UTI (w przeliczeniu na TEU - 304,8 tys. jednostek), a w roku 2004 - 225 257 szt. UTI, (w 355,6 tys. TEU), co daje 17,2% wzrostu. Według informacji źródłowych PKP, przewozy jednostek intermodalnych ogółem, tzn. w komunikacji krajowej i zagranicznej, wykonane przez spółkę PKP Cargo S.A. wyniosły w latach 2002-2005 w tys. ton odpowiednio: 2190,6; 2301,1 i 2404,5.

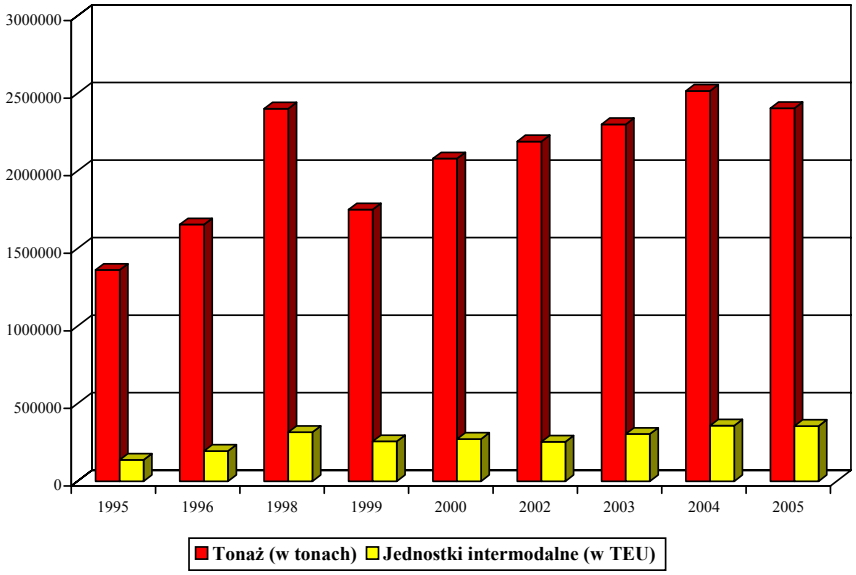
Pozytywnym trendem jest więc wzrost przewozów intermodalnych, choć ciągle ich udział w kolejowych przewozach towarowych jest znikomy (1,6% wszystkich ładunków).

Wzrost przewozów intermodalnych spowodowany był ożywieniem gospodarczym Polski, a przede wszystkim tendencją wzrostową eksportu, importu i obrotów krajowych.

Tabela 2 Wielkość przewozów intermodalnych jednostek transportowych według rodzajów (w sztukach)
Table 2. Volumes of intermodal transports according to different types of transport

Lata	Rodzaj UTI				
	Kontenery		Nadwozia wymienne	Naczepy siodłowe	Razem
	20’	40’			
1999	59 928	76 880	19 312	2 434	158 554
2000	89 224	72 370	36 449	1 259	199 302
2001	70 786	60 183	32 105	675	163 749
2002	74 997	71 977	17 540	430	164 944
2003	78 780	102 204	10 406	781	192 171
2004	92 345	119 895	12 197	820	225 257
2005	93 492	224 824	.	.	.

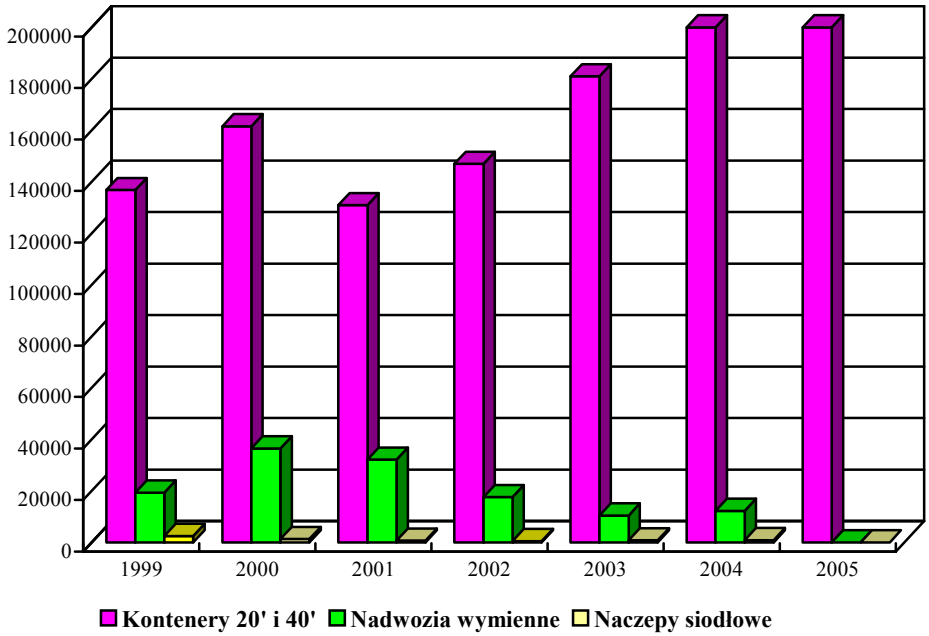
Źródło: opracowanie własne na podstawie danych źródłowych PKP Cargo S.A.



Źródło: opracowanie własne na podstawie danych źródłowych PKP CARGO S.A.

Rys. 1. Wielkość przewozów kombinowanych wykonanych przez PKP CARGO S.A.
Fig. 1. Volumes carried by intermodal transport of PKP CARGO S.A.

W kolejowych przewozach kombinowanych/ intermodalnych dominują kontenery 40' oraz 20' - udział kontenerów ogółem stanowił blisko 97% przewiezionych w 2005 r. jednostek intermodalnych w komunikacji międzynarodowej i krajowej łącznie. Liczba przewożonych kontenerów systematycznie wzrasta, przy czym wzrost ten szczególnie dotyczy kontenerów 40'. Przewozy kontenerów w ciągu najbliższych lat będą stanowiły największy udział w strukturze przewozów intermodalnych. PKP dysponują, bowiem określoną liczbą wagonów do przewozów tego rodzaju jednostek, jak również trwają prace związane z adaptacją wagonów platform na platformy kontenerowe. Istniejąca sieć terminali kontenerowych zarówno kolejowych jak i prywatnych umożliwia w miarę sprawne ich przemieszczanie zarówno w komunikacji krajowej jak i międzynarodowej.



Źródło: opracowanie własne na podstawie danych źródłowych PKP CARGO S.A.

Rys. 2. Wielkość przewozów intermodalnych jednostek transportowych według rodzajów (w sztukach)
Fig. 2. Volumes of intermodal transports according to different types of transport

Liczba przewiezionych nadwozi wymiennych zmniejszyła się ponad trzykrotnie w 2004 w porównaniu z rokiem 2002 (z 13373 do 4245 sztuk). Przewóz nadwozi wymiennych (blisko 4,3 % przewozów intermodalnych ogółem w 2004r.) z przyczyn niezależnych od PKP będzie rozwijał się wolniej. Zróżnicowane wymiary nadwozi ograniczają znacznie ich przewozy wagonami kontenerowymi. Zasadniczym warunkiem rozwoju tej technologii transportu jest pełna normalizacja tych jednostek intermodalnych oraz wprowadzenie zasady ich wymienności.

Przewozy naczep samochodowych mają marginalne znaczenie w przewozach intermodalnych (0,01% przewozów ogółem) i nie należy oczekiwać aby nastąpił jakiś znaczący wzrost udziału tych jednostek w przewozach ogółem w następnych latach.

Przewozy intermodalne realizowane są przede wszystkim w relacjach międzynarodowych, których udział w strukturze przewozów intermodalnych ogółem wyniósł prawie 86% w 2004r. W przewozach międzynarodowych znaczna część przewozów UTI wykonywana jest regularnymi pociągami z określonym rozkładem jazdy i za określoną cenę. Są to pociągi tzw. jednego operatora, który zabezpiecza ładunek do przewozu oraz jest płatnikiem przewoźnego za całą drogę przewozu.

Intermodalne przewozy kolejowe w relacjach międzynarodowych są realizowane przez pociągi kursujące w następujących relacjach:

Verona - Gliwice i vv.

- Przewozi kontenery nadwozia wymienne i naczepy siodłowe
- Kursuje 5 razy w tygodniu w obydwu kierunkach

Rotterdam - Warszawa Praga i vv.

- Przewozi kontenery
- Kursuje 3 razy w obydwu kierunkach

Rotterdam - Małaszewicze

- Przewozi kontenery
- Kursuje 1 raz w tygodniu

Hamburg - Warszawa Praga - Hamburg

- Przewozi kontenery
- 5 razy w tygodniu w obydwu kierunkach

Bremerhaven - Poznań Franowo- Bremerhaven

- Przewozi kontenery
- W relacji Bremerhaven - Poznań Franowo kursuje 2 razy w tygodniu
- W relacji Poznań Franowo - Bremerhaven kursuje 1 raz w tygodniu

Pruszków - Hamburg i vv.

- Przewozi kontenery
- Kursuje 6 razy w tygodniu

Pruszków - Duisburg i vv.

- Przewozi kontenery, nadwozia wymienne, naczepy siodłowe
- 3 razy w tygodniu

Prerov - Police Chemia i vv.

- Przewozi kontenery.
- Kursuje 1 raz w tygodniu w obydwu kierunkach
- Pociąg do przewozu nawozu

Gliwice - Picenza i vv.

- Przewozi kontenery.
- Kursuje 2 razy w tygodniu w obydwu kierunkach

Przewozy intermodalnych jednostek transportowych na polskim odcinku II korytarza transportowego, tj. na odcinku Małaszewicze - Rzepin - Małaszewicze koncentrują się na całopociągowych produktach logistycznych, prowadzonych przez dwóch operatorów:

- ICF (Intercontainer - Interfrigo)
  - połączenie Berlin Hul - Małaszewicze - i dalej do różnych stacji WNP tzw. "Ostwind"
  - połączenie Małaszewicze - Seddin tzw. "Westwind"
  - połączenie Rotterdam - Małaszewicze - i dalej do różnych stacji WNP
- Polzug GmbH
  - połączenie Bremerhaven - Małaszewicze - i dalej do różnych stacji WNP

Pociąg Ostwind w relacji Berlin Hul - Małaszewicze kursuje 5 razy w tygodniu. Czas przejazdu przez terytorium Polski wynosi 12 godzin i w obecnych warunkach techniczno-eksploatacyjnych jest to czas optymalny.

W kierunku odwrotnym dla pociągu Ostwind funkcjonuje pociąg Westwind w relacji Małaszewicze - Seddin. Pociąg ten kursuje raz w tygodniu. Czas jego przejazdu przez terytorium Polski wynosi 11,5 godz. I jest to również czas optymalny. Spływające z Brześcia przesyłki dla tego pociągu są zbierane na terminalu w Małaszewiczach.

Pociągami relacji Rotterdam - Małaszewicze i Bremerhaven - Małaszewicze obecnie kierowana jest przede wszystkim pomoc humanitarna z Europy Zachodniej na Wschód.

Poza pociągami "jednego operatora" przewozy intermodalnych jednostek transportowych w tranzycie przez Polskę można realizować również pociągami rozkładowymi, dostępnymi dla każdego klienta. Pociągi te także od strony organizacyjnej zapewniają dogodne warunki transportu przesyłek intermodalnych.

Obok pociągów logistycznych funkcjonujących w komunikacji międzynarodowej spółka PKP CARGO S.A. rozwija przewozy intermodalne poprzez sieć połączeń krajowych, aktywnie współpracując przy ich realizacji z polskimi portami morskimi. Przewozy krajowe wyniosły w 2004 roku ok. 45 tys. TEU.

W przewozach krajowych większość przewozów UTI odbywa się regularnymi połączeniami, przy czym są to pociągi rozkładowe, którymi mogą być przewożone przesyłki różnych operatorów/ spedytorów.

Sieć transportu intermodalnego jest częścią sieci TEN-T i obejmuje infrastrukturę liniową oraz punktową umożliwiającą przewóz i przeładunek intermodalnych jednostek trans-portowych. Infrastrukturę punktową sieci transportu intermodalnego tworzą przede wszystkim lądowe i morskie terminale intermodalne (głównie kontenerowe) i centra logistyczne. Terminale kontenerowe są wyposażone w odpowiednie urządzenia przeładunkowe, umożliwiające przeładunek jednostek intermodalnych pomiędzy różnymi rodzajami transportu, w tym przede wszystkim: miedzy transportem kolejowym a drogowym, między drogowym a morskim oraz między kolejowym i morskim.

Infrastruktura liniowa transportu intermodalnego obejmuje:

- sieć linii kolejowych ustalonych Umową AGTC,
- siec dróg wodnych ustalonych Umową AGN,
- sieć drogowa tworząca układ określony Umowa AGR,
- sieć dróg morskich łączących główne porty morskie europejskie i poza europejskie.

W przewozach kombinowanych istotną rolę odgrywają linie kolejowe objęte umową AGTC, która została ratyfikowana przez Polskę w 2002 r. Sieć linii w Polsce, objętych umową AGTC, wynosi 4 277,8 km, a do podstawowych terminali istotnych dla międzynarodowego transportu należą: Gdańsk, Gdynia, Gliwice, Kraków, Łódź, Małaszewicze, Poznań, Pruszków, Sosnowiec, Szczecin, Świnoujście, Warszawa. Natomiast sieć dróg morskich, którymi przewożone są ITU, obejmuje drogi morskie łączące porty morskie zlokalizowane w zatokach Gdańskiej i Szczecińskiej ze skandynawską drogą morską oraz z tranzytową drogą morską przebiegającą przez polski obszar morski.

CELE STRATEGICZNE I PODSTAWOWE ORAZ KIERUNKI ROZWOJU TRANSPORTU INTERMODALNEGO W POLSCE

Cel strategiczny i cele podstawowe

Strategicznym celem rozwoju transportu kombinowanego/intermodalnego w Polsce powinno być stworzenie korzystnych warunków technicznych, prawno-organizacyjnych i ekonomiczno-finansowych dla dynamicznego rozwoju systemu przewozów kombinowanych, tak aby ich udział w przewozach kolejowych osiągnął w 2020 r. średni poziom krajów Unii Europejskiej z 2000 roku, tj. 10-15% w ujęciu tonażowym.

W zależności od przebiegu procesu wdrażania instrumentów promujących oraz od możliwości budżetowych państwa można przyjąć dwa warianty realizacji celu strategicznego rozwoju tego systemu transportowego w Polsce [Wronka]:

- w wariancie optymistycznym udział przewozów kombinowanych w przewozach kolejowych ogółem powinien osiągnąć w 2013 roku poziom minimum 10% oraz 15% w 2020 roku (przy udziale 1,5% w 2003 r.).
- w wariancie realistycznym można przyjąć docelowy udział przewozów kombinowanych w przewozach kolejowych ogółem w roku 2013 w wysokości 6% i 10% w 2020 roku, czyli ok. 11,18 mln ton (przyjmując poziom przewozów z 2003 r.).

Natomiast do celów podstawowych rozwoju transportu kombinowanego/ intermodalnego można zaliczyć [Anonim 2004]:

1. obniżanie kosztów społecznych transportu, a w tym przede wszystkim kosztów zewnętrznych zgodnie z zasadami zrównoważonego rozwoju i zrównoważonego przemieszczania przyjętych przez UE jako priorytety paneuropejskiej polityki transportowej,
2. utrzymanie wzrostowej tendencji przewozów kombinowanych/ intermodalnych oraz systematyczne zwiększanie ich udziału w wolumenie całkowitych przewozów PKP CARGO SA,
3. systematyczne podnoszenie jakości świadczonych usług.

Kierunki rozwoju transportu kombinowanego/intermodalnego.

Można mówić o dwóch podstawowych kierunkach rozwoju transportu kombinowanego w Polsce [Wronka]:

- obsługa obrotów phz w relacjach lądowych i lądowo-morskich,
- obsługa przewozów tranzytowych przez terytorium Polski w relacjach lądowych na kierunku W-Z-W oraz przez polskie porty morskie na kierunku Północ-Południe- Północ.

Intensyfikacja przewozów kombinowanych/intermodalnych przez polskie porty morskie (zarówno w obsłudze phz, jak i tranzytu) jest kluczowym instrumentem dla rozwoju i integracji żeglugi morskiej bliskiego zasięgu w intermodalnych morsko-lądowych łańcuchach transportowych. Ten kierunek rozwoju przewozów jest szczególnie rekomendowany i promowany przez Komisję WE.

Należy dążyć do pełnego wykorzystania dogodnego położenia geograficznego portów polskich w układzie tzw. wschodnioeuropejskiego korytarza transportowego na osi północ-południe, poprzez zacieśnianie współpracy oraz promocję usług portowych z krajami skandynawskimi oraz wschodnimi landami Niemiec, Czechami, Słowacją, Austrią i Włochami.

Prowadzone obecnie inwestycje w polskich portach morskich, finansowane ze środków własnych i pożyczek BŚ, zapewnią wysoką jakość usług dla obsługi przewozów intermodalnych w morsko-lądowych łańcuchach transportowych.

Odnotowywany w ostatnich 3 latach dynamiczny rozwój obrotów kontenerowych w portach morskich tworzy korzystne warunki dla wzrostu udziału kolei w dowozach i odwozach kontenerów, ponieważ istnieją potencjalne możliwości dla uruchomienia połączeń pociągami blokowymi regionów o stosunkowo dużej masie ładunków podatnych na konteneryzację z portami morskimi w ramach morsko-lądowych łańcuchów transportu intermodalnego.

PODSTAWOWE UWARUNKOWANIA REALIZACJI CELU STRATEGICZNEGO I CELÓW PODSTAWOWYCH ROZWOJU TRANSPORTU KOMBINOWANEGO/ INTERMODALNEGO W POLSCE

Na podstawie wyników przeprowadzonych w Polsce badań [Wronka] można stwierdzić, że istnieją zarówno korzystne uwarunkowania zewnętrzne jak i perspektywy rozwoju transportu kombinowanego

w Polsce, zwłaszcza w kategoriach potencjalnego popytu. Szacunki prognostyczne w zakresie przewozów ładunków w komunikacji międzynarodowej o wysokiej podatności na technologie transportu kombinowanego/intermodalnego wskazuje, że istnieje potencjalny - i to znaczny - popyt na usługi tej technologii transportu.

O tym czy nastąpi wykorzystanie tego potencjału zadecydują następujące działania:

1. eliminowanie barier w ramach polityki transportowej państwa,
2. wdrożenie kompleksowych instrumentów promujących transport kombinowany,
3. opracowanie, przyjęcie i realizacja programu rozwoju transportu kombinowanego.

Dla osiągnięcia celu strategicznego i celów podstawowych rozwoju transportu kombinowanego/ intermodalnego w Polsce należy podejmować działania ukierunkowane na eliminowanie istniejących barier oraz tzw. działania wspierające (promujące).

Do głównych działań ukierunkowanych na eliminowanie barier można zaliczyć m.in.:

Przeciwdziałanie relatywnie niskiej jakości usług kolejowych

Działania eliminujące:

- modernizacja linii kolejowych AGTC,
- skrócenie czasu przejazdu regularnych pociągów z jednostkami intermodalnymi,
- zapewnienie rozkładowych czasów przejazdu pociągów,
- monitorowanie połączeń i zapewnienie bieżącej informacji o przesyłkach dla klientów.

Przeciwdziałanie niekonkurencyjności cenowej w stosunku do transportu drogowego

Działania eliminujące:

- elastyczna polityka cenowa i rabatowa PKP,
- dotacje budżetowe dla operatorów do kosztów przewozów kombinowanych/intermodalnych,
- ulgi w podatku dochodowym dla firm korzystających z transportu kombinowanego/ intermodalnego,
- ulgi w podatku dochodowym dla operatorów terminalowych,
- zwolnienie przewoźników samochodowych, zatrudnionych przy odwozie/dowozie jednostek ładunkowych z i do terminali z podatku od środków transportowych,
- środki ograniczające popyt na towarowe przewozy samochodowe na dalekie odległości.

Natomiast do głównych działań wspierających (promujących) można zaliczyć m.in.:

- tworzenie sieci połączeń transportu kombinowanego/intermodalnego w Polsce, wspieranych środkami publicznymi, jako pierwszego etapu w budowie nowoczesnej infrastruktury logistyczno-transportowej,
- budowa centrów logistycznych i modernizacja terminali intermodalnych zlokalizowanych w portach morskich i na sieci kolejowej AGTC,
- zapewnienie harmonizacji i standaryzacji intermodalnych jednostek ładunkowych,
- rozwój przewozów intermodalnych do/z Skandynawii,
- uruchomienie i rozwój stałych połączeń kontenerowych na kierunku W-Z-W z wykorzystaniem Magistrali Transsyberyjskiej,

Równolegle, uczestnicy rynku transportu kombinowanego powinni skoncentrować działania na uatrakcyjnianiu oferty usług transportu kombinowanego, w tym m.in. poprzez:

- zapewnienie przejazdu regularnych pociągów z intermodalnymi jednostkami zgodnie z rozkładem jazdy i w czasie konkurencyjnym do transportu samochodowego,

- skracanie czasu obsługi jednostek intermodalnych na terminalach,
- bieżące monitorowanie wszystkich połączeń w ramach systemów informacyjnych,
- prowadzenie bardziej efektywniejszego marketingu i promocji usług transportu kombinowanego,
- prowadzenie stałej współpracy z władzami lokalnymi i regionalnymi w zakresie kształtowania infrastruktury towarzyszącej terminalom intermodalnym i centrów logistycznych.

O tym, że bardzo trudno jest zapewnić znaczący rozwój transportu kombinowanego/ intermodalnego bez pomocy państwa (zwłaszcza finansowej), świadczą jednoznacznie przykłady państw UE, zwłaszcza tych, które odgrywają wiodącą rolę na rynku transportu kombinowanego w Europie. Państwa te wychodzą z założenia, zgodnie zresztą z rekomendacjami Komisji WE, że należy promować ten system transportu do czasu, gdy zostaną wyrównane warunki konkurencji między transportem drogowym i kolejowym.

Dlatego, zdaniem autorów, do czasu wyrównania warunków konkurencji międzygałęziowej, w tym przede wszystkim poprzez upodmiotowienie kosztów zewnętrznych transportu i zharmonizowanie poziomu opłat za korzystanie z infrastruktury transportowej - przynajmniej strategiczne połączenia w systemie transportu kombinowanego powinny być finansowo wspierane przez państwo - co doprowadziłoby do stworzenia stabilnej sieci połączeń transportu i obniżenie kosztów transportu w tej technologii oraz dostosowanie się rynku do tego systemu.

Wśród instrumentów ekonomicznych wspierających rozwój transportu kombinowanego istotną rolę odgrywa pomoc finansowa państwa w zakresie modernizacji linii AGTC oraz inwestycji majątkowych w tabor specjalistyczny i rozwój infrastruktury terminali.

Przy wyborze instrumentów wsparcia transportu kombinowanego należy również uwzględniać przesłanki, jakie wynikają z ustawy o zasadach wspierania rozwoju regionalnego. Dotyczy to zwłaszcza inwestycji infrastruktury liniowej i punktowej stanowiących w znacznej mierze element polityki regionalnej. Istotne jest wzmocnienie działań samorządów lokalnych i władz regionalnych dla stworzenia infrastruktury centrów logistycznych z terminalami intermodalnymi i połączenia z infrastrukturą drogową i kolejową.

Doświadczenia i osiągnięcia innych krajów w rozwoju transportu wskazują, że konieczna jest skuteczna i konsekwentna polityka transportowa państwa i to w ramach perspektywicznych programów rozwoju transportu kombinowanego/intermodalnego. O znaczeniu i roli programu w rozwoju transportu w Polsce pisało wielu ekspertów z dziedziny transportu w Polsce - sytuując Ministerstwo Transportu w roli inicjatora i organu nadzorującego realizację takiego Programu [Mindur, Wronka]. Jest to potwierdzenie tezy, że o przyszłości transportu kombinowanego w Polsce zadecyduje konsekwentna realizacja perspektywicznego Programu Rozwoju Transportu Kombinowanego przy pełnym zaangażowaniu państwa.

Realizacja podstawowych zadań Programu Rozwoju Transportu Intermodalnego powinna być prowadzona równolegle przez resort infrastruktury i wszystkie podmioty na rynku transportowym. Przy czym rola Ministerstwa Transportu jako organu państwa powinna koncentrować się na:

1. wdrożeniu instrumentów promujących rozwój transportu intermodalnego oraz
2. stworzeniu podstaw prawnych dla udzielania systemowej i kompleksowej pomocy finansowej państwa dla transportu intermodalnego, czyli stworzeniu korzystnych warunków dla rozwoju transportu w Polsce i od podmiotów na rynku będzie zależało czy stworzone możliwości zostaną w pełni wykorzystane.

Dzięki temu nastąpiłoby istotne wzmocnienie roli Ministerstwa Transportu w procesie planowania strategicznego rozwoju transportu tworząc tym samym szansę na integrację różnych rodzajów transportu, w tym przewozów w technologiach intermodalnych w ramach zintegrowanego systemu transportowego Polski.

Mówiąc o uwarunkowaniach rozwoju transportu kombinowanego w Polsce nie można zapominać o obszarach potencjalnych zagrożeń rozwoju tego systemu, a mianowicie:

1. Zagrożenia wewnętrzne, w tym przede wszystkim:
   - opóźnienie lub niepodjęcie działań promujących; chodzi tu zarówno o wdrażanie instrumentów promujących, jak i realizację podstawowych zadań programowych, które będą wymagały zaangażowania państwa w system uregulowań prawnych jak i system pomocy finansowej,
   - dalsze pogorszenie jakości usług kolejowych świadczonych w łańcuchach transportu kombinowanego i w konsekwencji utrata klientów,
   - brak współpracy między podmiotami na rynku transportu kombinowanego w Polsce, co może skutkować w zaostrzeniu konkurencji między polskimi operatorami.
2. Zagrożenia zewnętrzne to przede wszystkim niebezpieczeństwo przejęcia części polskiego rynku transportu przez silniejszych kapitałowo i organizacyjnie operatorów z krajów UE (głównie z Niemiec), którzy bezpośrednio i pośrednio wchodzą na polski rynek transportowy. Otwarta konkurencja na polskim rynku transportowym stała się faktem z chwilą uzyskania przez Polskę członkostwa w UE.

PODSUMOWANIE

Jeśli system transportowy w Polsce ma się rozwijać zgodnie z zasadami zrównoważonego rozwoju i zrównoważonego przemieszczania, konieczne jest wprowadzenie kompleksowych środków promujących rozwój transportu kombinowanego w Polsce.

Celowe i zasadne jest tworzenie kompleksowych i spójnych pakietów, obejmujących instrumenty organizacyjne, prawne i administracyjne oraz finansowo-ekonomiczne, promujących rozwój transportu kombinowanego/intermodalnego w Polsce.

Należy podkreślić, że promowanie transportu kombinowanego to wymierne korzyści społeczne w skali makro. Przesunięcie bowiem części międzynarodowych przewozów drogowych na transport kombinowany/intermodalny może wpłynąć w istotny sposób na zmniejszenie negatywnych skutków zewnętrznych transportu drogowego dla środowiska naturalnego oraz zdrowia i życia ludzi. Korzyści "netto" (zmniejszenie kosztów zewnętrznych transportu) z tytułu przesunięcia 1 mln ton z transportu drogowego na transport intermodalny kolej-droga (w przewozach na odległość 1000 km), czyli po uwzględnieniu wielkości traconych wpływów budżetowych można oszacować w wysokości 69 mln zł [Wronka].

Do czasu pełnej internalizacji kosztów zewnętrznych transportu strategiczne połączenia w systemie transportu powinny być finansowo wspierane przez państwo, przy czym wsparcie finansowe powinno polegać na pokryciu różnicy między kosztami i wpływami w początkowej fazie eksploatacji nowych, strategicznych połączeń wprowadzanych w oparciu o projekty przedstawione przez operatorów transportu i zaakceptowane pod względem możliwości udzielenia dotacji.

Zapewnienie wysokiego poziomu jakościowego usług transportu kombinowanego, w tym zwłaszcza niezawodności, terminowości, bezpieczeństwa i czasu dostaw, jest uzależnione od stanu infrastruktury liniowej, punktowej, nowoczesnego wyposażenia terminali oraz sprawności i efektywności ich funkcjonowania. Niezbędna jest więc pomoc finansowa państwa, w tym przede wszystkim w zakresie wspierania inwestycji w zakresie modernizacji linii AGTC, taboru specjalistycznego i rozwoju terminali.

Przedstawione podstawy prawne oraz zaproponowane instrumenty dla wyodrębnionych obszarów wsparcia pokazują możliwe do zastosowania instrumenty oraz abstrahują od możliwości finansowych państwa w kolejnych latach budżetowych. Tym samym prezentowane instrumenty nie przesądzają takich pochodnych wartości jak wielkość środków, które mogą być użyte na ten cel w określonej projekcji czasowej, i ich intensywność. Ustalenie tych elementów wymaga dokładnego określenia obszaru wsparcia, wartości niezbędnego zasilenia oraz uzyskania informacji o kwocie środków

możliwych do wygospodarowania z budżetu, tak aby transport kombinowany/intermodalny stał się konkurencyjny wobec transportu drogowego.

Promowanie rozwoju transportu kombinowanego/intermodalnego wymaga zaangażowania państwa również w tworzenie stosownych uregulowań prawnych, w tym m.in.: Rozporządzenie Rady Ministrów o udzielaniu pomocy przez państwo oraz Operacyjnego Programu rozwoju transportu.

Istotnym aspektem rozwoju rynku transportu kombinowanego/intermodalnego w Polsce jest integrowanie żeglugi morskiej bliskiego zasięgu w morsko-lądowych łańcuchach intermodalnych - zgodnie z rekomendacjami Komisji WE i w związku z tym wszystkie proponowane instrumenty promujące obejmują również i polskie porty morskie.

Należy promować rozwój zintegrowanych "logistycznych centrów towarowych" dla przewozów intermodalnych, z możliwie najnowocześniejszą techniką przeładunkową i kompleksową obsługą.

Rozwój transportu kombinowanego będzie uzależniony również od skorelowania polityki transportowej Państwa z działaniami podejmowanymi przez podmioty gospodarcze działające na tym rynku w celu zapewnienia maksymalnego zwiększenia i uatrakcyjnienia oferty przewozowej oraz świadczenia usług na wysokim poziomie jakościowym w intermodalnych łańcuchach transportowych.

LITERATURA

Anonim 2004, Materiały analityczne do założeń Narodowej Strategii Rozwoju Transportu na lata 2007-2013. Ministerstwo Infrastruktury, Warszawa.

Mindur L. (red.), 2002. Współczesne technologie transportowe. Politechnika Radomska, Warszawa.

Wronka J., 2001, Program rozwoju transportu kombinowanego w Polsce do 2015r. Temat OBE4-1260/2000. OBET P.P. Warszawa-Szczecin.

Wronka J., 2002. Analiza i ocena działalności EKMT, UE i UIRR w zakresie rozwoju transportu w Europie oraz wnioski dla polityki transportowej Polski. Temat OBE4 - 1294/02. OBET P.P. Warszawa - Szczecin, sierpień - grudzień 2002.

Wronka J., 2002, Transport kombinowany w aspekcie wymogów zrównoważonego rozwoju OBET P.P. Warszawa – Szczecin.

INTERMODAL TRANSPORT IN POLAND

ABSTRACT. The article contains the following sections: Introduction, three main parts and a Summary. The first part is an opinion of intermodal transport in Poland. In the second part the author defines all the targets and directions of intermodal transport development. The third part shows the basic conditions, necessary to realize the strategic target as well as basic targets of intermodal transport development. The Summary contains the general conclusions as the result of the analysis of the present days and advices for the improvement of the Polish intermodal transport.

Key words: intermodal transport, transportsystem, logistic centres.

INTERMODALER VERKEHR IN POLEN

ZUSAMMENFASSUNG. Der Beitrag setzt sich aus der Einführung, der drei Teile und der Zusammenfasung zusammen. Der erste Teil beschäftigt sich mit der Beurteilung des intermodalen Verkehrs in Polen. Im zweiten Teil wurden dessen Ziele und Entwicklungstrends dargestellt. Der dritte Teil präsentiert Grundprämissen für die Realisierung des strategischen Ziels und der Hauptziele der Entwicklung des intermodalen Verkehrs. In der Zusammenfassung wurden generelle Schlußfolgerungen erfasst, welche sich aus der Analyse des Iststands der Entwicklung des intermodalen Verkehrs ergeben.

Darüberhinaus wurde auf erforderliche Vorhaben zur Verbesserung der aktuellen Situation des intermodalen Verkehrs in Polen hingewiesen.

Codewörter: intermodaler Verkehr, Transportsystem, Logistikzentren.

prof. zw. dr hab. Leszek Mindur
Wyższa Szkoła Logistyki
ul. Estkowskiego 6
61-755 Poznań, Polska
e-mail: leszek.mindur@ilim.poznan.pl

prof. dr hab. Jerzy Wronka
Katedra Gospodarki Światowej
i Transportu Morskiego
Wydziału Zarządzania i Ekonomiki Usług
Uniwersytetu Szczecińskiego
ul. Cukrowa 8
71-004 Szczecin, Polska
e-mail: kgs@wzieu.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 2
No 4

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

PLANNING PROCESS SUPPORT FOR INTERMODAL SUPPLY CHAINS

Bogusław Śliwczyński

Poznań School of Logistics, Poznan, Poland

ABSTRACT. The main addressed challenge is to prepare for the future growth in transportation and logistics and to bring this issue from analysis mode into actions. Within the Baltic Sea Region is seen increased exploitation of natural resources (seafood, petroleum, minerals, forest products etc.) that results in increased transport demand as well as increased general trade due to strong economical growth. The development of transnational cooperation and interlinking of regions or actors of Region is one of intermodal supply chain main objective.
The intermodal planning is focused on choices support, while intermodal planning emphasized the most efficient way of moving from point-to-point within the system. The solution presented in this paper is unique in its approach to manage supply chain and logistics services as a collection of configurable processes. Multiple operators' activities are not managed as individual files, but as services in a coherent process. This enables proper planning and enhanced visibility.

Key words: supply chain, planning system, transport corridor, interoperability, intermodal operations, collaboration network.

Many results of researches and forecasts done in the Baltic Sea Region show that there will be a huge increase in transportation and logistics related the Baltic Region. Maritime transport development assessment for period 2003 - 2030 is presented on the Figure 1. The Conference of Peripheral Maritime Regions (CPMR) Baltic Sea Commission and Baltic Development Forum confirm that this situation results from and will affect simultaneously business development and living conditions in general and thus call for important political decisions.

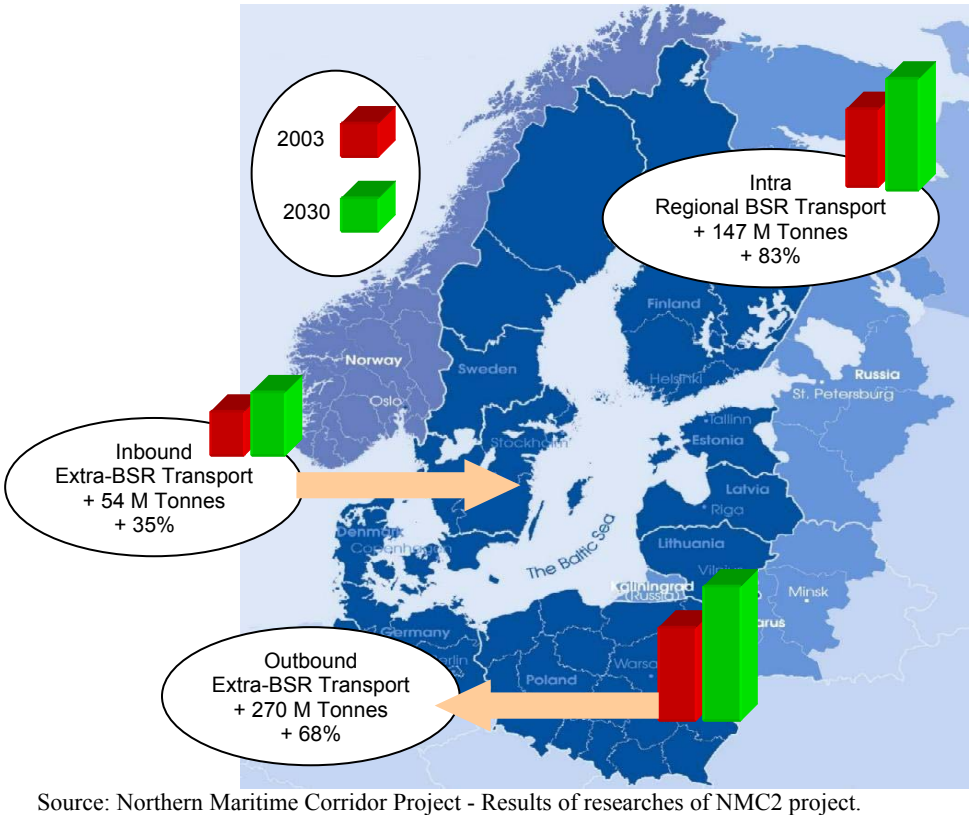
Main focus of many activities is developing practical actions in a partnership between the public and private sector based on a common strategic platform. Baltic Region applied projects complies with TEN, Motorways of the Sea, The Northern Dimension and national/supra-national politics and objectives.

The main addressed challenge is to prepare for the future growth in transportation and logistics and to bring this issue from analysis mode into actions. Within the region is seen increased exploitation of natural resources (seafood, petroleum, minerals, forest products etc.) resulting in increased transport demand as well as increased general trade due to strong economical growth. Important external factors that in particular will result in increased cargo flows through the region are the future economical growth in Russia and China and increased trade between these countries and Western Europe / USA. As result is seen future capacity problems and restrictions regarding transport through the region that

Citation: Śliwczyński B., 2007, Planning process support for intermodal supply chains. LogForum 3, 2, 4
URL: http://www.logforum.net/vol3/issue2/no4
Accepted: 20.06.2007, on-line: 25.06.2007.

makes major issue to develop alternative transport corridors. Some important factors to be considered are:

- lack of trans-national interoperability of intermodal transports and common strategies for infrastructure development,
- limited capacity in many ports and terminals,
- congestion on European roads making alternative transport corridors feasible,
- large number of countries with different technical transport standards, lack of cross-border operability and tradition for cooperation.



Source: Northern Maritime Corridor Project - Results of researches of NMC2 project.

Fig. 1. Maritime transport development assessment for period 2003 – 2030.
Rys. 1. Rozwój transportu morskiego w okresie 2003-2030.

These challenges can only be met through development of transnational cooperation.

The main objectives followed from above factors analysis include:

- to interlink regions and actors of Region into collaborative networks,
- to support logistics infrastructure investment decisions at country/region/hub level (based on accumulated cargo flows data analysis),
- to improve and to optimize planning of transport corridors and intermodal supply chains.

The comprehension of business processes interactions along supply chain is an important factor to succeed in the fast changing and competitive business arena.

The solution presented in this paper is unique in its approach to manage supply chain and logistics services as a collection of configurable processes. Multiple operators' activities are not managed as individual files but as services in a coherent process. This enables proper planning and enhanced visibility.

GENERAL ASSUMPTIONS OF PLANNING PROCESS FOR INTERMODAL SUPPLY CHAINS

1. The planning process is focused on building and dynamic search of international, intermodal transport chains.
2. The planning process system gathers data on transport network nodes (sea and inland ports, logistic centers, etc.) and allows its users to build transport chains on the basis of the data.
3. The gathered data include all information necessary from the point of view of logistics and IT in order to correctly build transport chains. This includes locations of the nodes, descriptions of logistic services available in a given node, as well as commercial data of the node and the services required to calculate the costs and to subsequently settle the services.
4. The data are introduced to the system by the operators and also with the help of messages generated by other, external IT systems.
5. The users are able to plan supply chain using a leg by leg method, taking independent decisions concerning the details of their course or system should to build a chain on the basis of user-specified start and end nodes, and intermediary nodes - if specified. The system presents solutions that have been optimized on the basis of required parameters or their combination.
6. The supply process planning system supports the realization of the transport service on the basis of the planned transport chains.

A general outline of data flow and participants of supply chain with their roles within the planning system are presented on the Figure 2.

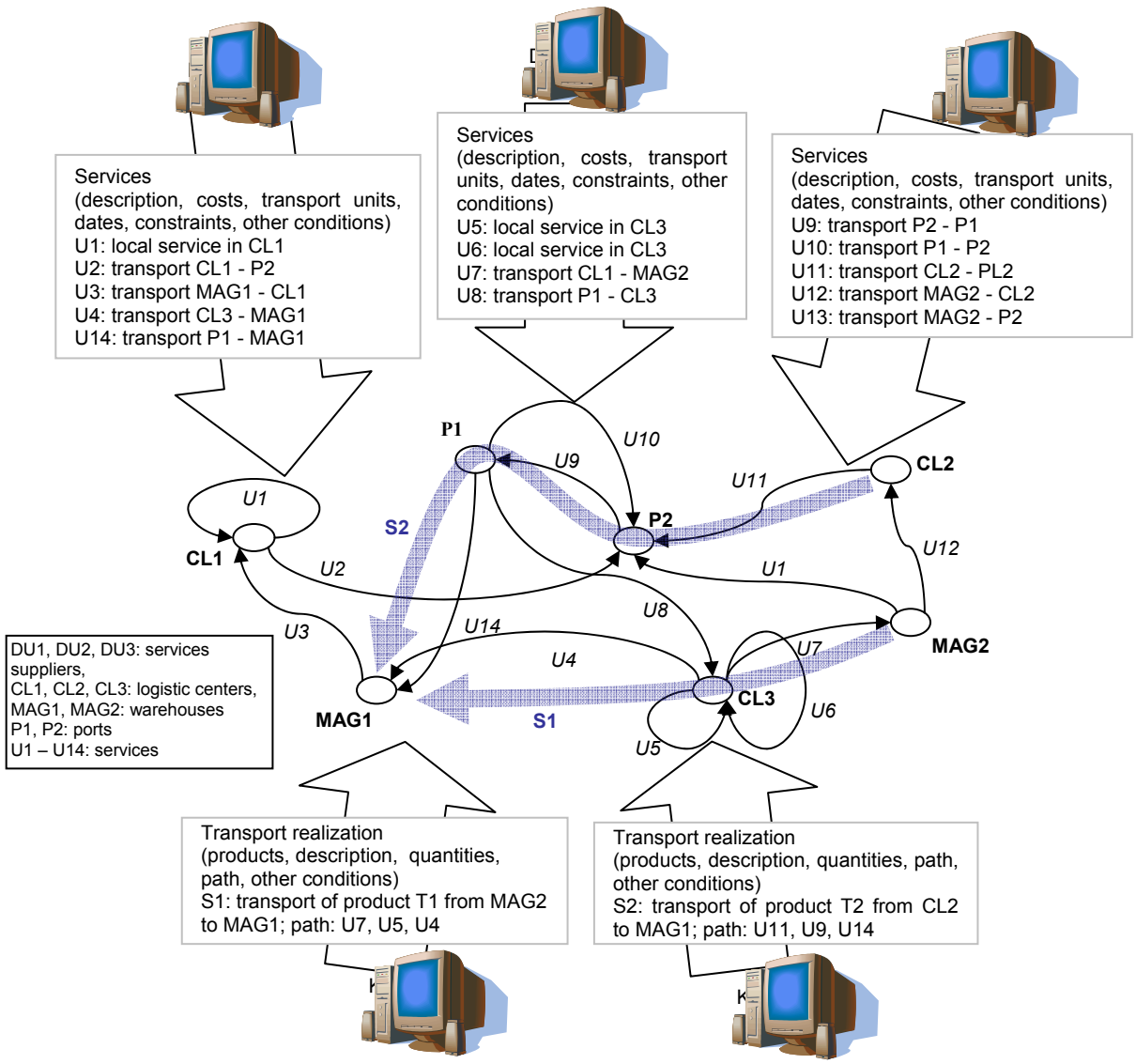
Interoperability of supply chain process stakeholders means that one combined planning process must cover:

- many transport routes
- many service providers
- different timetables
- different schedules
- different costs
- different quality measures

The supply chain planning process provides in complete information about service suppliers, logistics infrastructure (at line and node), logistics services, conditions of using those services, corridors parameters (road, rail, sea) etc. The infrastructure or services information mast be related to logistics node (centre) or route (transport line). The planning system provides consolidation mechanism of information:

provider or service → node (all providers and services) → chain or corridor (all nodes and routes)

Information include data essential for logistics planning e.g.: warehouse or transport capacity, pipeline capacity, lift of terminals capacity, infrastructure capability, actual level of load, lead time or time of service fulfil, load standards, etc. Designing of all possible cargo flows, routes and solutions in supply chains are enabled in the planning process.



Source: Terms of References : The System for planning intermodal supply chains; WP3 of Interbaltic Project; Institute of Logistics and Warehousing - Poland.

Fig. 2 General outline of data flow of supply chain planning process.
Rys. 2. Schemat przepływu danych w procesie planowania łańcucha zaopatrzenia.

PLANNING SYSTEM OF INTERMODAL SUPPLY CHAINS

The intermodal planning is focused on choices support, while intermodal planning emphasized the most efficient way of moving from point-to-point within the system. In intermodal planning, key interactions between modes, including transfers but also policy and service interactions, are paramount. Three-part intermodalism based on the concepts of connections, choice, and coordination/cooperation:

Choice among transportation options provided by competing modes, independently or in combination. (Choice also means that decision makers need to consider alternative systems to address transportation needs before investing in infrastructure.)

Connections that provide convenient, rapid, efficient, and safe transfer of people and goods from one mode to another (including end point, pickup, and delivery) during a single journey to provide the

highest quality and most comprehensive transportation service for cost, time, safety, punctuality and other.

Coordination and cooperation among transportation organizations to improve transportation service, quality, safety, and efficiency across all modes or combinations of modes.

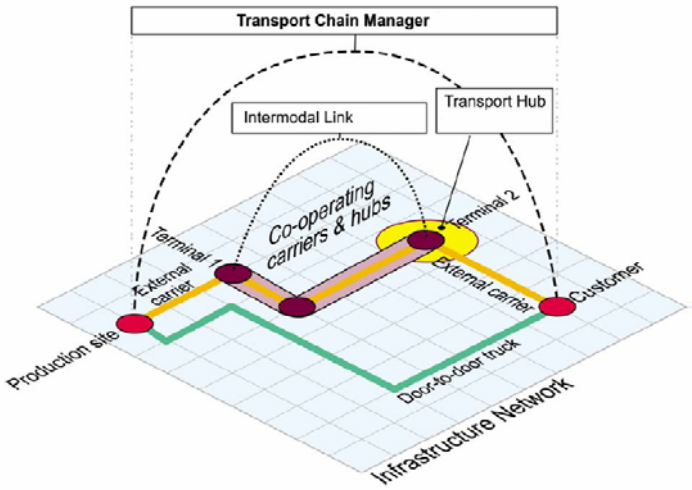


Fig. 3. Planning system of intermodal supply chains
Rys. 3. System planowania intermodalnego łańcucha dostaw

Intermodal freight operations involve the combination of different types of logistics services, some of them available according to specific timetables. Especially when multiple scheduled services are combined, this poses specific difficulties for planning.

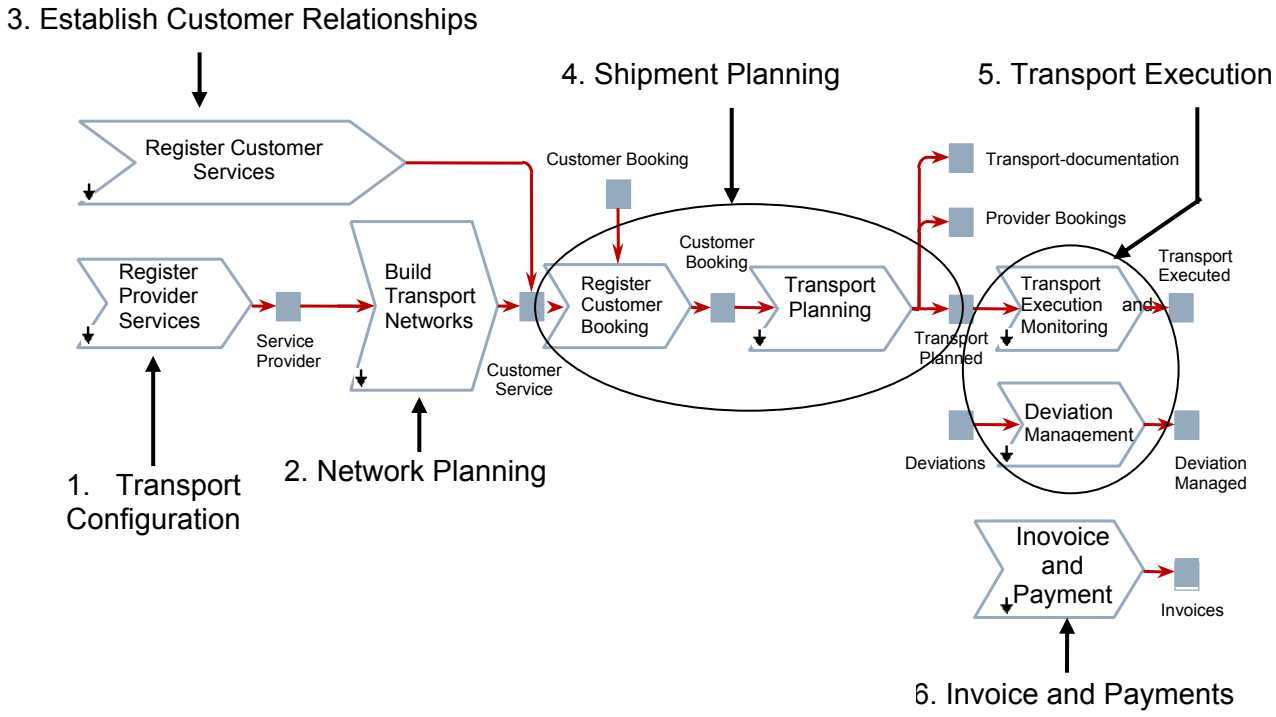


Fig. 4a. Supported Business Process
Rys.4a. Wspomagany proces zarządzania

Automatic routing decision support with a network of available intermodal services needs to be supported. Optimization decisions in such networks take place under the restriction that several (types of) services are available according to scheduled timetables, which is fundamentally different from standard linear optimization problems. Within planning process is created network of possible transport connections and choose the best route for the Customer and create a complete transport chain with estimated schedule and costs.

During the optimization process is allowed the automatic creation of intermodal chains on the basis of information on start and end nodes, intermediary nodes (optional), and available services, according to following criteria (or any combination of them): cost, time, punctuality, safety and other.

The planning process with described functionality and reference data for it is presented on Figure 4a and 4b.

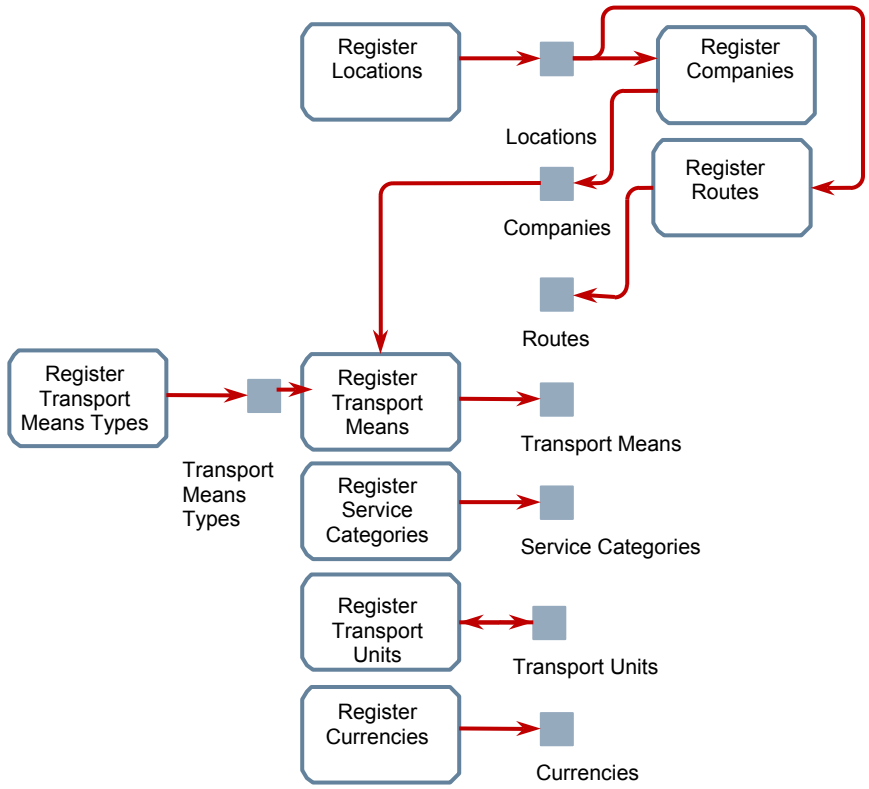


Fig. 4b. Reference data for supply chain planning system
Rys.4b. Dane referencyjne w systemie planowania łańcucha dostaw

Planning process includes analysis of multilayered network with intermodal switches (Transshipment Points). The generated proposals of supply chains are based on data about infrastructure and geographical positions and characteristics stored in database. The example of transshipment point (hub) description during planning process is presented on Figure 5.

The planning process of supply chains (including routes and schedules for an intemodal transportation) belongs to the most complex and complicated optimization problems that require a lot of computational effort. The coordination of separate schedules for different transportation modes is required. This coordination results in a system - oriented global optimization of routes and schedules, as opposed to local optimization leading to suboptimal solutions. In many real life situations the decision models involve non-linear description of certain phenomena, which additionally complicates solution procedures.

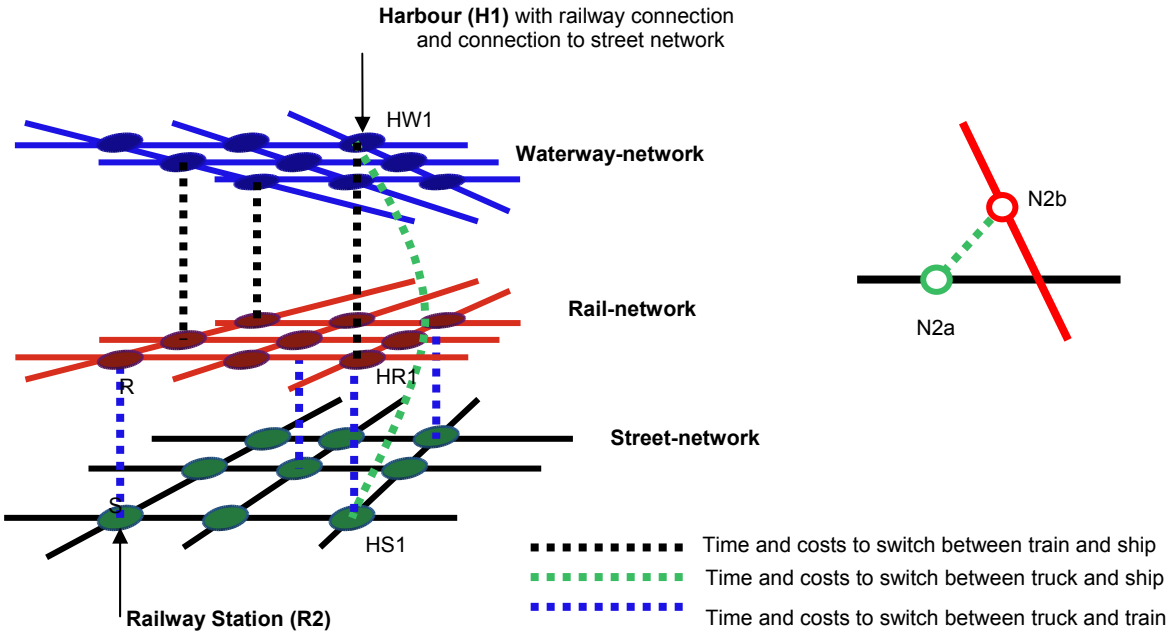


Fig. 5. Transshipment point (hub) of multilayered network description
Rys. 5. Punkt centralny (hub) sieci wielopoziomowej

CONCLUSIONS

Concluding these considerations about supporting of supply chain planning process it is essential to point out interlinking regions and actors of Region into collaborative networks and supporting logistics infrastructure investment decisions at country/region/hub level. The intermodal planning is focused on choices support, while intermodal planning emphasized the most efficient way of moving from point-to-point within the system. The international applying of described system is response to needs of trans-national interoperability of intermodal transport and makes a possible common strategy for infrastructure development. The planning process meets and alerts limitation capacity in many ports and terminals. Using of such system in large number of countries with different technical transport standards is one of most efficient way of cross-border operability and cooperation.

REFERENCES

The System for planning intermodal supply chains; Terms of References; WP3 of Interbaltic Project; Institute of Logistics and Warehousing, Poland, 2006.

WSPARCIE PROCESU PLANOWANIA INTERMODALNYCH ŁAŃCUCHÓW DOSTAW

STRESZCZENIE. Jednym z głównych wyzwań postawionych przed uczestnikami procesów biznesowych w łańcuchach dostaw Morza Bałtyckiego jest przygotowanie do znaczącego wzrostu obrotu towarowego i przewozów pasażerskich oraz przełożenie wyników analiz na płaszczyznę konkretnych działań. W rejonie Morza Bałtyckiego jest obserwowany oraz prognozowany wzrost transportu paliw, owoców morza, surowców mineralnych czy produktów drzewnych, wynikający ze stałego wzrostu obrotów handlowych i wzrostu gospodarczego wielu państw w tym rejonie.

Jednym z głównych celów rozwoju intermodalnych łańcuchów dostaw jest międzynarodowa (transgraniczna) współpraca oraz powiązania komunikacyjne i informacyjne poszczególnych regionów, portów i uczestników łańcuchów dostaw.
Planowanie intermodalnych dostaw jest zorientowane na wspomaganie decyzji wyboru najbardziej efektywnej drogi przewozu (ludzi lub towarów), z punktu startowego do docelowego punktu trasy.
W prezentowanym rozwiązaniu systemu planowania, zastosowano podejście procesowe. Zarządzanie łańcuchem dostaw i operacjami logistycznymi oparte jest na dynamicznym konfigurowaniu wielu operacji zdefiniowanych w procesach dostaw. W konsekwencji, działania operatorów są planowane w tworzonym połączeniu jako zestaw spójnych i powiązanych wzajemnie usług. Takie podejście pozwala na właściwe i sprawne planowanie oraz odpowiednią wizualizację procesu dostaw.

Słowa kluczowe: łańcuch dostaw, system planowania, korytarz transportowy, interoperacyjność, operacje intermodalne, sieć współpracy.

UNTERSTÜTZUNG DES PLANUNSGPROZESSES VON LIEFER-KETTEN

ZUSAMMENFASSUNG. Eine der Hauptherausforderungen vor den Unternhemen steht, die in Lieferketten in der Ostsee eingebunden sind, ist die Vorbereitung auf die erhebliche Erhöhung des Waren- und Passagierverkehrs sowie die Übertragung der Ergebnisse der Analysen auf konkrete Handlungen. In der Ostseeregion ist steigende Dynamik der Transporte von Kraftstoffen, Seefrüchten, Rohstoffen oder Holzprdukte sichtbar. Dieser ergibt sich aus dem konstanten Anstieg des Warenverkehrs und Wirtschaftswachstums in meheren Staaten dieser Region. Eines der Hauptziele der Entwicklung intermodaler Lieferketten ist die internationale (grenzüberschreitende) Kooperation sowie die Verkehrs- und Kommunikationsverbindungen der einzelnen Regione, Häfen und Unternehmen, die in den Lieferketten eingebunden sind. Die Planung intermodaler Lieferketten orientiert sich auf die Unterstützung des Entscheidungsprozesses der effektivsten Transportweges vom Start bis zum Ziel. In der dargestellten Lösung des Planungssystems wurde der Prozessansatz angewendet. Das Mangement von Lieferketten und Logistikoperationen basiert auf der dynamischen Konfigurierung meherer Operationen in dem Lieferungsprozess. Im Ergebnis werden die Aktivitäten von Logistikdienstleistern als Pakete kohärenter und aufeinader abgestimmter Dienstleistungen geplant. Durch einen solchen Ansatz ist richtige und effiziente Planung und entsprechedne Visualisierung des Lieferungsprozesses möglich.

Codewörter: Lieferkette, Planunsgsystem, Transportkorridor, Interoperabilität, intermodale Operationen, Kooperationsnetz.

dr inż. Bogusław Śliwczyński
Poznań School of Logistics
ul.Estkowskiego 6
61-755 Poznań, Poland
e-mail: boguslaw.sliwczynski@ilim.poznan.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 3
No 1

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

A CONCEPTUAL DISTANCE LEARNING ARCHITECTURE USING SEMANTIC WEB BASED MULTI-AGENT SYSTEMS

Ata Onal[1], Semih Otles[2], Inanc Seylan[1]

1) Department of Computer Engineering, Ege University, Izmir, Turkey
2) Department of Food Engineering, Ege University, Izmir, Turkey

ABSTRACT. In this paper, a conceptual distance learning architecture based on a semantic web enabled multi-agent platform is introduced. The need for such architecture arises to automate every day management tasks of a distance education system. Agents take care of such automation by using a common vocabulary of terms defined in ontologies. The users of the system are each given an agent to act on their behalf. These agents are then used to query, negotiate and cooperate with other agents to organize tasks and inform their users.

Key words: distance learning architecture, education system, ontology.

INTRODUCTION

Distance education is defined as a teaching form where the teachers and the students are in different locations [Silva]. In the beginning, it made use of postal service. Then new technologies such as radio, TV and computers were incorporated into it. Later, with the wide use of Internet, distance education environments are moved to the WWW. Many tools have been created such as WebCT [WebCT] to allow the content to be created, published and managed. However, the interaction between students and instructors doesn't go further than chat rooms, course materials or submitted assignments. Both users of the web based distance education environments require lots of human intervention. Tracking student progress requires manual methods to collect information and interpret that information.

Distance education is big business [Martz and Morgan]. Putting aside the economical facts, the amount of information that is needed to be managed in a distance learning environment is huge. It requires modern information management techniques which just don't store data but are able to fully categorize it, define relationships and rules; moreover, infer new knowledge. Therefore, distance learning provides opportunities that take advantage of ontologies. By ontology, we specifically mean ontologies written in W3C standard web ontology language, OWL [Web Ontology Language].

In the semantic web vision, the information published is both machine processable and human readable [Berners-Lee et al. 2001]. The computer programs that are agreed upon to process this information are software agents. Although software agents have a long history in the field of AI, research on them has increased in the last ten years. Despite its history, there isn't a universally-agreed definition of the term software agent. Different researchers describe it according to the key principals

Citation: Onal A. et al., 2007, A conceptual distance learning architecture using semantic web based multi-agent systems. LogForum 3, 3, 1
URL: http://www.logforum.net/vol3/issue3/no1
Accepted: 10.08.2007, on-line: 1.09.2007.

of their systems. [Woolridge and Jennings 1995] discusses that the defining characteristics of agency that are agreed upon by many researchers are: proactivity, reactivity, social ability and autonomy. Autonomous assistant agents representing their owners can help in management of a distance education environment, interact with other agents in the environment, thus making use of the services provided by a multi-agent system and automate everyday tasks of their owners.

There are some efforts to use software agents in distance learning. [Sheung at el 2005] uses autonomous interface agents to assist course coordinators in routine tasks. This architecture is different from ours because we model a multi-agent system in which each actor (student, academician) is represented by a software agent which is capable of communicating with other agents. We also make use of semantic web technologies. [Keleberda et al. 2004] focuses on the educational material selection based on student profiles, thus focusing on a single aspect of the proposed architecture. OntoEdu [Guang-zuo 2004] is a flexible educational architecture for e-learning with support for device adaptation. However it doesn't make use of the agent technology and task automation that comes with it.

This paper proposes a conceptual architecture for distance education that makes use of a multi-agent platform. The rest of this paper is organized as follows. Section 2 overviews the Seagent Platform which form the basis of the proposed distance learning environment. Section 3 discusses the architecture of this distance learning environment. Section 4 concludes the work and gives the direction of future research.

THE SEAGENT PLATFORM

SEAGENT is a new agent development framework and platform that is specialized for semantic web based multi agent system development. The communication and plan execution infrastructure of SEAGENT looks like other existing agent development frameworks such as DECAF [Graham et al 2003], JADE [Bellifemine et al. 2001], RETSINA [Sycara et al. 2003]. To support and ease semantic web based multi agent system development, SEAGENT includes the following built-in features that the existing agent frameworks and platforms do not have:

- Agents created using SEAGENT handle their internal knowledge base using semantic web standards and the platform provides specifically designed interfaces to manage and query the internal knowledge without being dependent on a particular application programming interface.
- The directory service of SEAGENT is implemented in a way that the directory knowledge is held in semantic web standards and the directory service supports semantic matching of the agent capabilities to find the semantically similar agents.
- FIPA-RDF content language [FIPA] has been used to transfer semantic content in the agent communication language messages and OWL-QL [Fikes at al. 2003] is integrated to the FIPA-RDF content language to query the agents and services.
- SEAGENT introduces a new service for managing and translating ontologies. It provides a means to define mappings between platform ontologies and external ontologies. The translation process is based on these defined mappings.
- SEAGENT supports discovery and dynamic invocation of semantic web services by introducing a new platform service for semantic service discovery and a reusable agent behavior for dynamic invocation of the discovered services.

The following section discusses the overall architecture of SEAGENT.

THE ARCHITECTURE

In this section, we discuss SEAGENT's layered software architecture. Each layer and packages of the layers have been specially designed to provide build-in support for semantic web based multi agent system (MAS) development. The overall architecture is shown in Figure 1. Although the introduced architecture is the implemented architecture of the SEAGENT platform, we believe that it is generic enough to be considered as a conceptual architecture of semantic web based multi agent systems. In the following, we briefly discuss each layer with an emphasis on the semantic support given by that layer.

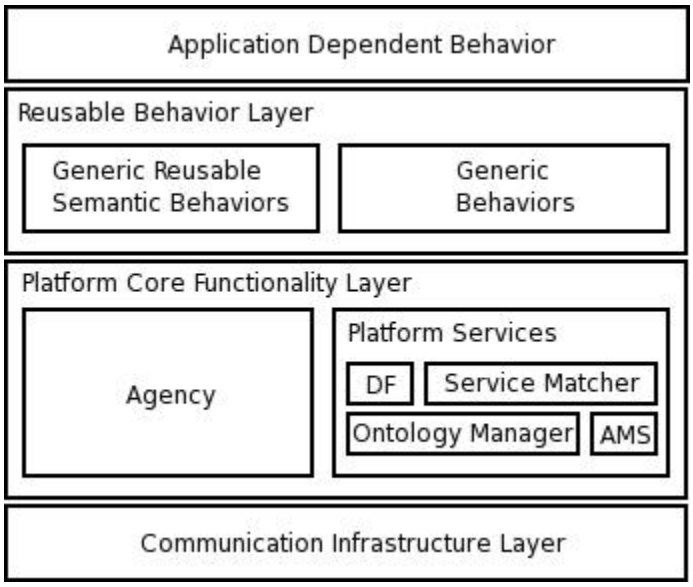


Fig. 1. Seagent Platform Overall Architecture
Rys. 1. Architerktura platformy Seagent

The bottom layer is responsible of abstracting platform's communication infrastructure implementation. SEAGENT implements FIPA's Agent Communication and Agent Message Transport specifications [FIPA] to handle agent messaging. Although Communication Infrastructure Layer can transfer any content using FIPA ACL and transport infrastructure, SEAGENT platform only supports FIPA RDF content language since it is very suitable to transfer semantic web enabled content.

The second layer includes packages, which provide the core functionality of the platform. The first package, called as Agency, handles the internal functionality of an agent. Agency package supports the creation of general purpose and goal directed agents. In this sense, Agency package provides a built-in 'agent operating system' that matches the goal(s) to defined plan(s), which are defined using HTN planning formalism [Paolucci et al. 2000]. It then schedules, executes and monitors the plan(s). From semantic web based development perspective, an agent's internal architecture must support semantic web ontology standards for messaging and internal knowledge handling to simplify semantic based development. For this purpose, Agency package provides a build-in support to parse and interpret FIPA RDF content language to handle semantic web based messaging. On the other hand, Agency provides two interfaces for semantic knowledge handling, one for local ontology management and the other one for querying. Although the current version includes the JENA [JENA] based implementation of these interfaces, other semantic knowledge management environments and query engines can be integrated to the platform by implementing these interfaces.

The second package of the Core Functionality Layer includes service sub-packages, one for each service of the platform. SEAGENT provides all standard MAS services such as Directory Facilitator

(DF) Service and Agent Management Service (AMS) following the previous platform implementations and FIPA standards. But these standard services are implemented differently using the capabilities of a semantic web infrastructure. For example, standard functionality of the DF is to store agent capabilities and return the matched agent(s) upon a capability-matching request. In SEAGENT implementation, DF uses an OWL [Web Ontology Language] ontology to hold agent capabilities and includes a semantic matching engine to be able to return agent(s) with semantically similar capabilities to the requested ones. Similarly, AMS stores agents' descriptions in OWL using FIPA Agent Management Ontology [FIPA] and can be queried semantically to learn descriptions of any agent that is currently resident on the platform.

Besides implementing standard services in a semantic way, SEAGENT platform provides two new services to simplify semantic web based MAS development. The first one is called as Semantic Service Matcher (SSM). SSM is responsible for connecting the platform to the semantic web services hosted in the outside of the platform. SSM uses 'service profile' construct of the Web Ontology Language for Semantic Web Services (OWL-S) standard for service advertisement and this knowledge is also used by the internal semantic matching engine for discovery of the service(s) upon a request. SSM and DF services are implemented by extending a generic semantic matching engine architecture. The second unique service is the Ontology Manager Service (OMS). It behaves as a central repository for the domain ontologies used within the platform and provides basic ontology management functionality such as ontology deployment, ontology updating, querying etc. The most critical support of the OMS is its translation support between the ontologies. OMS handles the translation request(s) using the pre-defined mapping knowledge which is introduced through a specific user interface. Through the usage of the ontology translation support, any agent of the platform may communicate with MAS and/or services outside the platform even if they use different ontologies.

Third layer of the overall architecture includes pre-prepared generic agent plans. We have divided these generic plans into two packages. Generic Behavior package collects domain independent reusable behaviors that may be used by any MAS such as well know auction protocols (English, Dutch etc.). On the other hand, Generic Semantic Behaviors package includes only the semantic web related behaviors. In the current version, the most important generic semantic behavior is the one that executes dynamic discovery and invocation of the external services. This plan is defined as a pre-prepared HTN structure and during its execution, it uses SSM service to discover the desired service and then using OWL-S 'service grounding' construct it dynamically invokes the found atomic web service(s). Hence, developers may include dynamic external service discovery and invocation capability to their plan(s) by simply inserting this reusable behavior as an ordinary complex task to their HTN based plan definition(s).

THE DISTANCE LEARNING ENVIRONMENT

ACTORS

The human actors of the system are considered to be students, academic staff, and system administrators. Every human actor is represented by a software agent in the system that is also of the same role as the human actor. Assigning roles to agents implicitly ensures that actors don't attempt of doing something out of their privileges.

It is a choice of implementation where these agents live. They may reside on local machines of the users or on system servers which users interact through a web interface. However, for performance considerations, it is better that they follow the more distributed approach of working on local machines. If this is the case, there must be mechanisms to reflect the updates of agent plans to the already working agents. After logging into the system, all agents may ask for updated versions of their plans to a dedicated agent. The goal of this agent is to manage the plans by keeping the versions and the roles of agents which can use them in an OWL ontology. The updates can be further categorized into being mandatory or optional so that users don't have to wait for an optional update to be finished

to use their agent. It would be better that these decisions given by the actor were recorded and followed in the same scenarios.

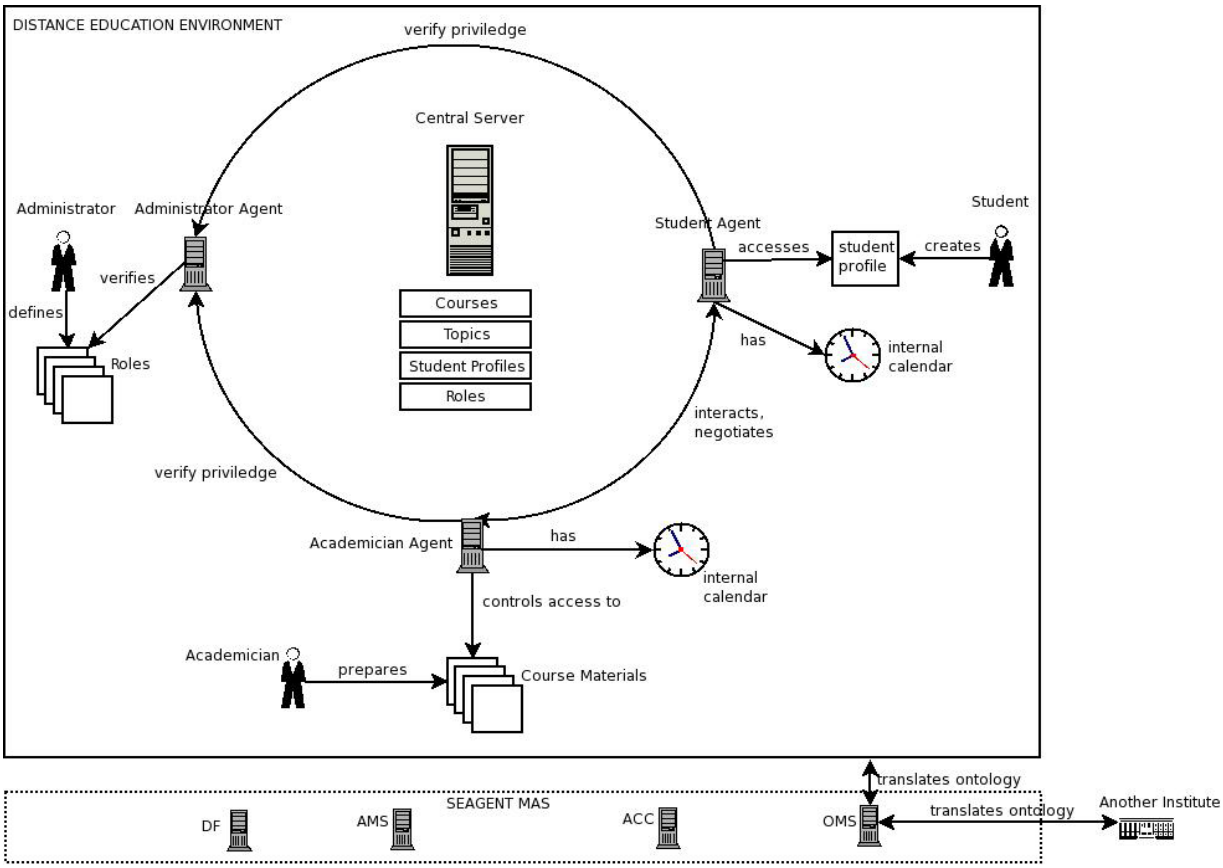


Fig. 2. The actors of the system
Rys. 2. Aktorzy systemu

It is important that the agents either have access to a calendar of the actor or they provide the calendar themselves. The latter is preferred because the events can then be customized for the education domain such as assignment due, examination. It is the responsibility of the users to provide their agents with a detailed schedule.

One of the promises offered by distance education is less rigid time constraints. Indeed, it is the reason many working individuals prefer distance education. So the system must take this to its advantage. Instead of the instructor just announcing a date for an exam, he can also announce a time duration that the exam can be taken. When the student agents connect with the system, and see the exam event, they can first check their schedule. In case of schedule overlaps, they can try to negotiate with other students agents, and even the instructor agent to decide on a free date for all them.

Inactive students (those who have not submitted their assignment, or did not view the course material for a specified time limit) can be detected by the agent of the instructor of that course and the student agent is then sent a warning if it's currently online. If not, the student himself is sent an e-mail. Students can also be reminded about approaching due dates. Letting the academician agent take care of such monitoring tasks gives more time to the instructor in preparing better course material. [Sheung at al. 2005] has implemented a similar monitoring system and it got positive feedback from the students because they thought that their teacher was enthusiastic about their studies and aware of their learning progress and performance in the course. However, the students were not aware that these mails were sent by a software agent.

ONTOLOGY KNOWLEDGE BASE

It is essential to define the terms in our domain of interest, distance learning, in ontologies. They must be categorized. But an ontology is more than just a pure classification of things. Such a classification is called a taxonomy. Ontologies also offer the power to express the relationships that can exist among things.

In the system, ontologies are used to store student profiles and course related information. Courses have relationships with other courses such that a course could be prerequisite of another one. It is likely that these courses share an amount of same teaching material. Even courses at different levels or grades might need to use materials that are already published.

Initially, the whole list of topics that the online courses cover must be defined in ontologies. For example, the term "multi-agent systems" is a field of "AI", but there are also applications of it in "Information Management". Thus, it can be declared as the sub class of "AI" and can link to "Information Management" by its "related Field" property. It is a difficult and detailed job to define the topics this way but it has many advantages. First of all, the instructor just needs to select the topics his course covers from the topics ontology and the relationships among the chosen topics are implicitly there. In addition, it helps to form a question-base where test questions prepared by the academic staff are kept. A test can be prepared anytime by providing a query on wanted topics, the ratio of hard/easy questions, etc. to the test preparation agent.

Furthermore, ontologies can help in exchange of knowledge between different institutions based on a common vocabulary. In such a case, the OMS (Ontology Management Service) of the SEAGENT Platform could be used to translate the concepts from one ontology to the other, hence providing university collaboration and joint programs.

Students are the consumers of the course material. At any time, they are taking courses and they have a list of token ones with passing or failing grades. According to the student's history, which is kept in his profile, he can be suggested directions that are tested to lead to success.

CONCLUSIONS AND FUTURE WORK

The proposed architecture is mainly based on our experience with agent and semantic web technologies. We are looking for domains that makes use of the expressiveness of ontologies and distributed, social, autonomic nature of software agents to test our agent platform. Therefore, we see distance learning as an exciting application area because of the opportunities explained in this paper. Our future work will include incrementally implementing this environment, testing it on samples of students from different departments and get their feedback. We also want to integrate the strategies defined in [Olt 2002] to online assessment coordinated by a software agent.

REFERENCES

Bellifemine, F., Poggi, A., and Rimassa, G., 2001, Developing Multi-agent Systems with a FIPA-compliant Agent Framework, Software Practice and Experience, 31 103-128.

Berners-Lee, T., Hendler, J., Lassila, O. 2001, The Semantic Web, Scientific American.

FIPA, 'FIPA Specifications', http://www.fipa.org

Fikes, R., Hayes, P. and Horrocks, I., 2003, OWL-QL - A Language for Deductive Query Answering on the Semantic Web, Knowledge System Laboratory, Stanford University, available at http://ksl-web.stanford.edu/KSL-Abstracts/KSL-03-14.html.

Guang-zuo CUI et al., 2004, OntoEdu: Ontology based Education Grid System for e-learning, GCCCE2004 International conference, Hong Kong.

Graham J. R., Decker, K. S. and Mersic, M., 2003, DECAF - A Flexible Multi Agent System Infrastructure, Journal of Autonomous Agents and Multi-Agent Systems, 7, 7-27.

Paolucci, M. et al., 2000, A Planning Component for RETSINA Agents, Intelligent Agents VI, LNAI 1757, N. R. Jennings and Y. Lesperance, eds., Springer Verlag.

JENA, A Semantic Web Framework for Java, http://jena.sourceforge.net/.

Keleberda, I. N., Lesna, N. S., Makovetskiy S. D., Terziyan V., 2004, Personalized Distance Learning Based on Multiagent Ontological System, ICALT.

Olt, M. R., 2002, Ethics and Distance Education: Strategies for Minimizing Academic Dishonesty in Online Assessment, Online Journal of Distance Learning Administration Vol. 5 Issue 3.

Martz, B., Morgan, M. S. Assessing the Impact of Internet Testing: Lower Perceived Performance. Distance Learning and University Effectiveness. pp. 177 - 189.

Sheung-On Choy, Sin-Chun Ng, Yiu-Chung Tsang, 2005, Software Agents to Assist in Distance Learning Environments, Educause Quarterly, Vol. 28 No. 2.

Silva, E., Moreira, D., Use of Software Agents for the Management of Distance Education Courses, http://citeseer.ist.psu.edu/silva00use.html

Sycara, K., Paolucci, M., Van Velsen, M. and Giampapa, J., 2003, The RETSINA MAS Infrastructure, Journal of Autonomous Agents and Multi-Agent Systems, 7, 29-48.

WebCT, http://www.webct.com

Web Ontology Language (OWL), http://www.w3.org/2001/sw/WebOnt/

Woolridge M., Jennings, N., 1995, Intelligent Agents: Theory and Practice. Knowledge Engineering Review. Vol. 10:2., pp. 115-152.

ARCHITEKTURA SYSTEMU EDUKACJI ZDALNEJ PRZY WYKORZYSTANIU SYSTEMÓW OPARTYCH NA WIELOAGENTOWYCH SIECIACH

STRESZCZENIE. W pracy przedstawiono zagadnienie architektury systemu edukacji zdalnej opartej na wieloagentowej sieci. Zapotrzebowanie na taki system wynika z potrzeby automatyzacji codziennej pracy w systemie edukacji zdalnej. Agent zajmuje się automatyzacją tej pracy, stosując powszechne słownictwo zdefiniowane w bazach. Każdy użytkownik ma swojego własnego agenta. Agenci tacy współpracują z innymi agentami w celu organizacji zadań i przekazywania informacji swoim użytkownikom.

Słowa kluczowe: edukacja zdalna, system edukacyjny, ontologia.

EIN KONZEPT ZUR FERNSTUDIENARCHITEKTUR UNTER NUTZUNG SEMANTISCHER WEBBASIERTER MULTI-AGENT-SYSTEME

ZUSAMMENFASSUNG. In diesem Artikel wird ein Konzept zur Fernstudienarchitektur unter Nutzung semantischer webbasierter Multi-Agent-Systeme vorgestellt. Der Bedarf für solch ein System entsteht durch die tägliche Notwendigkeit, Managementaufgaben des Fernstudiums zu automatisieren. Die Agenten erledigen solch eine Automatisierung unter Nutzung eines allgemein verbreiteten Vokabulars von definierten Begriffen in Ontologien. Jedem Nutzer des Systems wird ein Agent

gegeben, der in ihrem eigenen Namen handelt. Diese Agenten werden dann gebraucht, um andere Agenten abzufragen, sich mit ihnen auszutauschen und zu kooperieren, um Aufgaben zu organisieren und ihre Nutzer zu informieren.

Codewörter: Fernstudienarchitektur, Ausbildungssystem, Ontologie.

Semih Ötleş,
Department of Food Engineering
Ege University
Bornova 35100 Izmir, Turkey
e-mail: semih.otles@ege.edu.tr

LogForum
>Elektroniczne czasopismo naukowe z dziedziny logistyki<
www.logforum.net
ISSN 1734-459X
2007
Vol. 3
Issue 3
No 2

THE DILEMMAS OF CONTEMPORARY PRODUCTION DRAFTSMEN AND TRENDS IN SCHEDULING

Izabela Bejma-Bąk
The University of Economy, Bydgoszcz, Poland

ABSTRACT

Implementation of integrated management programmes has become some sort of fashion these days. The more expensive the programme is and the more complex modules, the better the position of the company of the market is; the faster the implementation is, the better the management staff a company can gain - this is what became a habitual perception but is this true? The article is to answer the questions the master schedulers encounter to whom the data reach and who are to plan the agenda and tasks related to sales, storing or production in the way that according to the assumptions of logistics dislocation of the goods ensue in the right time, the right amount and the right quality.
The fact is that logistics solutions in the production sphere based on integrated management systems are the chance of improving competitiveness and increasing demands of clients. The demands posed to production companies nowadays are high and connected to high risk. Inappropriate plans and forecasts can cause a risk of stock freeze costs. In the same time failure in performing production orders caused by a shortage of the production materials may be connected to client loss. How to reconcile it? The thesis is to present the importance of a human factor in proper performance of plans and more precisely how important in the company a master scheduler is. For a production company the most important a production plan should be and a detailed scheduling to react to any changes in a responsible way.

Key words: production, production schedule, main schedule, production draftsman.

INTRODUCTORY COMMENTS

Many articles have been written about functioning of systems of MRP class - the thesis will not be related to this subject - it will not also prompt, citing from numerous literature, solutions of proper implementations and proper work of such systems.

The thesis is the result of many discussions and interviews with master schedulers working in systems of MRP class in different business sectors. The article presents the problems and dilemmas master schedulers come across each day. What they

fight with to execute the schedule in time and decisions they have to make significantly exceed their range of duties.

The literature of the subject gives a vast number of solutions and prompts the proper functioning. Currently Polish reality seems more complex than examples presented in books often by western authors.

MASTER SCHEDULER AND A PERFECT PLAN

A plan is a scheme of tasks and activities in the form of a document on paper or any other data carrier. It usually includes:

- the amount of articles falling on the planned period, connected with planned actions (sales, warehousing, production) expressed in the standard of quantity or value,
- the size of required capacity or capacity to be gain which is necessary to complete all the planned actions,
- the schedule of aims which are to be achieved and tasks which need to be completed to execute the plan,
- the listing of commonly compliant decisions concerning the admitted aims and the means of their accomplishment,
- the procedure of implementation of the planned actions, locating variations in plan accomplishment and undertaking corrective actions when necessary.

In the context of the article we mainly focus on the first specification of the definition above. If a person taking care of planning is to fulfil the conditions of planning, so the manner of regulation and coordination of actions within time and procedures and means which will help to conduct the latter which are used to gain the certainty that they will proceed in an optimum way [Fertach, 2006], what should a master scheduler's range of duties look like when working in an integrated management system based on MRP? When asked about the profession we hear short answer - planning. It is only one word which in practice means a very wide range of duties and tasks to be executed and coordinated. Is a planning specialist also a logistics specialist? Unfortunately, the position of master scheduler is often understated in a company, in particular if within the structures of organisation a planning department subjects to a production division and not to the head of logistics. A production company should mainly focus on a proper production satisfying all the required quality, quantity and time conditions. The person taking care of production plan time coordination manages one of the most important role in such a company. It is according to his or her prepared schedules the remaining organisation divisions operate. A master scheduler is a person who should not only be knowledgeable about a supply management, storage, an inventory and transport management, a production and information system management, but also about economy, organization and management, so in agreement with M. Fertscha [2006] a master scheduler is a logistics specialist regardless of a division he works in. All the above shows that a master scheduler's work is not only clicking the open production orders with a mouse and putting them into a production schedule, but also logistic abilities of combining much information coming form different production divisions into an optimal production plan.

According to the tendencies in Polish companies people dealing with logistics are mainly transport and shipping specialists. If the structure of a company is so

developed that is has a logistics division people handling the logistics outside the division are not treated as logistics specialists. It is visible in wages as well as in a position of a person in a company.

TRENDS IN SCHEDULING - THEORY AFTER PRACTICE OR PRACTICE AFTER THEORY

In production logistics and production planning the leading role belongs to MRP (Material Requirements Planning). The condition of an effective cooperation of the planning production sphere on the tactical level within a company is supporting the functioning of both on the same standard of planning. The standard should correspond both to the needs of production and logistics, which means that it [Fertach 2003]:

- must be possible to implement within the frames of planning models,
- must provide data necessary for an integration of production planning and logistics, such data must simultaneously enough for detailed planning in both spheres.

The concept of planning material requirement refers to all the solutions where the bill of material is used as information controlling the course of a planning process. Applying the planning material requirement as policy for logistics system in a production company requires some rules [Fertach 2003]:

- planning material requirement at any level before load planning of production power,
- collaborative plan in one business department,
- creating only one requirement schedule for each item,
- combining all the sources of requirement occurring in a company (demand, company's own production , the need of service and repairs) within one schedule,
- current updating of each schedule of requirement.

While implementing systems of MRP class people taking part in creating syllabi of implementing a PP module and many others often hear that employing a planning policy of material requirement brings such benefits as [Fertach 2003]:

- acceleration of stock rotation - up to 6 times,
- reduction of work-in-process inventory - up to 25%,
- raw materials limitation - up to 50%,
- shortening of supplier's lead time - up to 50%,
- productivity enhancement - up to 10%.

Still, nobody adds that the results were created on the basis of Olivier Wright's research twenty years ago in conditions of American industry and they are of no relevance to current business and economical situation of Polish companies. Actually, it is unknown whether this information are passed on in this form as people taking care of implementation do not know it or whether it is a good marketing catch. Therefore many mistakes and misunderstandings appear and many companies with such a system implemented have to deal with it or actually the people who use them.

Implementation of a system will not bring benefits, especially if research and development syllabi are badly prepared and this is a plague of most of the organisations and the worst part is that they keep continuing such a situation. Unfortunately, from my observations and interviews it is clear that most of master schedulers and not only, as it is also concerned with distribution draftsmen, despite implemented systems of MRP class which require major financial expenses, still use help of tools such as Excel to arrange schedules. Here worth mentioning is that it is not caused by lack of familiarity with an information system they work with or unfamiliarity of the principles of functioning of an MRP rule but by the assumption concerning production and the process of planning itself which has been badly planned and has not been corrected in further agreements. The most absurd seems the fact that schedules are made parallel both in an information system and Excel, as otherwise controlling the time and correctness of orders fails. It is not just the production. Depending of the complexity of a company, piles of unnecessary documents appear apart from an information system. Many inner documents effect in proper order but also they are forced and add work instead of facilitating it.

THE DILEMMAS OF CONTEMPORARY PRODUCTION DRAFTSMEN

The development of a solution called master schedule or master production schedule has begun in the 80' last century. At first the master schedule was treated as a basic short-period production plan containing information about a product range and a quantity of the produced items [Fertsch, 2003]. Basically, two types of situation may occur [Muhlemann, Oakland, Lockyer, 2001]:

- items produced for stock. In this situation it is possible to prepare the schedule and load planning at the beginning of the production period, this is so called 'marketing' planning,
- items produced only for clients' orders. In this situation it is vital to prepare the schedule and load planning within the production period, this is so called 'distribution' planning.

The first option of planning is as good as a forecast is. As the forecast is usually incriminated with some mistakes it is difficult to foresee exactly a product range, quantity, quality and the requirement time. Master schedulers trust their experience and observations of the business situation on the market more that calculations. The example worth presenting here is this year requirement for building materials and increase of their prices of 200%. Despite such an increase materials are usually unavailable for customers. Mistakes in forecasts usually have a negative influence on contacts with clients. In situation where several orders with similar deadline coincide one cannot react properly. Additional danger of such an attitude is a shortage or a surplus of material stock or even refusing to accept the execution of the order due to the lack of production materials which production time at the supplier's is very long.

The second of the reasons mentioned is even more dangerous as a company may lose some part of clients due to long deadlines. Not every client is willing to accept the fact that after implementation of the system the order execution time lasts averagely around 3 weeks and after the implementation is lengthens double or more. Clients cannot plan their level of production or distribution very often which reflects

the producer's order number who has already implemented the system.

Implementing Just In Time has become very popular among procurement services. Unfortunately, implementation of this policy into companies restricts only to procurement leaving other divisions out. The result is that due to the lack of carrying out the purchasing rating according to commonly accepted rules - from the viewpoint of the importance for each company (ex. price, quality or delivery dates) - an agreement with only one supplier is signed with no substitute supplier. I would like to remark hereby that we are talking mainly about the suppliers of production materials from the view point of importance of delivery dates for master schedulers. It very often causes delays of material deliveries from suppliers. Lack of information regarding delays is a plague or even worse: lack of deliveries despite confirmation. From a master scheduler's perspective it results in changes in production schedule as it is impossible to produce an item without material. The worst part is that procurement services even is they have the knowledge about delays care nothing about the first rule of logistics which is information [Fertach, 2006]. There is one other danger if a company produces only one type of item at a given production line and has no possibility of change-over, it takes up decision about production and later scrapping due to the suitable quality of items. It is caused by the fact that stopping and launching the production again highly surpasses costs than the scrapping and benefits loss.

Another problem while scheduling it too big work load of the production line, especially during seasonal productions. To come up to many clients expectations concerning deadlines of items adjusted in quantity to productivity of clients' production lines combined with a huge amount of sales orders in big production batches some orders need to be divided. In effect sales orders are divided into several production orders is smaller lots. On the one hand a schedule prepared this way ensures realization of sales orders but on the other hand it causes often outage due to change-over. In situation when a company has some part of standard items ready for most clients such a production is anyway launched in small quantities which boost the percentage of faulty items.

A very often problem main schedulers encounter is layout of material incorrectly put into a system. It so happens that people make mistakes while putting material specification and also technological itinerary into a system. It is said the one who does not work makes no mistakes, still this is the cause of most of the corrections in scheduling. It needs to be marked there is no information from technical departments about a change of technology in produced item. There may also be last minute changes of technology made by clients when materials and production lines are already ready to execute orders or even worse if the production is in progress.

Main schedulers' nightmares are unexpected urgent orders when on division manager's instruction they need to change whole production schedules and they disturb the agenda. A very important element of scheduling is planning production of semi-finished products as a part of a finished product. When despite the collaborative planning, semi-finished products are produced in different business departments and the finished item assembly is still in another business department many problems with delivering semi-finished products on time occur. Lack of information from spedition divisions about the delays or many other reasons, like lack of information in a system about ready semi-finished product results in inability of production of a finished product and another schedules corrections.

Creating production schedules is also connected to planning human capacity on particular work centres. If incorrect yearly production plan is accepted on the basis

of sales department forecasts where the work load of working positions is planned conflict with overtime, employing new workers and their training occurs. Nowadays in connection with mass emigration to western European countries in search of better wages, lack of workforce has become very visible. There are no both skilled, like welders, and unskilled workers. Looking at a current situation on a labour market employers should be more engaged in problems of human resources - motivation and attachment to a company one works in. Probably one year after another the situation will be deteriorating due to the lack of graduates of technical and vocational schools which results from reforms in educational system in our country. Not everyone can or should be a manager.

During interviews I heard also that avoiding heads is also problematic as they should not walk around the production too often. I will leave it without comment.

Summing it all up every of the problems cited above many schedulers encounter every day is connected to the lack of information from any particular sphere. One is certain that lack of information is worse than the worst information. The result is that a stream of information which controls dislocation of material goods is the most important sequential of a logistics system in the whole chain of dislocating goods in a company.

FINAL COMMENTS

I am sorry to write here that in the literature of the subject one may read many solutions, prompts, ready-to-use models of implementing and executing the system described above, unfortunately there few practical case studies. If the latter appear they describe the process itself and not the problems which arrived and their solutions or suggestions so that companies implementing such systems in the future could avoid similar mistakes. In an unlimited source of knowledge which is the Internet one can find many interviews concerning implementations, comments of board members, heads, coordinators who always claim that the systems works properly and brings profits mentioned in point 3. Unfortunately, nobody interviews employees on a lower level who work in systems of MRP class day by day and they are undeniable source of enormous knowledge about weak points of the implementation itself. On the other hand nobody reasonable would agree to such an interview and give their name knowing that it might end with redundancy or other sanctions. Probably the same opinion is common among management responsible for implementations and functioning of the system. Who will claim in front of the board that the system works improperly and financial expenses spent on implementation and purchase of the equipment has been placed unreasonably or that the system should be restarted again and implemented again but this time avoiding any shortcomings or mistakes. If the company leads production activities which are discussed here, all the processes should be adjusted to production processes and should be a starting point in managing of the remaining areas of organisation. Production scheduling is not only a feature of integrated systems of MRP class, it may turn out that a company cannot afford the costs of implementation. Implementing by force, as those are the recent trends, will not be favourable for an organisation but only can deepen the lack of information and cause a conflict with clients or their loss.

REFERENCES

Fertsch M., 2006, Słownik terminologii logistycznej. Biblioteka Logistyka Poznań.

Fertsch M., 2006, Podstawy logistyki. Podręcznik do kształcenia w zawodzie technik logistyk. Biblioteka Logistyka Poznań.

Fertsch M.(red), 2003,Logistyka Produkcji. Biblioteka Logistyka Poznań.

Fertsch M., 2003,Podstawy zarzšdzania przepływem materiałów w przykładach. Biblioteka Logistyka Poznań.

Muhleman A.P., Oakland J.S., Lockyer K.G., 2001, Zarzšdzanie. Produkcja i usługi. Wydawnictwo Naukowe PWN Warszawa.

DYLEMATY WSPÓŁCZESNYCH PLANISTÓW PRODUKCJI I TRENDY W HARMONOGRAMOWANIU

STRESZCZENIE Wdrożenie systemu zarządzania zintegrowanego stało się ostatnio pewną modą. Im wdrażany system jest bardziej skomplikowany i im więcej posiada modułów, tym firma postrzegana jest na wyższej pozycji rynkowej. Im wdrożenie jest szybciej zakończone, tym lepsze można osiągnąć korzyści. Takie są ogólne opinie związane z tym procesem - czy są prawdziwe? Praca ma na celu odpowiedzieć na parę pytań planistów produkcji, którzy przetwarzają dane, związane ze sprzedażą, magazynowaniem czy produkcją a mające być podstawą do podejmowania trafnych decyzji dotyczących lokalizacji zapasu w czasie, przestrzeni oraz o odpowiedniej jakości. ,br/> Faktem jest, że rozwiązania logistyczne w obszarze produkcji oparte na zintegrowanych systemach mogą wspomóc wzrost konkurencyjności oraz zadowolenia klientów. Oczekiwania, jakie musi obecnie spełniać firma są wysokie i związane z dużym ryzykiem. Nietrafione plany i szacunki powodują ryzyko zamrożenia kapitału w zapasie. Z drugiej strony niezrealizowane zlecenia produkcyjne mogą powodować braki towarowe, co z kolei ma bezpośrednio przełożenie na poziom obsługi klienta. Jak to wszystko opanować? W pracy wskazano na istotę czynnika ludzkiego we właściwym przebiegu procesu planowania a dokładniej ważności planisty produkcji. W przedsiębiorstwie produkcyjnym najważniejszy powinien być plan produkcji oraz sposób postępowania i reagowania na każdą nawet najmniejszą odchyłkę od tego planu.

Słowa kluczowe: produkcja, harmonogram produkcji, harmonogram główny, planista produkcji.

DIE DILLEMAS DER PRODUKTIONSPLANER UND DIE TRENDS IN DER TERMINPLANUNG

ZUSAMMENFASSUNG. Die Einführung von integrierten Managementprogrammen ist heute in Mode gekommen. Je teuerer das Programm und je komplexer die Mudule desto besser ist die Marktposition der entsprechenden Firma - schnelle Programmeinführungen führen zu mehr Gewinnen beim Managment. Aber ist dieses bereits ritualisierte Verhalten auch richtig? Dieser Artikel beantwortet die Fragen der Terminplaner, wie z.B. : Wer bekommt die Daten? Wer plant die Agenda und daraus folgende Aktivitäten wie Vertrieb, Lagerung und Produktion gemäß der logistischen Vorgaben. Tatsache ist, dass Logistiklösungen, die in der Produktion auf integrierten Managementsystemen beruhen, Chancen bieten die Wettbewerbsfähigkeit zu verbessern und so die Kundenzufriedenheit zu steigern. Die Anforderungen an moderene Produktionsfirmen sind hoch und immer öfter mit Risiken verbunden. Ungenaue Planungen und Vorhersagen können unangenehme Folgen haben. Fehler in der auftragsgerechten Produktion, welche durch Engpässe entstehen, können sogar zu Verlusten beim Kunden führen. Aber wie kann man dies lösen? Diese Arbeit soll zeigen, wie wichtig der menschliche Faktor ist, wenn Pläne gut funktionieren sollen und wie wichtig Terminplaner in einem Unternehmen sind. Für eine Produktionsfirma ist der Produktionsplan von größter Wichtigkeit und damit einhergehend die Notwendigkeit, angemessen auf eventuelle Änderungen reagieren zu können.

Codewörter: Produktion, Produktionsplan, Terminplanung, Produktionplaner.

Izabela Bejma-Bąk
Wyższa Szkoła Gospodarki w Bydgoszczy
Katedra Transportu, Spedycji i Logistyki
ul.Garbary 2
85-229 Bydgoszcz, Poland

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 3
No 3

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

CHANCES AND HINDRANCES FOR THE REALIZATION OF THE PROGRAM FOR BUILDING MOTORWAYS IN POLAND

Bogusz Wiśnicki, Beata Huta

Szczecin Maritime University, Szczecin, Poland

ABSTRACT. In the introduction the reasons for importance of development of Polish road infrastructure were given. Afterwards, concepts and the present state of the program of motorways building in Poland were described. The possible options of financing motorways were also determined. The main part of the research paper presents factors which determine chances and hindrances for the realization of the program for building motorways in Poland. These enumerated synthetic factors are based on the up-to-now Polish experiences in building motorways. The paper is finished by Author's conclusions including propositions of modifications necessary for shorten time of duration of the road investment process in Poland.

Key words: motorway, expressway, road infrastructure, licensing system, financing of motorways.

INTRODUCTION

The condition of Polish communication infrastructure is undoubtedly one of the major problems of contemporary economy of Poland. Shortcomings of this matter pester Poles as well as foreigners visiting our country. Bad quality of roads is a negative factor which influences significance of Poland on the area of the European transit system. In an indirect way it also influences the pace of economic growth in our country.

One of the essential enterprises of national character which has been undertaken by Poland is organization of the World Cup Finals in 2012. Economists realize that success of this event may become an immense flywheel for the development of the country. At the same time everybody consents that one of the essential conditions of successful realization of such a big logistic enterprise is building an efficient net of transport connections of the domestic and international range. The situation which started to exist after acknowledging Poland organization of the World Cup Finals urged the fact that the program of building of motorways has become priority in development plans of Polish economy.

Since the program of building of motorways is of such significance and is determined by the period of five years' time which is left for Poland till the organization of the international sports event it is worth analyzing chances and hindrances of realization of this program. The analysis which follows below is of macroeconomic character and has been conducted on the basis of accessible information from offices and institutions responsible for realization of the program of building of motorways, especially from the General Management of State Roads and Motorways (GDDKiA).

Citation: Wiśnicki B., Huta B., 2007, Chances and hindrances for the realization of the program for building motorways in Poland. LogForum 3, 3, 3
URL: http://www.logforum.net/vol3/issue3/no3
Accepted: 10.09.2007, on-line: 25.09.2007.

CONCEPTS AND THE PRESENT STATE OF THE PROGRAM OF MOTORWAYS BUILDING IN POLAND

Since the end of World War II there were several plans of building a net of road connections in parameters of motorways in Poland. Considering this, the results of the up-to-now achievements are not very optimistic. In the middle of the year 2007 there are about 680 km of motorways in Poland and the longest stretch of the motorway on the line A-4 between Krzyżowa and Cracow is 364 kilometers long. According to the valid Decree of the Cabinet from 2004 the target lay-out of motorways in Poland was set for about 2000 km, out of which two motorways A-2 and A-4 running from the west to the east and one motorway A-1 running from the north to the south are the most important (table 1) [Regulation of the Council of Ministers from May 15, 2004].

Table 1. Target lay-out of motorway net in Poland
Tabela 1. Założenia sieci autostrad w Polsce

No	Route of motorway	Target length	Presently exploited length
A-1	(Helsinki) Gdańsk–Toruń–Łódź–Piotrków Tryb.–Częstochowa–Gliwice–Gorzyczki–granica państwa (Ostrawa)	560,5 km	17,5 km
A-2	(Berlin) state border–Świecko–Poznań–Łódź–Warszawa–Biała Podlaska–Kukuryki–state border (Minsk)	652 km	250 km
A-4	(Dresden) state border–Jędrzychowice–Krzyżowa–Legnica–Wrocław–Opole–Gliwice–Katowice–Kraków–Tarnów–Rzeszów–Korczowa– state border (Lvov)	667 km	381 km
A-6	(Berlin) state border–Kołbaskowo–Szczecin (S3 junction „Rzęśnica")	29 km	14 km
A-8	Motorway bypass at the stretch A-4–Psie Pole	27 km	-
A-18	(Berlin) state border–Olszyna–A4 Krzyżowa (Legnica)	75,5 km	17 km
TOGETHER		**2011 km**	**679,5 km**

Źródło: Office of Studies in GDDKiA, 2006.

The latest government program of motorway building was presented in 2006 and it predicts completion of the following stretches of motorways by the year 2013 [Ministry of Infrastructure, 2005]:

- A-1 stretches: Gdańsk-Nowe Marzy (91km), Nowe Marzy-Toruń(61km), Stryków- Pyrzowice (198 km), Pyrzowice-Sośnica (41km) Sośnica- Świerklany (23km), Świerklany-Goryczki (27),
- A-2 stretches: Świecko-Nowy Tomyśl (105), Stryków-Warszawa (41km), Warszawa-Siedlce (75 km),
- A-4 stretches: Cracow-Tarnów (77km), Tarnów-Rzeszów Wsch. (79km), Rzeszów Wsch.-Korczowa (86km), Zgorzelec-Krzyżowa (50km),
- A-8 motorway bypass of Wrocław at stretch A4- Psie Pole.

All in all, it is planned to let 981 km of motorways for public use within the next seven years, which is on average 140 km a year. This is a very ambitious project taking into consideration the up-to-now accomplishments in this matter. The key to success is an efficient finance system of particular investments. Polish legislator, on the strength of the article 38 of the Statute on payable motorways [Journal of Laws, 1994] allowed two possible options of financing motorways:

1. from financial means obtained from the State budget which are yearly agreed for these aims, so called traditional aims,

2. from concessionaires' own means and from obtained bank loans so called financing in licensing system.

The first kind of financing consists in building payable motorways thanks to funds obtained as a result of Polish State actions. Investment capital is obtained from:

- the budget means mainly coming from fuel excise, the means are estimated yearly in the budget statute,
- from the European means,
- from loans obtained from International Finance Institutions, e.g. the World Bank (BŚ), the European Investment Bank (EBI) as well as the European Bank of Reconstruction and Development (EBOiR).

The second kind of financing becomes more and more popular in Europe, especially in the situation when governments try to involve the private sector in financing and operating of elements of public infrastructure. The licensing system is characterized by the fact that financing is distinguished from the initiator's structures and finance transfers generated by the project are the source of paying debts and returns from individual capitals used for financing the project [The International Project Finance Association]. The hub of the licensing system is a company called special purpose vehicle whose shareholders are investors or because of other reasons they are interested in the project, e.g. a contractor or operator of the subject of investments. The government (named licensing authorities) admit license to the objective company which is the basis for the following agreements in the presented structure. The license usually entitles the objective company to realization of particular services in a particular period of time with the use of the infrastructure originated within it. After a period of time defined in the license the infrastructure which originated and belonged by the special purpose vehicle at the time under license becomes the property of the licensing organ [Czerkas, 2003].

The up-to-now Polish experiences show that building of roads, especially motorways is not only a very costly enterprise but long-lasting and complicated because of organization. The very moment of appearing of machines at the construction site is only the beginning of the final stage of investments, which is usually the shortest phase of the mentioned process. Arranging the building stage is decidedly more time-consuming and it consists of laying out the course of the route, obtaining required permissions and agreements. Buyout of grounds is also long-lasting. Next stage is long bidding procedures which are due to bureaucracy and the lack of clear regulations of law. Apart from that there should be mentioned a slow process of confirming applications as well as delays in transfers of financial means from the Cohesion Fund for beneficiaries. The present law minimizes public expenditures, therefore according to its procedures the factor which determines attractiveness of potential concessionaries' offers is the price for a particular stretch of a motorway. Unfortunately a part of contractors artificially understates the level of costs to receive realization of the project. The mentioned phenomenon causes a series of negative consequences, among which decreasing the quality of contractors' services and the quality of building materials used. Money is saved also on the level of the management which influences the deadlines of the project realization.

These and other negative experiences from the realization of the up-to-now investments in roads in our country allow for estimation of a series of factors which have an essential influence on the success of the presently initiated program for the building of motorways.

HINDRANCES FOR REALIZATION OF THE PROGRAM OF BUILDING MOTORWAYS

The crucial factors which could hinder realization of the present program of the building of motorways involve:

1. Inconvenient for the State concession agreements.
2. The statute on public procurement which has been drawn up defectively.

3. Restrictions resulting from the law of environmental protection.
4. Bureaucracy.
5. Shortage of professional contractors.
6. Inefficiency of the GDDKiA administration.
7. Delays in preparation of projects.
8. Too much expanded machinery of political and administrative superintendence.

Re 1. Inconvenient for the State licensing agreements

Committing realization of the building of motorways to the hands of private investors was to solve all problems connected with the unsatisfactory number of these roads in Poland. It turned out, however, that administrators of roads took advantage out of this instead of the Treasury. What is more, inconvenient for the State agreements may cost the budget 22 billion zlotys by 2037 which will get into private investors' pockets [Report of Supreme Chamber of Control, 2006]. The reason for this loss is putting the State under obligation to pay off specific compensations to concessionaries on the basis of lost returns, which happens because of the fact that in the name of law lorries of the weight of over 3.5 tons are not charged for passing along a motorway. Their owners purchase vignettes entitling to using all kinds of roads. Therefore, they cannot be charged twice for the same services that are for using motorways. Thus, it seems a logical idea to intend a part of the money from the mentioned vignettes for the development of transport infrastructure, particularly motorways. The major problem is estimating the number of lorries that use motorways, which automatically causes tendencies to increase of the mentioned sum by concessionaries. For example, the Wielkopolska Motorway just before releasing appendices sharply increased fares for lorries and because of that it secured higher surcharges from the Treasury for itself. Moreover, motorway companies are entitled to collect fares from drivers by 2027 (A-4) and 2037 (A-2). At that time the invested in building capital is to be returned. However, according to the appendices, if during that time private companies do not recover all the money the budget will compensate for the missing sum. It is amazing that the State budget takes responsibility for the economical risk undertaken by the private company.

Re 2. The statute on public demands which has been drawn up defectively

Joining the European Union totally changed legislative milieu of infrastructure projects in Poland. A typical example is the change of the law regulating public procurement. Guiding principles for the countries - candidates to the European Union ceased to exist as far as orders for services and investment arrangements co-financed by the EU are concerned and the system of the law for public orders, which had been hurriedly prepared, became obligatory, unfortunately, along with decrees which withdrew Poland in comparison with other European Union countries as far as modern forms of contracting are concerned. The obligatory prohibition of variation orders in agreements, the introduction of overregulation referring to bidding of the subject of order have brought to the blockade of the motorway A-4 at the stretch Zgorzelec - Krzyżowa.

Re 3. Restrictions resulting from the law of environmental protection

A significant restriction for building motorways are regulations on the environmental protection, mainly the "Nature 2000" program. Ecologists' protests may obstruct nearly every project of road building. A free choice of interpretation of the statute record, lack of suitable data about the "Nature 2000" system along with its imposition on formerly advanced investments cause enormous problems during the realization of investment. Introduction of new principles of the law of environmental protection and the necessity of backward investigation of studies for the already prepared projects extorts an unwise process in which the investigation objective is demonstration that the prepared project is appropriate for realization. All of these postpones the moment of starting the construction work. In such a way the construction of the beltway of Augustów and Wasilków has been obstructed

and the building of the motorway A-1 crossing the border of the voivodship of Łódź and Mazowsze has been brought to a standstill.

Re 4. Bureaucracy

Construction of a motorway is lawfully a very complicated process. The moment of appearing of machines at the construction site is a beginning of the shortest stage of investment. Preparation for the construction work is a much more time-consuming process, which means laying out the course of the route along with obtaining all permissions and agreements. In Polish conditions buyout of grounds for a motorway is usually a big problem. Reluctance of some proprietors towards to the sale leads to expropriation proceedings which, as a principle, are the finality allowed by the statute. Next stage is bidding procedure which is time-consuming and lasts even several months in some cases.

Re 5. Shortage of professional performers

Implementation stage of projects is badly influenced by changes of technical staff working for contractors. Shortage of well-qualified engineering staff is the greatest cause of realization delays. These are such difficult dilemmas because education of civil engineer along with acquiring appropriate experience and passing exams entitling to performing independent technical functions in construction lasts at least 8 years but in practice over 10 years. It should be observed that the outflow of staff influences contractors' possibilities of admission dramatically. For a few years shortage of a suitable number of qualified workers has been noticed. Most of them left for other countries of the European Union where they are able to obtain several times' higher pay for work in their profession.

Re 6. Inefficiency of GDDKiA administration

There is a sense of shortage of appropriately qualified civil servants who directly supervise particular road investments. The GDDKiA is a central organ of government administration adequate for the matters of domestic roads. It performs activities of the manager of domestic roads and realizes the State budget as related to domestic roads as a kind of the greatest road investor. This character of supervision duties specified as Procurement Agency requires qualified workers of specializations: project manager, budget specialist, purchase and procurement specialist, legal counsellors, experts for contracting, experts for commercial matters and management experts. The specializations are not common in the GDDKiA. One of the obvious reasons is discrepancy between offered remuneration and a potential responsibility and expectation of an active influence on enormous investments. A similar situation takes place on other levels of the road administration.

Re 7. Delays in preparation of projects

Preparation of an infrastructure project is usually several or even more than ten years long in Poland as well as in all countries which respect civil rights. Accessibility of appeals, participation of the society in preparation of the project, concern about the natural environment - these involve the necessity of assuming prolonged periods of preparation necessary for appropriate management and coordination. Particularly when a road passes through a densely populated area (e.g. suburbs of Warsaw) or areas of significance for natural environment (e.g. beltway of Augustów).

Re 8. Too much expanded machinery of political and administrative superintendence

This is the reason connected with surroundings. The GDDKiA is presented in a role of performer of politics rather than its creator. The number of management instruments accessible for the GDDKiA is relatively small in comparison with the number of supervising centres of control and centres settling its work. Institutions which in one way or another examine "irregularities" or express their expectations and demands towards the activity of the GDDKiA are: Ministry of Transport, Ministry of

Finance, Ministry of Regional Development, the Parliament and Senate of RP (interpellations), ABW, NIK, UKS, UZP, RIO, European Commission, and soon CBA. The list is surely incomplete. Such a pressure inevitably causes focusing on reporting, preparation of information and replies, etc. rather than on calm and systematic management of projects. In relation with continuous rotation of personnel and necessity of preparation of new employees for requirements at work, external pressure causes tendencies for caution, alert, not taking a decision, referring with problems to the highest level and looking for justification of once taken decisions instead of taking new ones.

CHANCES FOR REALIZATION OF PROGRAM FOR MOTORWAY CONSTRUCTION

Fortunately, there are factors which may influence fast development of Polish road infrastructure and adapt it to European requirements and standards which involve realization of the present program of for motorway construction. The factors are as follows:

1. Usage of the structural funds from the European Union.
2. Fast economic development.
3. Return to the traditional system of motorway construction.
4. Continuously shorter time of duration of the road investment process.

Re 1. Usage of the structural funds from the European Union

Poland is the main beneficiary of the European Union budget for the years 2007-2013. A subsidy of about 20 billion EUR out of 60 billion has been granted to our country for the adaptation in the scope of infrastructure and transport politics. Additional financing of road projects of about 80% of their value will allow for their smooth and dynamic realization. Year by year the usage of the EU funds improves and one may expect that the means allocated for investments in the scope of the Operational Program „Infrastructure and Environment" will not be wasted.

Re 2. Fast economic development

Macroeconomic parameters influence development of all sectors of economy. Poland, thanks to export, consumption and inner demand, has started dynamic economic development which is favourable for the investment expansion, also the infrastructure investments. The Gross Domestic Product for the year 2006 reached the level of 5,3% and in opinion of most experts it is characterized by the trend of growth with the expected value for this year on the level 5.5-7.0%. Moreover the inflation on the level 1.4% in the year 2006 as well as the reduced budget deficit also contributes to improvement of investment climate.

The inflow of direct foreign investments as well as the EU means in shape of the structural funds makes the economic growth rest on solid foundations in Poland at the same time warranting its stability in an average period. Simultaneously Foreign investments exert positive pressure on the development of road infrastructure in Poland determining further investments on its condition.

Re 3. Return to the traditional system of motorway construction system

The licensing system, though successful in western European economies, in Poland was an imperfect and ineffective idea. Motorway construction without concessionaries did not ensure a correct progress of the investment process; therefore the decision seems to be well-founded to return to the traditional system mainly based on the budget financing and also on the structural funds since the moment of Poland's accession to the European Union.

The State and indirectly the European Union as a warranty of investments may enforce the appropriate implementation of infrastructure projects in technological and accounting aspects as well as implementation of schedules.

Re 4. Continuously shorter time of duration of the road investment process

A positive phenomenon is that the length of the investment process, beginning from the idea to its realization, becomes shorter systematically. Not very long time ago construction of a stretch of a motorway took about 11 years, presently it takes 8 years and the government plans intend to limit this period to the maximum of 5 years [Hope for Motorways, 2007]. Nowadays in Poland it is possible to realize road construction work very fast which is a successful final of a long-term preparation of investment. An excellent example is the stretch of the motorway A-2. From Konin to Łódź 103 km were built within 17 months. Such a pace is impressive also on European scale.

CONCLUSIONS

The conducted analysis of chances and hindrances of realization of the road construction program in Poland proves predominance of disadvantageous factors and compels to very careful forecasts referring to realistic deadlines of road investment realizations. All of this suggests that problems are not caused by the sources of financing. Thanks to the support of the EU funds all planned investments are of sufficient financial coverage. The basic problem is grounded in the area of the legislative and management operations. The implementation of clear legislative regulations along with the efficient management system of the investments financed from the structural funds is a necessary condition for the full realization of the motorway development program. The key to successful realization of the enterprise is leaving the licensing system which did not prove appropriate in Polish conditions. The up-to-now investments realized in that system should be completed and the role of the State should be increased immediately in further enterprises. The Treasury must take the role of a guarantor of correct spending of the money from the EU while the government institutions should administer physically in managing of the construction and exploitation of next stretches of motorways.

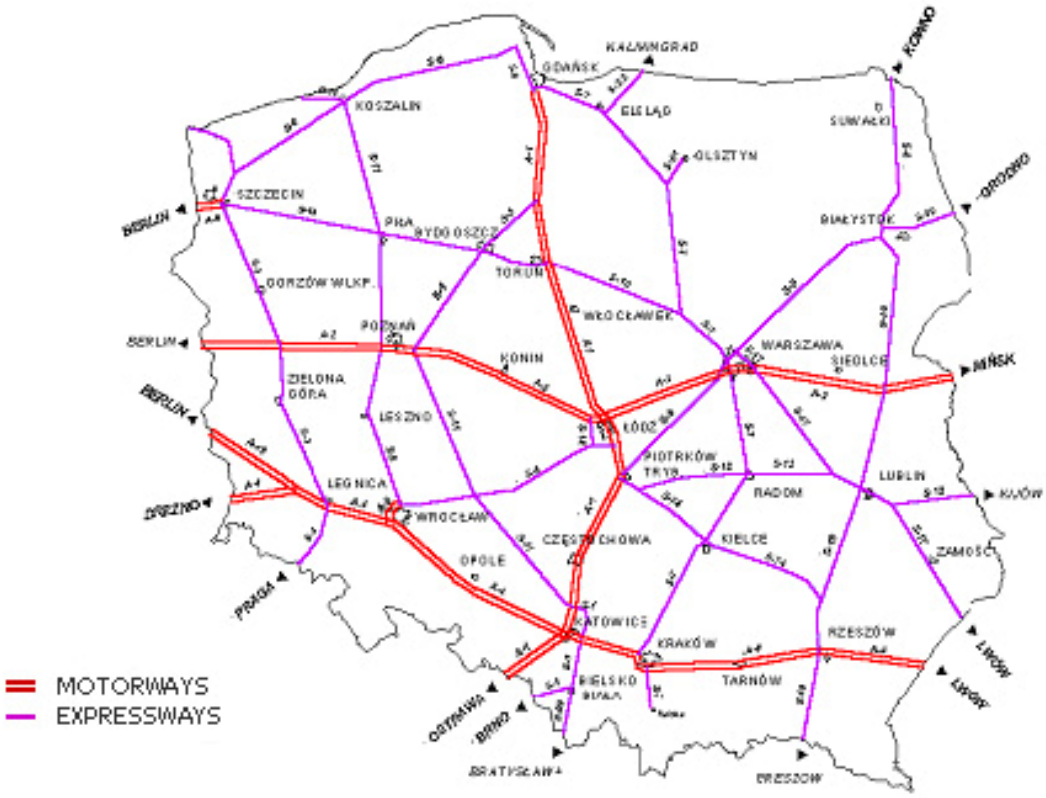
The institution which should have more management rights is the GDDKiA. A significant thing is to increase employees' competence of the government institution and finding a way to relieve the personnel from the necessity of service towards an enormous number of controllers. A program of implementation of road projects in Poland should be prepared for a long-range time than it is practiced nowadays to enable conducting the implementation process with assurance of proper coordination.

There are necessary amendments in government procurement statute which will make impossible its free interpretation by different institutions and which will obstruct investment blocking by long-lasting appeals from decisions of bidding commissions. Practice will show if the amendments to this statute made in 2007 will be sufficient [Journal of Laws, 2007].

It is highly significant to reconcile the already existing and planned investments with various restrictions imposed by the environment protection program called "Nature 2000". The impasse situations originating from arguments about interpretation enhance public conflicts with participation of ecological organizations. Thus, unambiguous alterations should be made in agreement with the valid law of the protection of nature. In situations where it is necessary to settle public arguments democratic instruments as for example referendum or local government commissions should be skilfully used.

The question whether the plan of motorway construction will be successful by the year 2013 stands open. Surely, since the year 2007 one can observe a distinct revival in realization of motorway investments for the time being at the stage of preparation for the construction work. What is important there is a favourable social atmosphere for such investments mostly because of the mobilization in the face of the approaching the World Cup Finals. This atmosphere should be a positive impulse for settling public conflicts about some stretches of motorways. In case of successful realization of the

present and future plans of road investments by the year 2025 Poland will cease to be a white spot on the map of Europe and it will become a lawful supplement of the Trans European net of road connections (figure 1).



Źródło: GDDKiA, the Office of Studies, 2006.

Fig. 1. Lay-out of motorways in Poland in 2025
Rys. 1. Schemat autostrad w Polsce w 2025

REFERENCES

Czerkas K., 2003, Project Finance in Polish practice, Twigger, Warsaw.

Hope for Motorways, Namiary na Morze i Handel 28.03.2007.

Journal of Laws, 2004, Regulation of the Council of Ministers from May 15, on the net of motorways and fast roads, , no 128, item 1334.

Journal of Laws, 2007, Statute from April 13, 2007, on the Statute alteration- Public Procurement Law and other acts, No 82, item 560.

Ministry of Infrastructure, GDDKiA, 2005, Schedule of Construction of Motorways and Fast Roads for years 2007-2013, Warsaw.

Report of Supreme Chamber of Control, 2006.

Statute from October 27, 1994, on payable motorways, Journal of Laws, no 127, item 627.

SZANSE I ZAGROŻENIA DLA REALIZACJI PROGRAMU BUDOWY AUTOSTRAD W POLSCE

STRESZCZENIE. We wstępie podano powody dla których tak ważne jest rozwijanie infrastruktury drogowej w Polsce. Następnie opisano założenia i stan obecny programu budowy autostrad w Polsce. Określono również możliwe warianty finansowania inwestycji autostradowych. Zasadniczą część pracy stanowi charakterystyka czynników stanowiących szanse i zagrożenie dla realizacji programu budowy autostrad w Polsce. Czynniki o charakterze syntetycznym zostały zestawione w podpunktach i opierają się w dużej mierze na dotychczasowych doświadczeniach z realizacji programu budowy autostrad. Pracę kończą autorskie wnioski dające propozycje zmian koniecznych dla przyśpieszenia dotychczasowego tempa realizacji inwestycji drogowych w Polsce.

Słowa kluczowe: autostrady, drogi ekspresowe, infrastruktura drogowa, budowa autostrad, finansowanie autostrad.

CHANCEN UND HINDERNISSE ZUR REALISIERUNG DES AUTOBAHNBAUS IN POLEN

ZUSAMMENFASSUNG. Zu Beginn werden wichtige Gründe für die Entwicklung der polnischen Straßenentwicklung genannt. Später werden Konzepte und der aktuelle Status der polnischen Autobahmen näher erläutert. Die verschiedenen Möglichkeiten, Autobahnen in Polen zu finanzieren werden ebenfalls genannt. Der größte Teil der Recherche wird aber Faktoren wiederspiegeln, die entweder Chancen oder Hindernisse zur Fertigstellung der Autobahmen darstellen. Diese hier aufgezählten Faktoren basieren auf den aktuellen Erfahrungen im Autobahnbau in Polen. Im Abschluss wird sich der Autor noch einmal mit Vorschlägen zur Verkürzung der Bauzeiten beschäftigen.

Codewörter: Autobahn, Schnellstraßen, Straßeninfrastruktur, Lizenzsysteme, Finanzierung von Autobahnen.

Bogusz Wiśnicki
Beata Huta
Instytutu Inżynierii Transportu
Akademia Morska w Szczecinie
ul. H. Pobożnego 11
70-507 Szczecin
e-mail: bogusz@am.szczecin.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 3
No 4

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

CRITICAL RISK IMPACT IN RISK MANAGEMENT

Wojciech Machowiak

Poznan School of Logistics, Poznań, Poland

ABSTRACT. The purpose for his paper is to highlight the importance of those business risk categories, which have outstanding crisis-genic potential. The reference to most common approaches to the problem of business safety and continuity is made, with a special emphasis on Risk Management strategy. Introduced concepts of "critical risk" and "critical impact" allowed making an efficient selection of critical risks from the generic variety of threats.

Key words: risk, risk management, risk impact, crisis, crisis management.

Identification and evaluation of threats, which are inevitable present in business activity, is a core element of each process aiming in improving business safety and sustainability. It doesn't matter is it Risk Management (RM), Business Continuity Management (BCM), Crisis Management (CM), or any other from the variety of concepts - in diverse shape, variously named and situated in the processes, risk assessment must be done. Neglected or misestimated in preventive emprise, risk can result in crisis, misdiagnosed (as a reason of) in the course of crisis, may contribute to make survival unachievable.

Critical situations happen in enterprises as well as in supply chains. In many cases crises are unavoidable, however, being aware what may happen, company's management may do a lot - either to avoid crisis, or at least to reduce the range and the magnitude of possible impacts. The sooner we know threats and risks which may result in critical situations, the better risk treatment may be applied. That seems to be obvious. Nevertheless, crises - caused by a wide spectrum of reasons - are quite frequent in common practice, and thousands of enterprises collapse each year due to their unpreparedness or lack of abilities to face such event successfully. Only in 2006 there were over 10 000 business crises reported [ICM 2007].

In business management strategies numerous solutions are proposed and practiced concerning crises. Whatever are their names, generally may be grouped into three main approaches to the considered problem corresponding to these mentioned before: risk management, business continuity management and crisis management. To a certain extent all three concepts evidently interfere, have some convergent features, and in some aspects are complementary (Fig. 1.). Nevertheless, developed independently, they have no direct contact points and frequently represent somewhat different way of thinking or "philosophy of management", they also significantly differ in which main procedures and activities (analytic ones and actions) are they focused on. One of such differences is how the possibility of crisis occurrence is situated in the entire process.

Citation: Machowiak W., 2007, Critical risk impact in risk management. LogForum 3, 3, 4
URL: http://www.logforum.net/vol3/issue3/no4
Accepted: 17.09.2007, on-line: 25.09.2007.

WM

Fig. 1. Types of managements
Rys. 1. Typy zarządzania

Crisis Management concept is drawn from the military and community disaster applications [Heath, 2005], nowadays extended also onto business practice. CM patterns basically provide managers with the tools enabling them to cope with critical situations, so from its nature is focused more on dealing with crises than preventing them. Certainly, it comprises also procedures of identification of crisis sources, but this is usually done from the position how to best counteract already existing problems, as necessary step to understand what happened. Sometimes CM procedures are extended on preventive functions, than the assessment of risks (understood as potential sources of crises) is also included. Such risk and impact analysis is subservient to reactive response and strategy of recovery and doesn't invoke what we practice as risk management.

According to Peter Barnes [Burnes, 2005], Business Continuity Management is "the development of strategies, plans and actions which provide protection or alternative modes of operation for those activities or business processes which, if they were interrupted, might otherwise bring about a seriously damaging or potentially fatal loss to the enterprise". Depending on execution (specific to particular organization), BCM may comprise activities typical for both - RM and CM. As it is focused on recovering from a given situation, conventional BCM, like CM is a kind of reactive approach, where evaluation of risks and their impacts plays rather auxiliary, although extremely important role and is subordinated to quickly finding the optimal survival solution. Usually this phase is referred to as Business Impact Analysis or Risk and Business Impact Analysis. Contrary to Risk Management, in this approach risk analysis is made after defining and analyzing the possible impacts [Meredith, 2005].

From clearly pragmatical point of view the most rational approach is to anticipate contingency of crisis affecting it at its source. Generally speaking this source may be designated as a specific risk category. So the backbone step for the entire process of counteracting critical situations should be determination and evaluation of these risks, which may result in crisis ("crisis-genic", or "critical" risks). In RM concepts the most substantial attention is paid to the process of risk identification and assessment. During its already 50-years old financial/insurance tradition [Sadgrove, 2005], as well as in more contemporary versions of risk treatment (Enterprise Risk Management), numerous tools and techniques have been developed, almost all based on dual risk measure: describing risk as combination of the likehood of its occurrence and the magnitude of its impact. Within this formula, methods which are in use focus at attempts to avoid weighty risk consequences (when materialized), to reduce all major threats in such way, that perspective of crisis should be rather eliminated. The entire process of risk management is usually systematized into few steps (Fig. 2a), ending on monitoring and control of the risk-reducing actions taken (preventing the occurrence of dangerous situations), with no contingency of continuation in case of crisis.

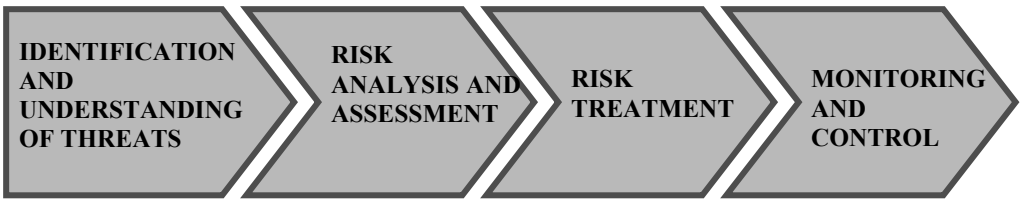


Fig. 2a. Steps of risk management process
Rys. 2a. Etapy procesu zarządzania ryzykiem

Risk Management approach gives no direct relevance to Crisis Management, no junction to that - whatever to say - possible extensure of events, which we used to call "crisis". The term "crisis" itself is rather absent in the literature concerning risk management. Also in numerous taxonomies and risk categorizations proposed, there is no reference to this quite real after-effect of various threats. Considering all the convergences - substantial identity as well as formal resemblance of procedures, it seems to be reasonable to recognize crisis management as the next (potential) step in risk management process (Fig. 2b).

Fig. 2b. Crisis and risk management process
Rys. 2b. Proces zarządzania ryzykiem i kryzysem

Nevertheless, in books and articles on risk management, crises are present everywhere - in form of examples and illustrations of extreme risk impacts, case studies, hypothetic results of risk taking with poor risk management, etc. Such inconsequence seems to be understandable considering the different history of both concepts, but inexplicable from pragmatic and both - strategic and operational point of view. Within the procedures of risk management process it may easily happen, that using common techniques (especially considering lack of precision of available tools and simplifications inevitable in standard risk assessment phase), two or more risks are qualified to the same impact category - let it be „high", or even "very high" (adequately to the established scale). When reported by risk manager to the board, it makes a vital difference if particular risk may result in - say - financial loss (even very high) only, or might cause a seriously critical situation. Existing formalism doesn't provide any risk assessment criteria referring to the critical potential of risk, which could be applied effectively to distinguish above mentioned cases. Obviously - it may be assumed, that within risk assessment procedures such imaginable consequence may be considered, but the final judgement remains: "very high impact" only. Such record may appear to be insufficient from the management's point of view, especially considering necessity to be well prepared for that kind of contingency. Additional difficulty is that in "traditional" risk assessment techniques only the maximal risk impact is considered, whereas it can happen that some level of risk consequences may be considerably lower then maximum, may appear to be a critical one. Moreover, the probability of "realization" of such threat may be higher, than maximum. This situation must be recognized as far from being satisfactory.

In this aspect the key question is how to distinguish and select critical risks using more accurate means than descriptive ones. What must be clearly emphasized here is fact, that crisis-genic risks [Machowiak, 2005, Konecka, Machowiak, 2006] must not be perceived as another risk category (in typological sense), as financial risks, operational, logistics or similar. Each of such identified risk may be supposed to be critical, if only its impact will overrun the magnitude ("critical impact") which - in consequence - makes impossible reaching the enterprise's goals (definition of crisis according to Ch. F. Hermann [8] and other sources). If so, all those risks, for which such threshold value of impact may

be defined (and is lower than really feasible maximal one), should be considered as critical risks and treated as extremely dangerous for business safety and continuity.

There are a lot of examples of risk types, which (in particular, enterprise specific conditions and circumstances) may be qualified as potentially critical. Almost all financial risks belong to this category, e.g. risk of delayed payments - having exceeded easy to be defined total amount; they disrupt cash-flow, what quickly may become critical. A large group of such risks are technical and logistic ones - for example stoppage in supply longer than "x" days may easily result in crisis. Also some HR categories - as group absence of more than "y" employees (caused by avian flu pandemic), which paralyses normal functioning of the enterprise. Other examples are such risks as loss of key customer or of market share, production disruptions etc. Certainly, this tool may be not so easy to be applied in case of all, sometimes very sophisticated risk categories (than we may stay with descriptive warning), but it seems to be very helpful in selection of critical risks.

Critical situations - whatever are their origins and affected areas - are the most dangerous threats for business safety and ability to be continued. According to another of its many definitions, crisis in the enterprise is the situation which - when tolerated - invites the organization's breakdown [Nogalski, Macinkiewicz, 2004]. What is frequently emphasized - additional and extreme difficulty when they come about is time shortage. Then the circumstance of inappreciable value is if enterprise's staff and management preparedness to crisis. This is why risks of high crisis-genic potential as well as their possible impacts should be included into risk management procedures a special matter of interest and considerations.

REFERENCES

Burnes P., 2005, The Definitive Handbook of Business Continuity Management; J.Wiley&Sons Ltd.

Heath R., 2005, A crisis management perspective of business continuity, in: A. Hiles, P.Burnes (ed.), The Definitive Handbook of Business Continuity Management; J.Wiley&Sons Ltd.

ICM Crisis Report 2006, Institute for Crisis Management, Louisville, June 2007.

Konecka S., Machowiak W., 2006, Kryzysogenne kategorie ryzyka specyficzne dla struktur logistycznych., 1st International Conference of Logistics INTLOG.

Machowiak W., 2005, Logistyczne aspekty kryzysu w przedsiębiorstwie, Logistyka, 4.

Meredith W., 2005, Business Impact Analysis, in The Definitive Handbook of Business Continuity Management, J.Wiley&Sons Ltd.

Nogalski B., Macinkiewicz H., 2004, Zarządzanie antykryzysowe przedsiębiorstwem, Difin.

Sadgrove K., 2005, The Complete Guide to Business Risk Management, Gower.

Zelek A., 2003, Zarządzanie kryzysem w przedsiębiorstwie. Perspektywa strategiczna, Instytut Organizacji i Zarządzania w Przemyśle ORGMASZ.

RYZYKO KRYTYCZNE W ZARZĄDZANIA RYZYKIEM

STRESZCZENIE. Zamierzeniem niniejszej publikacji jest zwrócenie uwagi na znaczenie tych kategorii ryzyka w działalności gospodarczej, które cechuje zwiększony potencjał kryzysogenny. Problem odniesiony jest do najbardziej popularnych koncepcji dotyczących kwestii bezpieczeństwa i ciągłości biznesu, ze szczególnym uwzględnieniem strategii Zarządzania Ryzykiem. Wprowadzone pojęcia "ryzyka krytycznego" i "skutku krytycznego" pozwalają na dokonanie skutecznej selekcji ryzyk krytycznych z ogólnej różnorodności zagrożeń.

Słowa kluczowe: ryzyko, zarządzanie ryzykiem, skutek ryzyka, kryzys, zarządzanie kryzysem.

KRITISCHES RISIKO IN RISIKOMANAGEMENT

ZUSAMMENFASSUNG. Die vorliegende Publikation hat zum Ziel, die Aufmerksamkeit zu machen auf die Bedeutung von diesen Risikokategorien in der wirtschaftlichen Tätigkeit, für die ein vergrößertes Krisenpotenzial charakteristisch ist. Das Problem bezieht sich auf die bekanntesten Konzeptionen von Sicherheits- und Businesskotinuitätsfragen, mit besonderer Rücksicht auf die Risikomanagementstrategie. Die eingeführten Begriffe, wie "kritisches Risiko" und "kritische Folge" ermöglichen, eine erfolgreiche Selektion von kritischem Risiko aus der gesamten Gefahrenvielfalt durchzuführen.

Codewörter: Risiko, Risikomanagement, Krise, Krisengefolgen, Krisenmanagement.

dr inż. Wojciech Machowiak
Wyższa Szkoła Logistyki
ul. Estkowskiego 6
61-755 Poznań
e-mail: wmachowiak@wsl.com.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 3
No 5

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

PROCESY TRANSFORMACJI SYSTEMOWEJ W POLSKIM TRANSPORCIE

Maciej Mindur

Szkoła Główna Handlowa, Warszawa, Polska

STRESZCZENIE. W artykule przedstawiono przebieg transformacji systemowej w polskim transporcie oraz wskazano, że jego rozwój nie może opierać się wyłącznie na regułach wolnej gry rynkowej a powinien być także wspierany finansowo i monitorowany przez państwo. Tego rodzaju praktyki mają miejsce również w państwach Europy Zachodniej. Z artykułu wynika, że rozwój gospodarki wymusza wyprzedzający rozwoju transportu.

Słowa kluczowe: transport, transformacja systemowa.

WPROWADZENIE

Transport odgrywał, odgrywa i będzie odgrywał bardzo istotną rolę w gospodarce narodowej. Można stwierdzić, że towarzyszy on każdej działalności o charakterze ekonomicznym i społecznym, stanowi niezbędny warunek determinujący rozwój gospodarczy, pełni funkcję "krwiobiegu" gospodarki narodowej.

Kwestią o zasadniczym znaczeniu jest określenie specyfiki transportu, charakteru jego działalności oraz roli w tworzeniu dochodu narodowego. Rozważania dotyczące istniejącego systemu transportowego winny uwzględniać wpływ uwarunkowań historycznych na kształtowanie jego rozwoju w poszczególnych etapach. Problematyka ta ma szczególnie duże znaczenie, ponieważ analizy w tym zakresie ułatwiają zrozumienie aktualnego stanu polskiego transportu (jego infrastruktury) oraz stanowią podstawę programowania rozwoju w perspektywie.

Niewątpliwie to, jak transport w Polsce będzie się rozwijał, zależne jest między innymi od wielkości nakładów przeznaczonych na ten dział gospodarki. Zbyt niski poziom nakładów może doprowadzić do sytuacji, w której zahamowaniu ulegnie rozwój gospodarczy. Istnieje bowiem ścisły związek między rozwojem gospodarki a transportem.

TRANSPORT W OKRESIE TRANSFORMACJI SYSTEMOWEJ

Zmiany ustrojowe i przeobrażenia gospodarcze doprowadziły również do zmian w polityce transportowej. W Polsce, odejściu od gospodarki nakazowo-rozdzielczej towarzyszyła tendencja do ograniczania regulacji prawnych i ogólna liberalizacja wszelkiej działalności. Proces ten dotknął także

Cytowanie: Mindur M., 2007, Procesy transformacji systemowej w polskim transporcie. LogForum 3, 3, 5.
URL: http://www.logforum.net/vol3/issue3/no5
Zatwierdzono: 26.09.2007, on-line: 29.09.2007.

transport, co przełożyło się również na politykę transportową. Było oczywiste, że wprowadzenie gospodarki rynkowej ograniczy możliwość kreowania przez państwo polityki transportowej.

Wydaje się, że przyjęto zasadę analogiczną, jak w przypadku polityki przemysłowej, że najlepszą polityką przemysłową (transportową) jest brak polityki przemysłowej (transportowej). Konsekwencją tego był brak wizji polityki transportowej [Bauer 2000]. Zakładano, jak w przypadku innych dziedzin, że wszystko załatwi tzw. "niewidzialna ręka wolnego rynku".

Zakładając, że w dziedzinie transportu będą zmienione ogólne zasady, takie jak kryteria efektywności oraz zakres pola optymalizacji, miałoby to oznaczać, że każde przedsiębiorstwo transportowe musi respektować prawa wolnego rynku i funkcjonować tak długo, jak długo przynosi zysk. Tak jednak nie było. Przyjęcie bowiem założenia, że podstawowym i nadrzędnym celem przedsiębiorstwa jest wytwarzanie dochodu, oznaczałoby, że państwo rezygnuje z wykonywania deficytowych przewozów, zwłaszcza pasażerskich. Ze względów społecznych wiele deficytowych przewozów utrzymano, zwłaszcza dotyczyło to Polskich Kolei Państwowych. Nierzadko jednak nie była to świadoma polityka państwa, lecz działanie pod presją różnych lobby.

Kolejnym elementem, który wpłynął na transformację polskiego transportu [Engelhardt 1998], była zmiana struktury produkcji, bowiem zarówno infrastruktura, jak i system przewozów ładunków dostosowany był do starej struktury gospodarki.

Następnym czynnikiem była również zmiana geografii polskiego handlu zagranicznego, która pociągała za sobą nie tylko zmiany kierunków przewozów, lecz także zmiany struktury ładunków.

Również zmiana kolejnego elementu z zakresu polityki gospodarczej - liberalizacja cen i dostosowanie opłat za ropę naftową (czyli paliw do cen światowych) spowodowały zmianę struktury kosztów. Skutki te odczuli boleśnie wszyscy przewoźnicy, zwłaszcza LOT. Dawniej płacąc za paliwo w cenach z I obszaru płatniczego mógł prowadzić politykę tanich przelotów w ruchu międzynarodowym, jednak gdy w Polsce poziom cen zbliżył się do poziomu cen światowych, jego sytuacja i możliwość prowadzenia przez firmę tej polityki zmieniła się diametralnie. Firma, która w latach 70. dzięki przewozom międzynarodowym mogła poprawiać bilans płatniczy, stawała się jednym z największych dłużników.

Zmiana systemu gospodarczego, prywatyzacja spowodowały, że zmieniła się również struktura przedsiębiorstw. Duże zakłady były dzielone, a także powstawały małe i średnie przedsiębiorstwa. Zaczął pojawiać się popyt na inną formę świadczenia usług. Zmniejszyły się przewozy masowe, natomiast bardziej zaczął liczyć się czas przewozu i elastyczność, a od końca lat 90. coraz częstsze stawało się zapotrzebowanie nie tylko na przewóz ładunku, lecz także na usługi logistyczne. Zdaniem ekspertów w tym kierunku będzie rozwijał się przewóz ładunków, nie tylko przetransportowania od-do, lecz także towarzyszyć będą temu czynności związane z opakowaniem, posortowaniem w czasie realizacji procesu transportowego od nadawcy do odbiorcy.

Należy stwierdzić, że pomimo różnych deklaracji i apeli środowisk naukowych i transportowych, szczególnie w pierwszych latach, nie zrobiono nic lub niewiele na rzecz kreowania rozwoju zrównoważonego transportu. Brak interwencji ze strony państwa doprowadził do tego, że przewozy ładunków i pasażerów w pełni zdominował transport samochodowy.

Skromne zasoby kapitałowe powodowały, że przewoźnicy, podobnie jak przedsiębiorcy w innych działach gospodarki, zainteresowani byli szybkim zyskiem, nie zaś rozwojem dającym możliwość nawet zwielokrotnienia zysku w perspektywie kilkuletniej. W polskich warunkach na inwestycje rozwojowe, przynoszące zysk dopiero po kilku latach, mógł sobie pozwolić jedynie zagraniczny przewoźnik "Polski Express".

Problem braku środków bardzo dobrze ilustruje projekt budowy autostrad. W początkach lat 90. Ministerstwo Transportu przygotowało program budowy autostrad, zdając sobie sprawę, że nie można sfinansować inwestycji korzystając jedynie ze środków budżetu państwa, ogłoszono projekt partnerstwa publiczno-prywatnego. Był to projekt wieloletni. Głównym założeniem było, że pierwszy rok budowy będzie sponsorowało państwo, a kapitał prywatny będzie partycypował w niewielkim stopniu. Z każdym jednak rokiem miały zmniejszać się udziały państwa w ogólnych kosztach przeznaczonych na inwestycje, a zwiększać udział kapitału prywatnego, aż do odwrócenia proporcji

początkowych. Kapitał prywatny miał partycypować w zyskach, bowiem założenie było takie, że "lwia" część zysków pochodzących z opłat za przejazd prywatną autostradą będzie zyskiem prywatnego inwestora. Po ogłoszeniu projekt ten spotkał się z żywym zainteresowaniem i wiele różnych firm zaczęło walczyć o koncesje. Koszty poniesione przy budowie infrastruktury miały zwrócić się dopiero po kilkudziesięciu latach. Okazało się to szczególnie trudne do zrealizowania. W Polsce przewoźnicy zaczęli omijać płatny kawałek autostrady drogami równoległymi, zmniejszając komfort, ale zwiększając opłacalność przejazdów. Po pewnym okresie, gdy projekt zaczął funkcjonować, zainteresowanie nim wygasło lub przynajmniej zmalało, a właściciele koncesji w większości zaczęli się ich pozbywać. Przykład ten pokazuje, jak trudne są inwestycje w infrastrukturze i potwierdza, że w kraju o skromnych zasobach kapitału państwo musi się zajmować rozbudową dróg. Z reguły jest tak na całym świecie, tyle, że w krajach biednych uwidocznia się to najbardziej jaskrawo.

Ogólna sytuacja budżetu i stan finansów publicznych znalazła szersze omówienie w rozdziałach autora pt. Transport w gospodarce [Liberadzki B., Mindur L, 2006]. Pomimo ciągłej prywatyzacji stale utrzymywała się tendencja większych wydatków z budżetu państwa niż przychodów, aż w 1999 r. deficyt budżetu państwa (dziura budżetowa) osiągnął zatrważające rozmiary. Przy takim stanie finansów publicznych państwo musiało sprostać podstawowym i tzw. "sztywnym wydatkom", niewiele środków przeznaczając na modernizację, nie wspominając już o budowie infrastruktury, chociaż jak wspomniano wcześniej, Polska i tak znacznie odbiegała już pod względem nasycenia infrastruktury drogowej od państw Europy Zachodniej, gdzie od dłuższego czasu dominowały przewozy samochodowe. Znacznie korzystniej wyglądała natomiast pod względem infrastruktury kolejowej.

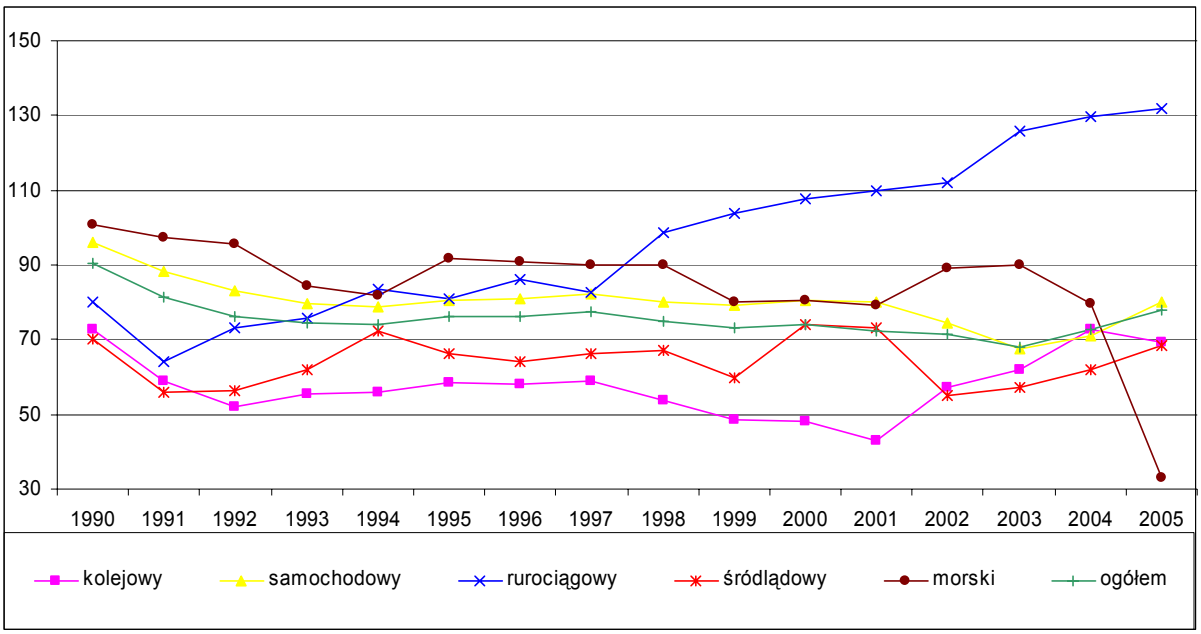
Przy tak niskich nakładach na budowę dróg i tranzytowym znaczeniu Polski, polityka transportowa państwa zmierzająca do zrównoważenia przewozów wydawała się koniecznością. Tym bardziej że Polska w przeciwieństwie do np. Białorusi nie potrafiła wykorzystać swego tranzytowego położenia i nałożyć na obcych przewoźników odpowiednio wysokich opłat pokrywających zniszczenia dróg, jakie następują po tak wielkich przejazdach. Należy przy tym zaznaczyć, że przed 1989 r. większość przewozów ładunków na dalsze odległości przewożono koleją, przez co również znacznie odciążano drogi. Brak zainteresowania ze strony państwa rozczłonkowaniem przewozów ładunków, przy niedostosowanym natężeniu ruchu, bardzo szybko prowadził do dewastacji dróg.

Przedstawiona sytuacja znajduje swoje odzwierciedlenie w liczbach. W 1989 r. w Polsce eksploatowano 216 tys. km dróg, w tym 181 tys. km o ulepszonej nawierzchni, oraz eksploatowano 26 644 km linii kolejowych, w tym normalnotorowych 24 287 km. W 1989 r. przewieziono ogółem 1 820 626 tys. t ładunków, w tym transportem samochodowym 1 347 864 tys. t, kolejowym 388 920 tys. t i żeglugą śródlądową 14 040 tys. t.

W 1995 r. przewieziono ogółem 1 380 810 tys. t ładunków, transportem samochodowym 1 086 762 tys. t, co stanowiło 78,7%, transportem kolejowym 225 348 tys. t, co stanowiło 16,3%, transportem wodnym śródlądowym 9306 tys. t, co stanowiło 0,7%.

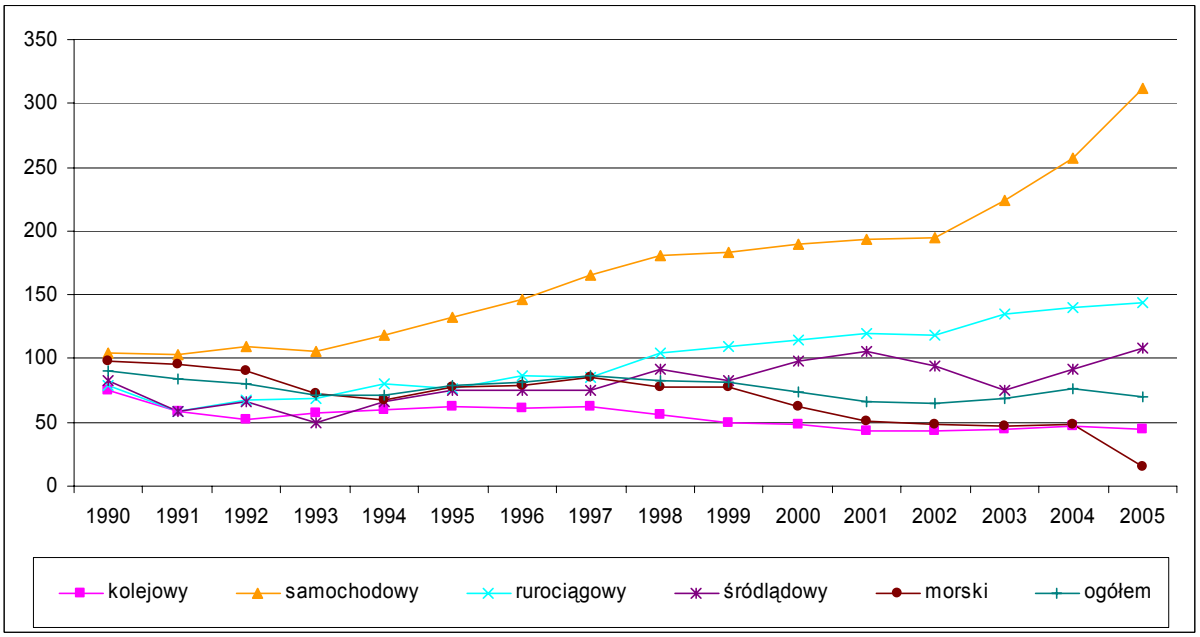
W 2000 r. przewieziono ogółem 1 347 895 tys. t ładunków, transportem samochodowym 1 083 071 tys. t, transportem kolejowym 187 247 tys. t ładunków, transportem wodnym śródlądowym 10 433 tys. t.

W 2004 r. zahamowana została wieloletnia tendencja spadkowa ilości przewożonych ładunków. Również w 2005 r. nastąpił wzrost przewozów. Przewieziono ogółem 1 422 576 tys. t ładunków, w tym transportem samochodowym 1 079 761 tys. t co stanowiło 75,9% ogółu przewozów, transportem kolejowym 269 533 tys. t, co stanowiło 18,9%, transportem wodnym śródlądowym 9 607 tys. t, co stanowiło 0,7%. Kształtowanie się przewozów ładunków w latach 1990-2005 przedstawiono na rys. 1 i 2.



Źródło: Opracowanie własne [Roczniki Statystyczne GUS 1991-2005; Transport - wyniki działalności w 2005 r. GUS 2006

Rys. 1. Przewozy ładunków (1989=100) w tonach
Fig. 1. Cargo transport in tons (1989=100)



Źródło: Opracowanie własne [Roczniki Statystyczne GUS 1991-2005; Transport - wyniki działalności w 2005 r. GUS 2006

Rys. 2 Przewozy ładunków (1989=100) w tonokm
Fig. 2. Cargo transport in tonkm (1989=100)

Pomimo niewielkich wahnięć uwidoczniła się hegemoniczna rola transportu samochodowego, ponad 4-krotnie przewyższająca przewozy transportem kolejowym [Rocznik Statystyczny 2005].

Zmniejszenie przewozów koleją na rzecz wzrostu przewozów transportem samochodowym potwierdza również zmniejszenie pracy przewozowej, i tak: w 1989 r. udział przewozów kolei wynosił 29%, a w 2005 r. już tylko 22% (bez uwzględnienia transportu morskiego w 1989 r. 66%, w 2005 r.

25%), natomiast nastąpił wzrost udziału przewozów transportem samochodowym z 10% w 1989 r. do 53% w 2005 r. (bez transportu morskiego z 23% do 61%) [Rocznik Statystyczny, 2001-2005].

Należy założyć, że przytoczone dane nie uwzględniają jednak wszystkich przewozów samochodowych (w tym przyczepami, naczepami). Dynamika wzrostu transportu samochodowego była wyższa, niż przedstawia to statystyka. Dodać też należy, że nadmierna liberalizacja i brak kontroli ze strony państwa stworzyły warunki do rozwoju tzw. przewozów zarobkowych (nieprowadzących zarejestrowanej działalności gospodarczej), które również nie są uwzględniane w statystyce lub w innych opracowaniach, a są tylko określane szacunkowo. Często tzw. przewoźnicy zarobkowi wykonują usługi, ale nie prowadzą rejestru działalności gospodarczej. Przewozów tych dokonują również przedsiębiorstwa małe, dysponując zamortyzowanym już taborem, relatywnie zaniżają ceny przewozów i powodują swoiste "psucie" rynku [Rocznik Statystyczny, 2001-2005].

Z przedstawionych danych statystycznych wynika, że walka o podział przewozów na rynku toczyła się między transportem kolejowym a transportem drogowym i zakończyła się zdominowaniem rynku przewozów przez ten ostatni. Nie można mówić o większej aktywności transportu wodnego śródlądowego, jeśli jego udział kształtuje się na poziomie 0,6-0,7% i raczej ma tendencję malejącą. Tendencję rosnącą wykazują przewozy ładunków transportem lotniczym od 22 000 t w 1995 r. do 34 000 t w 2002 r. Transport ten praktycznie jako konkurent nie odgrywa żadnej roli, podobnie żegluga śródlądowa przewozi raczej śladowe ilości ładunków.

Trudno więc w warunkach polskich mówić o tendencji do zrównoważenia transportu. Natomiast struktura gałęziowa przewozów upodobniła Polskę do krajów Europy Zachodniej. Nie jest to jednak kierunek zmian mogący napawać optymizmem, gdyż Unia Europejska - przynajmniej teoretycznie - dąży do zrównoważonego transportu, a co najważniejsze, na Zachodzie proces ten był wydłużony w czasie i następował stopniowo. Rozwojowi przewozów towarzyszył także proces rozwoju dróg. Podkreślenia wymaga fakt, że w Polsce w ciągu krótkiego okresu nastąpiły bardzo głębokie przeobrażenia w strukturze przewozów polskiego transportu. Nagły rozwój transportu musiał doprowadzić do dewastacji dróg.

Kolejną kwestią wpływającą na rozwój polskiego transportu było przejście od gospodarki tzw. zamkniętej do gospodarki otwartej. O ile przed 1989 rokiem przewozami międzynarodowymi zajmowały się trzy przedsiębiorstwa państwowe: PKS, PEKAES, C. Hartwig, o tyle po 1989 r. państwo utraciło monopol na międzynarodowe przewozy ładunków. Nowi, bardziej elastyczni, tańsi przewoźnicy zaczęli wypierać także kolej z niektórych przewozów międzynarodowych.

Czynnikami wpływającymi niewątpliwie na zmianę struktury gałęziowej polskiego transportu były zmiany struktury polskiego handlu zagranicznego oraz zmiana struktury polskiej gospodarki. Problematyka ta jednak wykracza poza zakres niniejszego artykułu i wymaga oddzielnych badań.

PODSUMOWANIE

Konkludując rozważania na temat procesów transformacji systemowej oraz zależności między transportem a gospodarką, należy stwierdzić, że rola transportu w stosunku do innych działów i sektorów gospodarki jest wtórna ze względu na usługowy charakter. Ze względu jednak na specyfikę transportu i jego zadania oznacza to także, że rozwój transportu powinien wyprzedzać rozwój innych gałęzi gospodarki, aby nie ograniczać rozwoju gospodarczego kraju [Ciesielski, Szudrowicz 2001]. Taka teza implikuje stwierdzenie, że nakłady na rozwój transportu dodatkowo tworzą podstawy dla rozwoju w pozostałych sektorach i działach gospodarki narodowej. Wspominając o tym, że transport powinien wyprzedzać rozwój gospodarki, należy zauważyć, że będzie tak jedynie wówczas, gdy określone będą plany rozwojowe poszczególnych gałęzi gospodarki, a z tych planów będą wynikać potrzeby przewozowe, których realizatorem będzie transport.

W literaturze przedmiotu znaczenie transportu dla gospodarki omawiane było wielokrotnie przez wszystkich teoretyków tej dyscypliny. Transport jest jednakże tym obszarem, gdzie dochodzi do wzajemnych relacji między gospodarką i jej wymaganiami a swoim - nie zawsze pozytywnym - oddziaływaniem na otoczenie. Jednocześnie, to właśnie transport wyznacza kierunki rozwoju

infrastruktury, a więc po części całej gospodarki. Jak wspomniano wcześniej, transport jest podstawowym narzędziem do wszelkiego działania. Takie stanowisko znajduje odzwierciedlenie w zaangażowaniu zagadnień transportowych we wszystkich obszarach funkcjonowania gospodarki. Zagadnienia transportu są na przykład elementem polityki gospodarczej, polityki zagospodarowania przestrzennego, polityki społecznej, polityki samorządowej i lokalnej, a na polityce budżetowej i fiskalnej kończąc. Potwierdza to tezę o nierozerwalnych związkach oraz zależnościach transportu i gospodarki.

Ostatnia część rozdziału przedstawia istotny problem dla funkcjonowania gospodarki i transportu - transportochłonność gospodarki narodowej. Przedstawiono w niej definicję, omówiono pojęcie transportochłonności, a także podjęto próbę doboru najbardziej miarodajnych zmiennych odzwierciedlających rzeczywisty poziom transportochłonności gospodarki narodowej. Rozważania zawarte w tej części pracy, jak się wydaje, stanowią dobrą podstawę do określenia działań ograniczających transportochłonność gospodarki narodowej.

LITERATURA

Bauer: R., 2000, Dylematy polityki transportowej, w: Transport u progu XXI w. SGH, Warszawa.

Burnewicz J., Szczerba E., 2004, Nowa jakość polskiego transportu po integracji z UE. Przegląd Komunik. nr 10/2004.

Ciesielski M, Szudrowicz A., 2001, Ekonomika transportu. Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań.

Engelhardt J., 1998, Transport kolejowy w Polsce w warunkach transformacji gospodarczej. KOW, Warszawa.

Liberadzki B., Mindur L, 2006, Uwarunkowania rozwoju systemu transportowego Polski, pod red. ITE, Warszawa.

Rocznik Statystyczny 2003.

Rydzkowski W, Wojewódzka-Król K., 2002, Transport, PWN, Warszawa.

Transformacja społeczno-gospodarcza w Polsce. Rządowe Centrum Studiów Strategicznych, Warszawa 2002.

THE SYSTEM TRANSFORMATION PROCESSES IN THE POLISH TRANSPORT

ABSTRACT. The course of the system transformation in the Polish transport was presented in the article and it was indicated also in the article that the transport may not be based only on free market rules, but it should also be financially supported and monitored by the State. The practices of this kind take also place in the Western Europe countries. It is resulting from this article that the development of economy constrains the advanced transport growth.

Key words: transport, transformation process.

PROZESSE DER SYSTEMTRANSFORMATION IN DER POLNISCHEN TRANSPORTWIRTSCHAFT

ZUSAMMENFASSUNG. In dem Beitrag wurde der Verlauf der Systemtransformation in der polnischen Transportwirtschaft dargestellt. Der Autor weist daruf hin, daß deren Entwickung nicht ausschliesslich gemäß den Regeln der freien Marktwirtschaft erofolgen kann. Der Staat muß sie finanziell unterstützen und verfolgen. Solche Regelungen gelten auch in westeuropäischen Staaten.

Codewörter: Transport, Systemtransformation.

dr hab. Maciej Mindur
Katedra Polityki Gospodarczej
Szkoła Główna Handlowa
Al. Niepodległości 162
02-554 Warszawa
e-mail: Maciej.Mindur@sgh.waw.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 4
No 1

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

THE "ZERO-G-LOADER"-PROJECT AS AN INNOVATIVE SOLUTION FOR AIRPORT BAGGAGE HANDLING ON THE APRON

Tobias Erxleben, Lars Sallwey

Projektlogistik GmbH, Wildau, Germany

ABSTRACT. Baggage handling systems differ strongly between the high developed transports systems inside of the terminal and those on the apron, where it is moved by hand, if it is not transported in ULD and that causes high injury risks for the involved staff. The attempt of the "Zero-G-Loader" is the automation of unloading bulky baggage and thereby acceleration of the process is achieved.

Key words: baggage handling, luggage handling, baggage, airport logistics, aviation logistics, baggage dispatch, apron.

INTRODUCTION AND DEPICTION OF THE NECESSARY OPTIMIZATION IN THE LOGISTIC PROCESS

The handling of baggage is an awkward point in discussions about employment protection. A series of statistics face the high injury risks for ramp agents in connection with the handling of bulky baggage on the apron. The analyzed interfaces are the loading of dollies in the make-up room, the loading and unloading of them in front of the aircraft and the unloading at the terminal in order to return the baggage to the passengers. The following pictures show the work in the mentioned areas.

Fig. 1. Make-up room [OSHA 2007]
Rys. 1. Pomieszczenie przygotowawcze [OSHA 2007]

Citation: Erxleben T., Sallwey L., 2007, The "Zero-G-Loader"-project as an innovative solution for airport baggage handling on the apron. LogForum 3, 4, 1
URL: http://www.logforum.net/vol3/issue4/no1
Accepted: 15.10.2007, on-line: 20.12.2007.

Fig. 2. Ramp area [OSHA 2007]
Rys. 2. Strefa rampy [OSHA 2007]

Fig. 3. Baggage return area [OSHA 2007]
Rys. 3. Strefa zwrotu bagaży [OSHA 2007]

It is remarkable how the employees move the heavy baggage in partly hazardous positions. It is necessary to twist and bend forward the upper part of the body to move the baggage, which has a weight between 15 and 45 kilogram at the maximum. It is handled up to 2000 times a day by one person. The exposure for the staff is very high at present and it may rise in the future, because the growth of the aviation market will go on in the next years [IATA 2005]. Aside from some throwbacks caused for example by the terrorist attacks of 9/11 the growth was continuous in the past. Further remarkable is the disproportionately high growth of the low-cost-carrier market. Low-cost-carrier offer a major part of its seat capacities for a price below the average market price. The processes of those airlines are characterized by a high speed orientation often in combination with single occupancy on each function, which causes an additionally high exposure for the staff.

PRESENT SOLUTIONS FOR AN ERGONOMIC AND AUTOMATED BAGGAGE HANDLING RESPECTIVELY

There are already airport technologies that speed up the process of baggage handling, make it more economic or safe. The foldover of baggage into the dollies or ULDs (Unit Load Device) in the make-up room may be done by robots in the near future. The development of those robots by different companies is highly sophisticated at present. The solutions are more or less feasible for the series launch and differ most in the design of their baggage grabbing part.

Already used are products like Power Stow, Sliding Carpet or Ramp Snake, which speed up the loading and unloading of the aircraft and make the process in the baggage compartment more ergonomic. The functional principle of these products is a roller or belt conveyor respectively that moves the baggage in and out of the baggage compartment.

Fig. 4. Power Stow [Power Stow 2007]
Rys. 4. Przenośnik [Power Stow 2007]

Fig. 5. Ramp Snake [FMC Technologies 2007]
Rys. 5. Przenośnik taśmowy [FMC Technologies 2007]

Fig. 6. Sliding Carpet [Telair 2007]
Rys. 6. "Sliding Carpet" [Telair 2007]

However the unloading of bulky baggage of the dollies is not or partly improved by these solutions. There are no standard products for the unloading of the baggage at the terminal in order to return it to

the passengers. The Grenzebach Onero GmbH has developed a prototype for the unloading of baggage at the terminal. The dollies are cleared by a tilting mechanism.

The Projektlogistik GmbH developed a solution covering and improving both interfaces of the process.

THE "ZERO-G-LOADER" AS A FURTHER MODULE FOR AN OPTIMAL PROCESS

The "Zero-G-Loader" concept is a solution for the unloading of bulky baggage in front of the aircraft and at the terminal. It substitutes the so far used dollies and can be implemented in the airport operations without the need to change the process or to rebuild parts of the airport buildings. It was the intention of the "Zero-G-Loader" to make the handling of baggage more ergonomic in combination with minimal costs. Hence it follows that the components of the construction are function-oriented and robust.

The main problem of an automated unloading is to loosen the baggage getting caught during the transport over the apron and move it to a small conveyor belt without the risk of baggage hold-up. The basic principle of the "Zero-G-Loader" is based on a combination of transport technology that is already used as a standard at airports. The baggage compartment of the cart turns its small side towards the belt loader in order to reduce the difference between both conveyors (currently used dollies are two times longer then wide). Those turntables are already used for trailers that transport ULDs. The "Zero-G-Loader"-train is moved to the aircraft by a tractor and the baggage compartment is manually turned towards the belt loader. Baggage gets out of the cart by a conveyor that covers the whole bottom of the baggage compartment of the cart. For moving the baggage from the baggage compartment of the cart to the conveyor of the belt loader or the terminal, the "Zero-G-Loader" has a module consisting of a conveyor belt and scrapers on the side. This module has to be opened after turning the baggage compartment in order to form a bridge between the "Zero-G-Loader" and the belt loader. The conveyors of the baggage compartment and the module are powered by one crank which can be turned manually or by an engine, however the manually option is economically better. The baggage is moved slowly out of the baggage compartment and thereby it is separated by stretching out the baggage flow. The conveyor belt in the baggage compartment is moving slower than the one of the module, which moves slower than the conveyor of the belt loader again. When the baggage compartment is empty, the module has to be flipped up and thereby the baggage compartment is closed. The baggage compartment is turned to the starting position and the next "Zero-G-Loader" is prepared for unloading its baggage. The tractor pulls the train of carts forward, till the next "Zero-G-Loader" has the right position in front of the belt-loader. In addition to the unloading of baggage in front of the aircraft, the "Zero-G-Loader" is used for its unloading at the terminal. At this position the module is opened too and the bag-gage compartment has to be turned. The main difference between both interfaces of the process is the direction of conveyance. The conveyor at the terminal moves across the grain of the conveyor inside the baggage compartment. The clearing is speeded up in comparison to the actual process, because the baggage carrying system is designed for a big volume flow. Speeding up the process is not or only partly possible in front of the aircraft, because the ramp agent inside the aircraft is the bottleneck.

In order to test and optimize the functional principle of the "Zero-G-Loader", before constructing a prototype, a model on a scale of 1:5 was built.

Fig. 7. Filled "Zero-G-Loader"
Rys. 7. Załadowany "Zero-G-Loader"

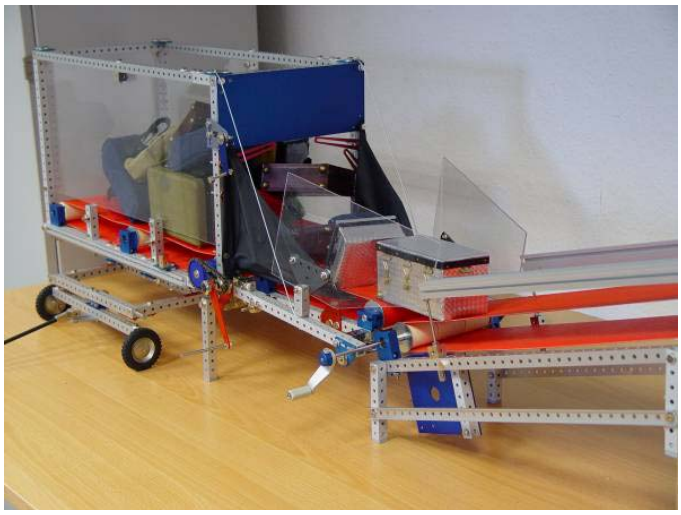


Fig. 8. Unloading in front of the aircraft
Rys. 8. Wyładunek z przodu samolotu

In addition to the model of the "Zero-G-Loader" it was necessary to imitate the baggage in order to verify the results of the experiment. Miniature baggage pieces have been made, which relate to the original ones in the size, weight, surface property and form stability. Additional components like straps and handles are necessary to simulate the hold-up risk.

The test results approve the functional principles of the "Zero-G-Loader" and help to optimize the construction in order to build a prototype.

SUMMARY

The exposure for the staff during the unloading of the dollies in front of the aircraft as well as at the terminal is strongly reduced, because the hazardous positions by moving the baggage are substituted by turning a crank in an ergonomic way or an engine respectively. At the same time the process is accelerated, which causes a reduction of costs.

The simple technical construction in combination with components that need low maintenance make the "Zero-G-Loader" inexpensive and allows a fast amortization towards the actual used vehicles on the apron.

In the course of future requirements resulting from trends in the aviation sector that will mainly be affected by cost pressure, higher safety requirements and new types of aircrafts, the "Zero-G-Loader" is an outstanding alternative or addition referring to existing material flow solutions.

The chances resulting from the approach are recognized by the Projektlogistik GmbH from Brandenburg and the development is supported by the European Fund for Regional Development and the Ministry of Economic Affairs Brandenburg.

REFERENCES

FMC Technologies, Inc., RampSnake, http://www.fmctechnologies.com/upload/rampsnake2.jpg, 09/2007

IATA (International Air Transport Association), 2005, Passenger and Freight Forecast Publications.

OSHA (Occupational Safety & Health Administration), 2007, "make-up room" and "ramp area", http://www.osha.gov/SLTC/etools/baggagehandling/index.html, 09/2007.

POWERSTOW A/S, 2007, About Power Stow, http://www.powerstow.com/about/about.html, 09/2007.

TELAIR International GmbH, Narrow-Body Systems, http://www.telair.com/narrowBody_slidingCarpet.html, 09/2007.

PROJEKT "ZERO-G-LOADER" JAKO INNOWACYJNE ROZWIĄZANIE OBSŁUGI BAGAŻU NA PŁYCIE LOTNISKOWEJ

STRESZCZENIE. Pomiędzy zaawansowanymi technologicznie systemami obsługi bagażu wewnątrz terminalu lotniczego a ręcznym przeładunkiem na płycie lotniska występują istotne różnice. .Jeżeli bagaż na płycie lotniska nie jest przewożony w pojemnikach, to pracownicy obsługi naziemnej są narażeni na wypadki. Celem projektu "Zero-G-Loader" jest próba automatyzacji rozładunku bagażu i dzięki temu przyspieszenie całego procesu.

Słowa kluczowe: obsługa bagażu lotniczego, bagaż lotniczy, logistyka w portach lotniczych, wysyłka bagażu, płyta lotniskowa.

"ZERO-G-LOADER" PROJEKT ALS EINE INNOVATIVE LŐSUNG VON GEPÄCKABFERTIGUNG AUF DEM VORFELD

ZUSAMMENFASSUNG. Der Gepäckumschlag auf Flughäfen unterscheidet sich zwischen den hoch entwickelten terminalinternen Transportsystemen und dem Umschlag auf dem Vorfeld deutlich. Vorfeldseitig wird das Gepäck, sofern es nicht in Containern transportiert wird, manuell umgeschlagen, wodurch ein hohes Verletzungsrisiko bei den beteiligten Mitarbeitern entsteht. Der "Zero-G-Loader" verfolgt den Ansatz einer automatisierten Entladung von losem Gepäck und beschleunigt dabei gleichzeitig den Gesamtprozess.

Codewörter: Gepäckhandling, Gepäckumschlag, Fluggepäck, Flughafenlogistik, Gepäcklogistik, Gepäckabfertigung, Vorfeldprozesse.

mgr inż. Dipl.-Wirtsch.-Ing. (FH) Tobias Erxleben
Dipl.-Wirtsch.-Ing. (FH) Lars Sallwey
Projektlogistik GmbH
Bahnhofstr. 1 / Halle VII
D-15745 Wildau, Germany
e-mail: Projektlogistik_GmbH@t-online.de

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 4
No 2

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

THE ROLE OF INFORMATION EXCHANGE IN LOGISTIC NETWORK STRATEGIES

Marek Matulewski

Poznań School of Logistics, Poznań, Poland

ABSTRACT. The author discusses the role of information and information exchange in logistic supply network strategies. First, the difference between the logistic supply chains and logistic supply networks are discussed. Next, two types of information flows are distinguished, that is to say: information flow aiding coordination activities and information flow aiding operational activities. The relations occurring in the supply networks, constituting the source of the advantage, are dealt with. The author touches upon the following factors affecting information exchange in logistic supply networks: changes in consumers' behaviour, the increase in the consumers' spending power, internationalization and globalization of economy, consolidation processes and technological development. Then, the main areas of potential conflicts affecting the information exchange preferences between industry and commerce are listed. Finally, two basic types of relations (as far as the interrelations between network links are concerned) are enumerated: (i) confrontative approach to the participant, and (ii) co-operative behaviour. The changeability and uncertainty of demand is also a very important logistic problem, which is especially visible in the so-called Bullwhip Effect (or Whiplash Effect). Many companies resort to forecasting when they try to protect themselves against the demand uncertainty and changes. Finally, the impact of new technologies on the information exchange is presented.

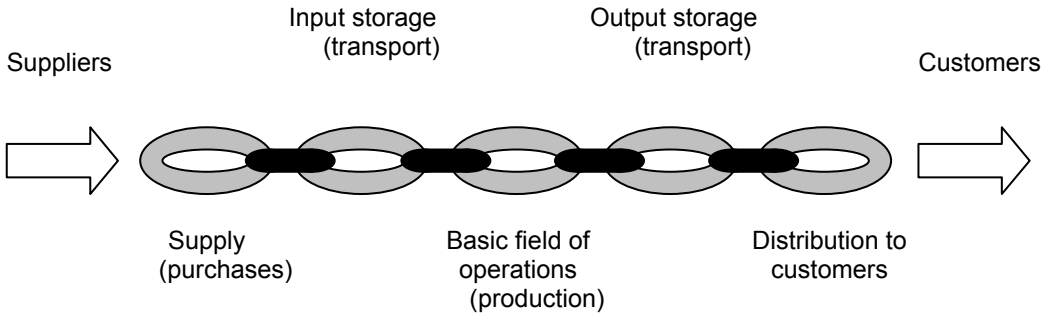
Key words: information, logistic chain, logistic network, logistic strategy, confrontative approach, co-operative behaviour, bullwhip effect, information exchange.

INTRODUCTION

The continuous increase in the market requirements which must be met by enterprises has resulted in the creation and development of supply networks. They have been developed as the continuation of supply chains. Supply chain - is a "(…) a net of relations and interrelated organizations which operating on the basis of mutual co-operation, jointly control, manage and improve the flow of goods and information from suppliers to final recipients." [Fechner I., 2007].

They have been created as a result of the progressive process of liquidation of barriers existing between entrepreneurs.

Citation: Matulewski M., 2007, The role of information exchange in logistic network strategies. LogForum 3, 4, 2
URL: http://www.logforum.net/vol3/issue4/no2
Accepted: 10.11.2007, on-line: 20.12.2007.



Source: Coyle J.J., Bardi E.J., Langley Jr. C.J., Zarządzanie logistyczne.

Fig. 1. A logistic supply network structure
Rys. 1. Struktura logistycznego łańcucha dostaw

The progressive development of world economy and the widespread globalization tendencies result in the fact that many companies operating in the market participate in more than one supply chain. Such chains constitute the elements of mutually bound chains. However, those chains analyzed separately still constitute independent undertakings. It means that the following processes: planning, organizing, processing and supervising of the flow of goods take place independently.

Supply networks are created by joining independent supply chains through which products and services travel from the place of supplying in raw materials and components needed for production up to the place of their consumption. [Świerczek A., 2007].

In such a case the mutually dependent chain links of different supply chains which create a supply network, on the one hand possess common information and on the other hand, co-participate in making common decisions. All applied solutions are to improve the flow of materials and information as well as to optimize activities designed to gain competitive advantage.

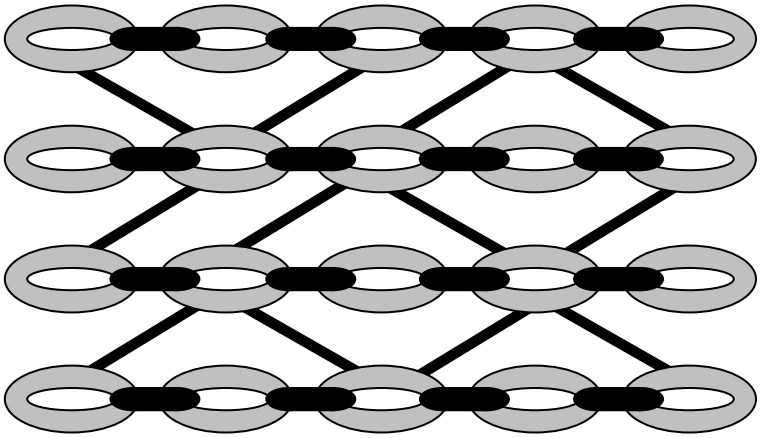


Fig. 2. Logistic supply networks
Rys 2. Logistyczne łańcuchy dostaw

Of course the existence of supply networks (which are very complex and not easy to present due to the number of links) poses many organizational and technological challenges. In order to take the maximum advantage of the opportunities given by logistic supply networks, it is necessary to create an effectively operating system encompassing all factors affecting the flow of goods, money and information within the network.

Information constitutes a basis for the operation of a contemporary enterprise. In logistics, in the broader sense one may distinguish two types of information flows that is to say: information flow aiding coordination activities and information flow aiding operational activities. The information flow aiding coordination activities is vital among others in the creation of demand schedules and planning the demand. On the other hand, the information flow aiding operational activities is essential in issuing and monitoring bills, invoices, allocation of stocks and dispatching consignments. Information is a specific type of resource which enables to increase the level of knowledge on a given enterprise and its closer or further environment [Kisielnicki J., Sroka H., 2005]. As far as the supply networks are concerned, it is the most important element affecting its functioning. One should realize that information may be encountered in every aspect of supply network operation (starting from offers, orders or other commercial documents, and ending with financial settlements, complaints or returns). At the same time, it is the information which enables to meet the needs and expectations of consumers. Of course, information must have certain features or parameters which are called information quality. Information quality includes information accessibility, information accuracy and the efficiency of information transmission.

SUPPLY NETWORKS

One should realize that in the face of the widespread market trend of the continuously increasing requirements of consumers and ubiquitous globalization, even the biggest enterprise is unable to compete with powerful supply networks. It results among others from the fact that the network (understood as an organization) generates additional profits in comparison with an enterprise operating on its own. The relations occurring in the supply networks (such as mutual co-operation, and widespread information exchange, continuous elasticity increase, development of co-operation relations, precise definition of the role, tasks and scope of responsibilities, fair distribution of risks, costs and profits which motivate and generate new initiatives) constitute the source of the advantage. The reasons of such state-of-fact are connected among others with such processes as: the change of consumers' behaviour, the increase in spending power, internationalization and globalization of economy, consolidation processes and technological development.

Changes in consumers' behaviour are connected with very numerous factors affecting the widespread social life model. Among those factors there are such elements as the changes in the style of life and consumer patters. Right now, we can observe a widespread trend of the growing importance of the quality of life, healthy life style, value of time and shopping consciously. All those factors result in the fact that the commercial companies change their approach to customers and they adapt their offers more to the needs and requirements of individual customers.

The increase in the consumers' spending power is the next factor affecting the observed changes. The power of consumers is growing together with their spending power. They become the 'pressure group' which is becoming more and more influential in the relations in the logistic supply networks.

Internationalization and globalization of economy is a more and more widespread phenomenon observed in the economies of selected countries or even continents (e.g. Europe, Asia etc.) The following trends create especially favourable conditions for this phenomenon: the widespread saturation of local markets, opening borders, the existence of customers having similar features in many parts of the world, the need to decrease the risk connected with business operation, making high profits or the trend of broadening ready markets. As a result of such processes the expectations of final customers are changing as well. The production capacity of manufacturers is also changing. Manufacturers may choose optimal location of raw materials and component parts necessary for the production process. The same applies to the location of factories, logistic centres or even whole sales networks, after-sale maintenance service points, etc. The biggest American sales network, Wal-Mart may serve as an example here. Its turnover in 2005 amounted to over $ 288 billion (the profit exceeding $10 billion). At the same time its share in the world market amounted to over 2%!

Consolidation processes are the direct consequence of the increasing competition fights which are commonly observed phenomena in the contemporary markets. Those processes are especially visible in Europe. "In 2001 30 biggest European retailers had a market share of 68.5%, in comparison with the share of 51.5% in 1992. This increase is a result of a ruthless fight with small retailers who either did not manage to compete successfully or were taken over. It is estimated that within a few next years 30 retailers may have a share of 90% in the European market." [Rutkowski K.(red.) 2005].

Technological development affects the supply networks in a very visible way. The popularization of such technologies as the Internet (new solutions include e-mails, WWW (World Wide Web), discussion groups and lists (Usenet), FTP (File Transfer Protocol) or IRC (Internet Reley Chat)), EDI (Electronic Data Interchange), GPS (Global Positioning System), GSM (Global System for Mobile Communications) or RFID (Radio Frequency Identification) has changed the world. It results from the fact that the distance is no longer vitally important. We have become the inhabitants of a global village in which apart from traditional solutions there are new solutions enabling to take advantage of new technologies which are used on a mass scale. One of such solutions is the so-called e-commerce. (One should realize that e-commerce is not limited solely to the usage of the Internet. There are also other types of solutions such as t-commerce (cable and satellite television) or m-commerce (telephone commerce).

The characteristic feature of the supply systems in the 70-ies was the producers' domination, whereas in the 80s it was the consolidation of the retail market as a result of which the new force a so called 'consolidated retailer' appeared. Such a retailer became an equivalent partner for producers. In the 90s retailers gained an additional advantage over other market exchange participants. Retailers became a domineering force in the existing chains and emerging supply networks. The existence of the advantage of that sort in relations generates different conflicts between producers and retailers as well as leaders and other market participants of supply networks. In extreme situations such a situation may lead to the network destabilisation and operational commotion and disturbance connected with it.

Table 1. Main areas of potential conflicts between industry and commerce
Tabela 1. Główne obszary potencjalnych konfliktów między przemysłem a handlem

Areas of aims	**Producer's aims**	**Commerce aims**
Product and price policy	– Creation of the trade mark image – A wide array of product innovations – Forcing producers' trade mark – Policy of high prices – Elimination of too-high margins	– Creation of the point-of-sale image – The best possible permanent offer of products – Forcing brand name – Policy of low prices – Forcing additional discounts
Distribution policy	– Large orders – Advantageous localization of own products on the shelf – The best possible array of additional services – Expecting the commerce readiness to accept deliveries	– Fast deliveries of small consignments – Optimal localization of product range – Avoiding rendering additional services – Low volume of stocks
Communication Policy	– Product advertisement – Taking care of preferential treatment of the product make – Privileged product make localization – Promotion steered by the producer – Increasing the loyalty towards the product make	– Shop advertisement – Taking care of preferential treatment of the shop – Localization of the product make according to the product range – Promotion steered by the commerce – Increasing the loyalty towards the shop

Source: Heldt A. 1998, Peter Lang 2005.

There are two basic types of relations as far as the interrelations between network links are concerned:

- Confrontative approach to the participant, and
- Co-operative behaviour.

The direct consequences of such relations are strategies (strategy is a method of operation via which the organization intends to achieve a specified goal) adopted by particular entities. In the case of confrontative relations there is a widespread trend of confrontative behaviours. The fixed role-model is present then. The purchaser (or contractor) designs the final product and the methods of its manufacturing. The producer processes the order. The information exchange is limited to the absolute minimum (the producer gives the contractor only one information - the price) Co-operation relations differ significantly from the confrontative ones. There are three basic forms of co-operative relations that is to say:

- Marketing approach,
- Operational co-operation,
- Conceptual partnership

Marketing approach enables to make purchases effectively and profitably and to influence the behaviour of suppliers. When adopting that approach the receiver may aim at joining operational management procedures with the supplier's system.

Operational co-operation is based on the full information exchange between the supply network links the aim of which is to share the responsibility for the occurring risks.

Conceptual partnership is a solution which requires two conditions to be fulfilled: a large portfolio of orders and a low level of competition between suppliers. Such a strategy is based on consultations between sub-contractors referring to particular components of a given product. Of course, the success of the adopted strategy depends on many factors. However, the closer bonds between business partners the highest probability that both parties will strive at achieving the following aims:

- Shorter delivery time,
- Delivery reliability,
- Less schedule disturbances,
- Lower level of stocks,
- Faster changes (including new models),
- Less problems with quality,
- Fixed competitive prices. [Christopher M., 1998]

The role of information is always fundamental no matter the type of relations. Information exchange limitations lead to slowing down or disturbing or even stopping the product flow. Moreover, it may be noticed that the final product price may be lower only if the information is more accessible (it is among others connected with the information flow speed in the information system of the whole supply network). Efficient information flow (that is to say proper quantity, quality, time and price of necessary raw materials, components, and products meeting all requirements) between particular links is a guarantee of the effective operation of the network. As a consequence the supply network becomes more competitive.

There are, however, also problems connected with information flow and transmission. Such problems occur when a company is supposed to reveal and pass the information which is considered the competitive advantage. In such a situation the company is not willing to make the information available for other participants of the logistic supply network. Such a situation is unfavourable and often leads to the increase in the level of stocks. It happens so due to the increase in the level of insecurity as to the availability of stocks or the operational capacity of the particular network elements

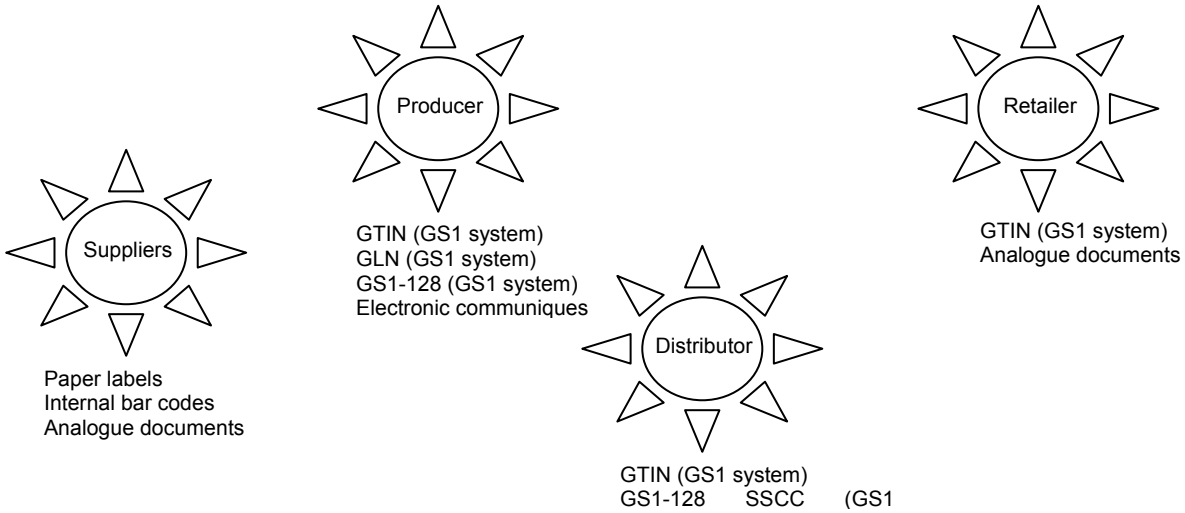
(including enterprises). Consequently, the process of replacing physical stocks with information is hampered or ineffective.

Outsourcing is also a tool enabling to gain additional profits provided that there is an effective information exchange system between the company and the hired contractor. It is used for performing all non-key processes outside the enterprise. Such a situation is possible only when the information system operates effectively.

Another important element which must be taken into consideration is the demand and its forecasting. The process of forecasting itself may be done in various ways (e.g. quality forecasting techniques, time ranking models, simulation techniques or combined forecasting), however, information is crucial in every one of them. Moreover, due to the general trend of the increase in the probability of error occurrence the longer the forecast time, the fastest the information system created to deliver the information on the demand. Such a solution will significantly decrease the number of errors made in forecasts.

The changeability and uncertainty of demand is a very important logistic problem. It is especially visible in the so-called Bullwhip Effect (or Whiplash Effect). Entities try to protect themselves against the demand uncertainty and changes by using forecasting. However, there is also the risk of an error. Of course it is possible to minimize possible discrepancies between the forecast and real demand e.g. by speeding up the information flow. Unfortunately, it is not possible to eliminate those discrepancies. There are also other methods of decreasing the gap between the forecast and reality e.g. by keeping the stocks, having economic capacity exceeding the average production, or flexible change of production period. However, all of them are dependent on the information system operation. The higher the efficiency of the information system, the lower the probability of the discrepancy between the forecast and reality, and as a consequence the lower costs incurred by the enterprise and the more competitive the enterprise is.

Relatively small changes in the demand of the final consumers increase together with the increase in the information flow. It is a direct consequence of the fact of not transmitting the primal information but the modified data in the form of subsequent orders.



where:
GTIN – global identificator,
GLN – global identificator,
GS1 (*Global System One*) – the world identification and communication system for products, services, and localization based on the standards accepted in international trade,
GS1-128 – bar code.

Source: own draft on the basis of Fechner I. 2007

Draft. 1. Information carriers in different links of supply networks
Schemat 1. Nośniki informacji w różnych punktach łańcucha dostaw

The dissemination of IT and new forms of e-business results in the changes in the supply networks. This situation is especially visible in data exchange processes. Initially the information was exchange on paper and via phone. Later, the EDI and Internet-based solutions have become ubiquitous. Right now it is hard to imagine a contemporary modern enterprise not using the network communication technologies in the face of market requirements.

The fulfilment of requirements imposed by consumers (such as faster, better, cheaper) requires economical time management. It is possible only in the case of effective implementation of tools improving the functioning of the supply network. They include the following solutions:

- Computer systems for gathering and exchange of data e.g. Automatic Data Interchange ADC and EDI,
- Systems of tracing supplies - e.g. objects (among others supply materials, final goods), specialized equipment (code printers, bar code readers, portable terminals, etc.), software, or systems such as GPS or DGPS, (Differential Global Positioning System - is an enhancement to Global Positioning System that uses a special correction database to correct automatically the pseudo-ranges broadcast by satellite)
- E-logistics - using new IT in logistics.

All above-mentioned tools which facilitate supply network functioning operate on the basis of the effective data exchange system which should include the information which features the following criteria:

- information usefulness, that is to say adapting it to the users' needs,
- information relevance, that is to say adapting it to the time of usage,
- information reliability, that is to say the guaranteed information correctness,
- type of information properties, that is to say right of access to the information,
- type of information protection, that is to say methods of limiting the access to and modification of the information by the wrong hands.

CONCLUSIONS

In conclusion, it should be stressed that the supply network efficiency depends on its weakest link. Thus, the information which is an element of the links must be accessible, precise and effectively transmitted. Additionally, the information exchange in logistics supply networks and its flow pose a problem and are a challenge. Furthermore, information exchange systems must ensure that the defined logistic goals are realized. It means that the information must reach proper customer, inform him about a proper product. Consequently, manufacturers must know the features of desired products as proper products must be delivered in proper quantity and of proper quality, in proper place and at a proper time, and at acceptable costs. Those goals can be achieved when the information is up-to-date, complete and reliable (trustworthy). Whether the information is up-to-date or not depends on the method of its gathering, transmission channels, reliability of the network and intensity of the information flow. Information completeness depends on the method of measuring certain object features, accuracy of measurement and existing disturbances. The reliability of information on the other hand depends on the properties of the input and output signals, codes and used equipment.

It should be remembered that in competitive relations the quantity and quality of information differ in comparison with the co-operative relations. The more co-operative approach the more information and the better quality of the data.

REFERENCES

Christopher M., 1998, Logistyka i zarządzanie łańcuchem podaży, Kraków, Wydawnictwo Profesjonalnej Szkoły Biznesu.

Coyle J.J., Bardi E.J., Langley Jr. C.J., 2002, Zarządzanie logistyczne, Warszawa, PWE.

Fechner I., 2007, Zarządzanie łańcuchem dostaw, Poznań, Wyższa Szkoła Logistyki.

Kisielnicki J., Sroka H., 2005, Systemy informacyjne biznesu, Warszawa, Placet.

Rutkowski K. (ed.), 2005, Logistyka dystrybucji, Warszawa, Szkoła Główna Handlowa w Warszawie - Oficyna Wydawnicza.

Świerczek A., 2007, Od łańcuchów dostaw do sieci dostaw, in: Logistyka 1/2007, p. 74-77.

WYMIANA INFORMACJI W STRATEGIACH SIECI LOGISTYCZNYCH

STRESZCZENIE. Autor omawia rolę informacji i wymiany informacji w strategiach logistycznych sieci dostaw. W artykule zostały omówione różnice pomiędzy logistycznymi łańcuchami i sieciami dostaw. Następnie wyróżniono dwa typy przepływów informacji tzn. wspomagający działania koordynacyjne i wspomagający działania operacyjne. Opisano relacje występujące w sieciach dostaw i stanowiące źródło przewagi nad konkurencją. Autor omawia następujące czynniki wpływające na proces wymiany informacji w sieciach dostaw: zmiany w zachowaniu konsumentów, wzrost siły nabywczej konsumentów, internacjonalizację i globalizację gospodarki, procesy konsolidacyjne i rozwój technologiczny. Następnie przedstawia obszary potencjalnych konfliktów mogących wpływać na sposób wymiany informacji wybierany na potrzeby przemysłu i handlu. W artykule zostały także przedstawione dwa zasadnicze typy relacji tj. konfrontacyjne podejście do drugiego uczestnika i zachowania kooperacyjne. Zmienność i niepewności popytu jest również istotnym problemem logistycznym, który jest szczególnie widoczny w tzw. "efekcie byczego bicza." Wiele przedsiębiorstw wykorzystuje prognozowanie, by chronić się przed zmiennością i niepewnością popytu. Na koniec, autor prezentuje wpływ nowych technologii na wymianę informacji.

Słowa kluczowe: informacja, łańcuch logistyczny, sieć logistyczna, strategia logistyczna, podejście konfrontacyjne, zachowanie kooperacyjne, efekt bullwhip, wymiana informacji.

DIE BEDEUTUNG DES AUSTAUSCHES VON INFORMATIONEN IN LOGISTISCHEN NETZWERKSTRATEGIEN

ZUSAMMENFASSUNG. Der Autor diskutiert die Bedeutung von Informationen und deren Austausch auf Strategien für logistische Versorgungsnetzwerke. Zunächst wird der Unterschied zwischen logistischen Versorgungsketten und logistischen Versorgungsnetzwerken beleuchtet. Danach werden zwei verschiedene Typen des Informationsflusses beschrieben: Der Informationsfluss als Unterstützung von Koordinierungs- und Planungsmaßnahmen sowie der Informationsfluss als Unterstützung für operative Tätigkeiten. Die Beziehungen innerhalb von Netzwerken und deren Vorteile werden ebenfalls behandelt. Folgende Faktoren für den Informationsaustausch in logistischen Versorgungsnetzwerken werden vom Autor beschrieben: Änderung des Verbraucherverhaltens, Steigerung der Kaufkraft des Verbrauchers, Internationalisierung und Globalisierung der Wirtschaft, Konsolidierungsprozesse und technologische Entwicklungen. Danach werden die potentiellen Hauptkonfliktpunkte beim Informationsaustausch zwischen Industrie und Handel aufgeführt. Im Anschluss werden zwei Arten von Beziehungen beschrieben: Konfrontative Beziehungen und kooperative Beziehungen.

Die Schwankungen und Unsicherheiten in der Nachfrage sind ebenfalls ein wichtiges logistisches Problem, dessen Auswirkungen zum Beispiel in Form des Peitschen-Effekts beobachtet werden können. Viele Unternehmen führen daher Prognosen durch, um sich vor Nachfrageschwankungen und Unsicherheiten im Verbraucherverhalten zu schützen. Zum Schluss des Artikels werden die Auswirkungen von modernen Technologien auf den Informationsaustausch beschrieben.

Codewörter: Information, Lieferkette, Logisitiknetz, Logistikstrategie, konfrontativer Ansatz, kooperatives Verhalten, Peitscheneffekt, Informationsaustausch.

Marek Matulewski PhD
Poznań School of Logistics
Chair of the Logistics Bases
ul. Estkowskiego 6
61-755 Poznań, Poland
tel:+48 061 850 47 92
fax:+48 850 47 89
e-mail: Marek.Matulewski@edu.wsl.com.pl

LogForum

ISSN 1734-459X
2007
Vol. 3
Issue 4
No 3

> Elektroniczne czasopismo naukowe z dziedziny logistyki <

http://www.logforum.net

FACTORS DETERMINING THE MANAGEMENT OF THE TRAFFIC CONGESTION IN THE URBAN AREA

Zbyszko Pawlak

Poznan School of Logistics, The Poznan University of Economics, Poznan, Poland

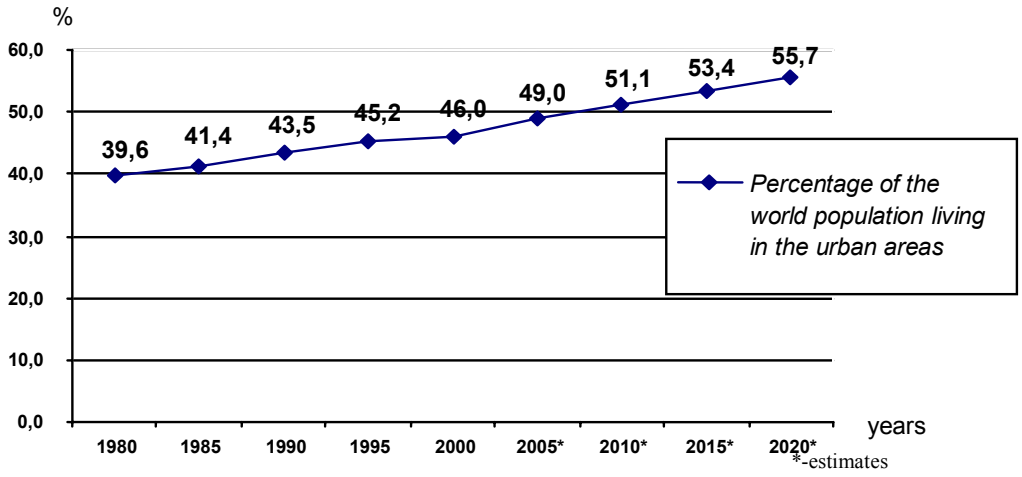
ABSTRACT. The aim of the article is to investigate factors that can affect management of the traffic congestion in the urban area. The predictions according to the theoretical background presented are that such factors as: migrations (commuting), location within a functional zone, road constructions, presence of public institutions and facilities, traffic network arrangement, suburbanisation, significance of the route, road type, presence and the nature of junctions, grade crossings, bridges or public transport presence can to a different extent influence the traffic congestion pattern. The level of this influence in the urban area of Poznan (Poland) is stated using the self-created indicator - Synthetic Congestion Ratio (SCR). Moreover, it was predicted that the traffic volume is higher on week days than during weekends. In order check the truthfulness of the hypotheses the research was conducted by establishing some checkpoints near crossings where investigated factors are present and later by measuring the traffic volume in the urban area researched. The conclusions are that the most influential factors determining the management of the traffic congestion in the urban area are: level of road's significance as a communication route, central business district (CBD) approach or thoroughfare and road type (expressway, two-lane, multi-level junctions), whereas the other factors' influence is significantly smaller (streets' layout, facilities attracting people, location within a functional zone). Furthermore, it was observed in one of the checkpoints that there was a discrepancy between the predicted and the actual traffic volume. This was probably a result of yet another, not known (not taken into consideration) factor e.g. car accident.

Key words: management, urban area, traffic congestion, synthetic congestion ratio.

INTRODUCTION

The problem of traffic congestion management concerns every bigger urban area in the world (although sometimes the issue is influenced on by the level of the economic development) and due to the fact that more and more people live in urban areas than in the rural, this trend is expected to continue in the future. By the term traffic congestion the following phenomenon is meant - the accumulation of vehicles leading to overloading of the traffic network and problems from it resulting [Szymczak 2002]. An urban area is an area with an increased density of human-created structures in comparison to the areas surrounding it [Pawlak 2006]. As it can be observed in the diagram (Fig.1) it is predicted that by the year 2020 more than 50% of the world population will have been living in the urban areas. Such an increase will surely lead to the increase of the usage of cars which may lead to the growth in the traffic congestion. This means that the problem will be acquiring importance.

Citation: Pawlak Zb., 2007. Factors determining the management of the traffic congestion in the urban area. LogForum 3, 4, 3
URL: http://www.logforum.net/vol3/issue4/no3
Accepted: 30.11.2007, on-line: 20.12.2007.



Source: "UN The World Urbanization Prospects: The 2005 Revision" Annex Tables.

Fig. 1. Percentage of the world population residing in urban areas
Rys. 1. Odsetek ludności świata zamieszkujący obszary zurbanizowane

The management of the traffic congestion is very closely connected to the process of urbanisation and this trend is true for both economically more and less developed countries. The most important role of the traffic transportation network is linking people, resources, activities and enabling the exchange of goods (trade) and ideas (information). However, different types of transports are appropriate in different situations and the road transport will be the most appropriate in the urban areas, because of [Waugh 2000]:

- The low cost of transportation over short distances
- The independence (the possibility of transporting regardless of time or to some extent weather conditions, which will be unable for other types e.g. air or sea transport)
- The flexibility of transportation (the possibility of changing the destination point without very high costs)
- The densely developed road network in the city, which enables to carry the goods in a "door-to-door" way.

However, the development of a given area is always entwined with the increase in the trade exchange, mostly in the urban areas where the majority of investment capital is concentrated. Hence the development of the road transport will be surely following the economic development of a city. Nevertheless the result of rapid development of the road transport may not be followed (due to either lack of funds or lack of possibilities) by the modernisation of the transportation network. This discrepancy is followed by the traffic intensity disturbances within the city. Therefore any changes in the traffic pattern (rapid increase in the number of cars in a given area) may result in traffic problems (jams, gridlocks). The factors that may affect the traffic intensity:

- Migrations, especially Commuters, but also rapid inflow of people due to some events with the national or international significance (e.g. fair exhibitions, football matches, cultural events, historical anniversaries)
- The location within a given city functional zone
- Road constructions
- Presence of institutions or trade facilities attracting people (e.g. tourist attractions, shopping centres)

- Buildings and the arrangement of the transport network originating from the pre-automobile times (e.g. narrow streets, narrowings)
- The process of suburbanization
- The significance of a road as a city, national and international communication route
- The nature of the road
- The presence and nature of junctions (e.g. two-level junctions)
- The presence of grade crossings or bridges
- The presence of public transport facilities (e.g. tram tracks)

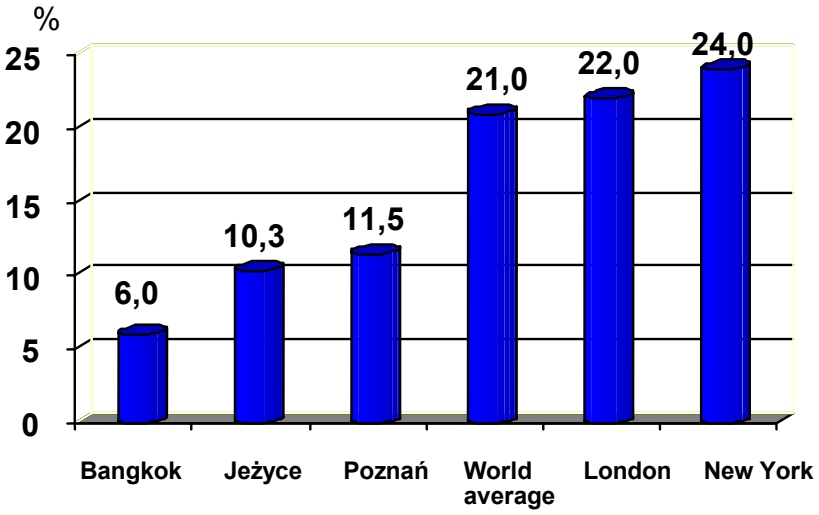
RESEARCH AREA AND HYPOTHESES

The investigation of the traffic congestion was carried out in the Jeżyce Urban Area (JUA) of Poznań - the city located in the western part of Poland. The city and the investigated area were chosen due to their accessibility and the personal experience of the author of this article.

In the year 2005 the population of Poznań was 574125 people on the area of 26130 ha determining the density of 2197 people per square kilometre, whereas the JUA with its population 81300 on the area of 5790 ha was characterised by the density of 1404 people per square kilometre. Moreover it should be clearly stated that Poznań, being the fifth biggest city in Poland, has many very important functions like:

- Educational and Scientific - 22 tertiary-level schools with more than 120 thousands students studying
- Cultural and Historical - a fair number of monuments, museums, theatres and cinemas (including 2 cinema complexes)
- Trade - Poznań International Fair with 42 exhibitions annually visited yearly by hundreds thousands of people from 142 sectors of economy
- Service - health services including hospitals, financial services, wholesale and retail services (shopping centres, shopping arcades)
- Transportation - international airport, important railway hub and the location on the international communication route E-30
- Industrial - factories from different branches of construction and industry
- Agricultural - Poznań Food and Agricultural Exchange
- Administrative - capital city of the Wielkopolska (Western Poland Province)

The number of cars registered in the city was 289700 (211000 passenger and 64800 lorries), whereas there were 367 passenger cars per 1000 people (2005). At the same time the overall length of roads within the city agglomeration was 1120 km (the density of the roads per 100 km^2 was 330 km). Last but not least the streets' surface (596.9 ha) makes 11.5% of city's surface, whilst in the JUA the same index is even smaller - 10.3%. However, both of these indices are relatively low comparing to the other cities and world average index (Fig.2.).



Source: Own elaborations based on city hall statistics.

Fig. 2. Percentage of the cities' surfaces used for streets.
Rys. 2. Odsetki powierzchni miejskiej zajętej przez ulice.

This situation is a result of both lack of investments in development of the traffic network and spatial problems resulting from the domination of pre-automobile times city's layout. The investigated JUA traffic network is largely based on the streets' layout created in the past. However, two stages of the greatest changes can be distinguished:

- The beginning of the twentieth century, when first tenement houses were built (the layout originating from this stage can be better observed in the eastern parts of the area adhering to the central business district). This network is called pre-automobile and hence it is characterized by very narrow streets. At the same time the network is dense.
- The 1970s, when due to the national programme of traffic network development (mostly expressways and motorways) the western part of the traffic network was converted into motorways and the transit street was converted into the thoroughfare in order to be able to receive the increased traffic volume on the international E-30 route (Warszawa - Berlin).

Due to these differences in the traffic network, some the increased traffic congestion may occur. In order to check the state of the traffic network, several indices will be used. First of all the number of cars registered in the city will be compared to the city's traffic network's surface. The length of the network is not going to be used, since the 3-lane expressway will be able to receive bigger traffic volume than extremely narrow, one-way street. Instead the traffic network's surface will be used, since this value includes as well network's length as the streets width. Hence for Poznań the car/surface ratio will be 48,5 (2005). Comparing to the other cities, the index is low (Fig.3.), therefore the traffic intensity disturbances will not result in traffic jams, or at least not in kilometers long jams characteristic for the compared megacities.

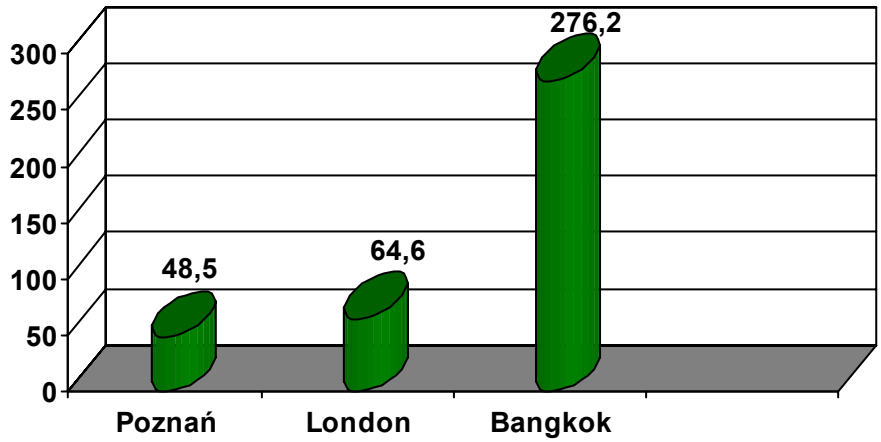
It can be seen particularly well in case of comparing the index of Poznań to the one of Bangkok, where the index is over 5 times higher. It means that there are 5 times more cars on the same traffic network's surface, resulting in 5 times bigger congestion. So according to the car/surface index the congestion in Poznań is quite high, nonetheless it will not cause many traffic jams. However, the index posses some limitations such as:

a) it does not take into the account the number of cars not registered within the city borders. This means that it does not include any cars coming from outside the cities whose impact on the city

congestion may be severe, especially in case of megacities [London 2004], which can be surrounded by smaller cities, for instance Reading or Luton around London,

b) it does not take into consideration the quality and nature of the roads, which means that all streets are treated equally, e.g. expressways in the same way as wide city streets. This can be misleading due to the fact that for instance city motorways, rings help significantly in reducing the traffic congestion, especially when the thoroughfare traffic is considered (e.g. London's M25),

c) it does not say anything about traffic congestion prevention strategies that often help to reduce the traffic problems (e.g. The London Congestion Charges, one-way streets, parking-meters). Nonetheless, it can be used to estimate that theoretically the traffic disturbances in Poznań and



JUA may result in traffic problems, especially in case the road is narrow and simultaneously plays an important role in the traffic pattern, receiving the significant traffic volume.

Source: Own elaborations based on the statistics.

Fig. 3. Percentage Poznań Car/Surface Index (2005) compared to the other cities in the world in [cars/ha]
Rys. 3. Wskaźnik liczby samochodów przypadających na powierzchnię miasta dla Poznania (2005) w porównaniu z innymi miastami świata [samochody/ha]

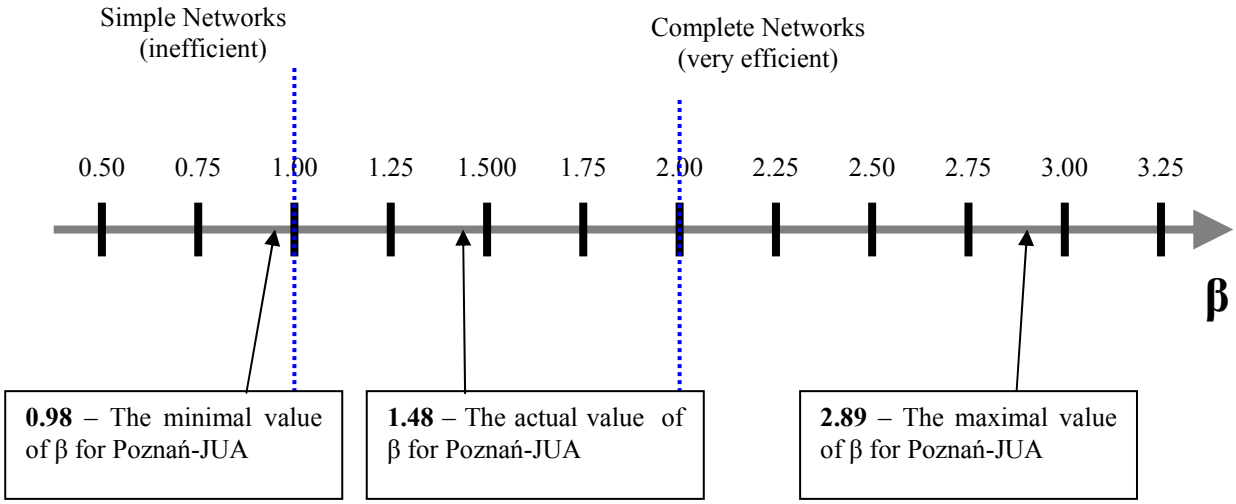
Another index that can be used to describe the research area traffic network is the beta index (β), which is one of the simplest methods to describe the connectivity of the given network [Waugh 2000]. In order to calculate the index, it is essential to calculate the number of vertices (in this case - junctions) and edges (roads' sections between the junctions) of the network. These numbers are: 54 vertices (v) and 80 edges (e) .

Therefore the beta index for the JUA traffic network will be:

$$\beta = ev^{-1} \qquad [\beta = 1.48]$$

However, number 1.48 in order to be more meaningful needs to be compared with the minimum and maximum values that in this case beta index can adopt. The minimum value of the beta index in case of the investigated network is 0.98, whereas the maximum value is 2.89. The situation is presented on the axis (Fig.4.). As it is presented, the lowest value of beta index for Jeżyce Urban Area (0.98) is qualified to the group of the simplest networks ($\beta < 1$), being very inefficient i.e. the connectivity is very poor. The highest value of the index (2.89) qualifies to the group of the most efficient networks ($\beta > 2$), where the connectivity is the best. The actual value of the index (1.48) means that the JUA traffic network is mediocre being neither simple nor complete. Therefore in case

of traffic network problems (road construction, an event resulting in closing a part of the network e.g. grade crossing closing) the flows may not find the alternative route which may result in traffic jams. Furthermore parts of the network linking the areas of the biggest significance i.e. international routes, thoroughfares, central business district (CBD) approaches - may not be able to receive the increased traffic volume and due to this fact severe traffic problems may occur [Vickrey 1969], including "triggernecks" and even "gridlocks".



Source: Own elaboration

Fig. 4. The value of β-index for Poznań - Jeżyce Urban Area (JUA)
Rys. 4. Wartości wskaźnika β dla obszaru zurbanizowanego Poznań - Jeżyce (JUA)

Therefore in case of JUA, the most vulnerable network sections will be thoroughfares and approaches to the CBD. The other factor that can have an influence on the traffic congestion is the functional zones' layout within the JUA. It can be noticed that the functional zones within the research area are rather stretched towards the CBD creating "functional wedges" and therefore showing some similarities to the Hoyt's sector model of urban structure [Waugh 2000].

What is more, similarly to what the model of the bid-rent theory suggests, alongside the main communication routes, there will be the most profitable functional zone able to afford the highest cost of rent i.e. the business zone. It can be clearly noticed if comparing the approaches to the CBD with the functional zones within the JUA - the business areas exist only alongside the approaches. This is because of the necessity of being accessible, hence it can be linked as well that many people will be willing to concentrate in the business areas, especially during the rush hours. However, it as also anticipated that the movement of cars will be taking place mostly between the residential and business areas, whereas the industrial areas and the green areas will be less frequently the aim of the people's travel. This is because the present industry within the JUA does not employ so many people as it used to be - some factories are even being closed or restructured. Hence the main migration movements within the city are predicted to be between the residential and business urban areas and within them alike. In order to verify whether the above factors influence the traffic congestion, several checkpoints were established to investigate the traffic congestion intensity and the influence of particular factors on this congestion. However, every factor has its own influence on the traffic congestion intensity and the risk of occurrence of traffic problems (reducing or enhancing) and the extent to which it affects the intensity (the influence can be for instance negligible or very significant). Therefore it has to be stated how the particular features will affect the congestion. The hypothetical influences of particular factors investigated in research urban area are stated in the table below (Tab.1).

Therefore in order to state hypothetically, whether at the given checkpoint the traffic congestion intensity will be high or low, a Synthetic Congestion Ratio (SCR) will be introduced. This ratio will indicate if the given checkpoint is vulnerable to the high congestion intensity and problems resulting from it (jams) according to the hypothetical factors' influence.

Table 1. The hypothetical factors influencing the traffic congestion in Poznań-Jeżyce Urban Area
Tabela 1. Hipotetyczne czynniki wpływające na kongestię ruchu ulicznego w obszarze zurbanizowanym Poznań-Jeżyce

Factors Reducing Congestion (FRC) And the risk of traffic problems		Factors Enhancing Congestion (FEC) And the risk of traffic problems	
Factor	Influence	Factor	Influence
Three-lanes road (expressway)	- - -	Approach to the CBD (commuters' migration)	+ + +
		Former communication route	+ + +
Two-lane road	- -	Thoroughfare	+ + +
Two-level junction	- -	Pre-automobile streets, narrowing	+ +
		Facilities attracting people	+ +
		Traffic lights	+ +
		Business	+ +
		Residential zone	+ +
		Industrial zone	+
		Grade crossing	+
		Tram track/ Tram track junction	+
		Part of junction closed for traffic	+

Source: Own elaboration.

In order to find the ratio, the matrix showing the presence of particular factors at the given checkpoints must be created (Tab.2.). The SCR ratio is therefore the sum of the "influence points" at the given checkpoint and the higher the SCR is, the bigger the risk of high traffic congestion and problems resulting from it is. Therefore it can be noted that the highest risk is present at CP4 - 14, whereas the lowest one in the CP9 - 3. The other values are included between them, so it can be predicted that the highest traffic congestion and the most numerous jams will occur at CP4 and also at CP2, CP5, CP6, CP8 (the SCR value >10), whilst the lowest risk and traffic congestion alike will be at the CP9 and to some extent at CP1, CP3, CP7 (SCR<10).

One more hypothetical regularity that is predicted is that during the week days the average volume of traffic will be higher than it is during the weekends. Such a situation is predicted, because during the weekend fewer people will commute to the CBD to their jobs and more people are anticipated to either stay at home or to travel rarely (e.g. to the green zone and back home). Therefore the intensity is predicted to be lower. To verify this and the previous hypotheses, the research were conducted.

Table 2. Factors influencing traffic congestion vs. Chekpoints. Synthetic Congestion Ratio deriving matrix.
Tabela 2. Czynniki wpływające na kongestię ruchu ulicznego w punktach pomiarowych; macierz bazowa Syntetycznego Wskaźnika Kongestii

		Checkpoints								
		CP1	CP2	CP3	CP4	CP5	CP6	CP7	CP8	CP9
Factors	Approach to the CBD	+++	+++	+++	+++	+++	+++	+++	0	0
	Former com. route	+++	0	0	0	0	0	0	+++	0
	Thoroughfare	0*	0	0	+++	+++	0	0	+++	0
	Pre-automob. streets, narrow.	0	0	++	++	0	++	++	0	0
	Facilities attract. people	0	++	0	0	0	++	0	0	0
	Traffic lights	0	++	++	++	++	++	++	++	0
	Business zone	++	++	0	++	0	++	++	++	0
	Residential zone	++	++	++	++	++	0	0	++	++
	Industrial zone	+	+	0	+	+	0	0	+	0
	Grade crossing	+	0	0	0	0	0	0	0	+
	Tram track/ Tram track junction	0	0	0	+	+	+	+	0	0
	Partially closed	0	0	0	0	0	0	+	0	0
	3-lanes	---	0	0	0	0	0	0	0	0
	2-lanes	0	--	--	--	--	0	--	--	0
	2-level junction	--	0	--	0	0	0	0	0	0
SCR =Σ		**7**	**10**	**5**	**14**	**10**	**12**	**9**	**11**	**3**

Legend: * - "0" indicates that the given factor is not present at the given checkpoint;
+/- The value of influence by enhancing/reducing congestion

Source: Own elaboration.

ANALYSIS OF THE FACTORS DETERMINING THE MANAGEMENT OF THE TRAFFIC CONGESTION IN THE RESEARCH AREA

The research was conducted four times (twice on the week days and twice on the weekend days) at 12AM and 4PM. At every checkpoint (CP) the traffic volume in every direction was measured over 15 minute period, so that it is possible to investigate not only the volume of the traffic at the given checkpoint, but also the direction from which the biggest traffic volume reaches the junction Furthermore the occurrence of the traffic jams was noted as well. However, in order to make it more precise the values obtained during the two investigations were averaged and multiplied by 12 to obtain the number of cars crossing the checkpoint per one hour. Thus the following results can be presented in a table (Tab.3.). Nevertheless it is not yet clearly visible, whether the prediction according to the Synthetic Congestion Ratio is true or not.

Table 3. Traffic volume at the checkpoints on week and weekend days [cars/h] and the Synthetic Congestion Ration (SCR) for the given checkpoints.
Tabela 3. Wolumen ruchu ulicznego w punktach pomiarowych w dni robocze i świąteczne [samochody/godz] oraz wartość Syntetycznego Wskaźnika Kongestii (SCR) w tych punktach.

Checkpoint	Traffic volume [cars/hour]		SCR
	Week days	Weekend days	
CP1	3984	3120	7
CP2	3288	2688	10
CP3	3912	3792	7
CP4	5136	3600	14
CP5	4032	3000	10
CP6	2376	1536	12
CP7	2604	2016	9
CP8	3780	3060	11
CP9	408	312	3

Source: Own elaboration.

Therefore to make it clearer the results are presented with the use of a diagram (Fig.5.). This diagram clearly presents to what extent it was possible to anticipate the traffic congestion using the Synthetic Congestion Ratio. In several checkpoints the SCR value perfectly fits the collected data of the traffic volume. Such a situation can be observed in case of Checkpoints 2, 4, 5, 7, 8, 9. On the other hand, in cases of the other Checkpoints the ratio either fits the collected data to a very limited extent (CP1) or does not fit at all (CP3 and CP6). On the other hand, in cases of the other Checkpoints the ratio either fits the collected data to a very limited extent (CP1) or does not fit at all (CP3 and CP6). The discrepancy might have occurred because of:

- omitting some factors which could not be anticipated and therefore the SCR value may not be proper for the given CPs,
- too short research i.e. the volume of the traffic would fit the SCR value providing that the research had been conducted over a longer time,
- the occurrence of traffic problems (e.g. car accidents) that might have caused the jam leading to the sudden decrease in the traffic flows (the traffic volume decreased due to the people being unable to travel through the checkpoints which resulted in the lower traffic volume).

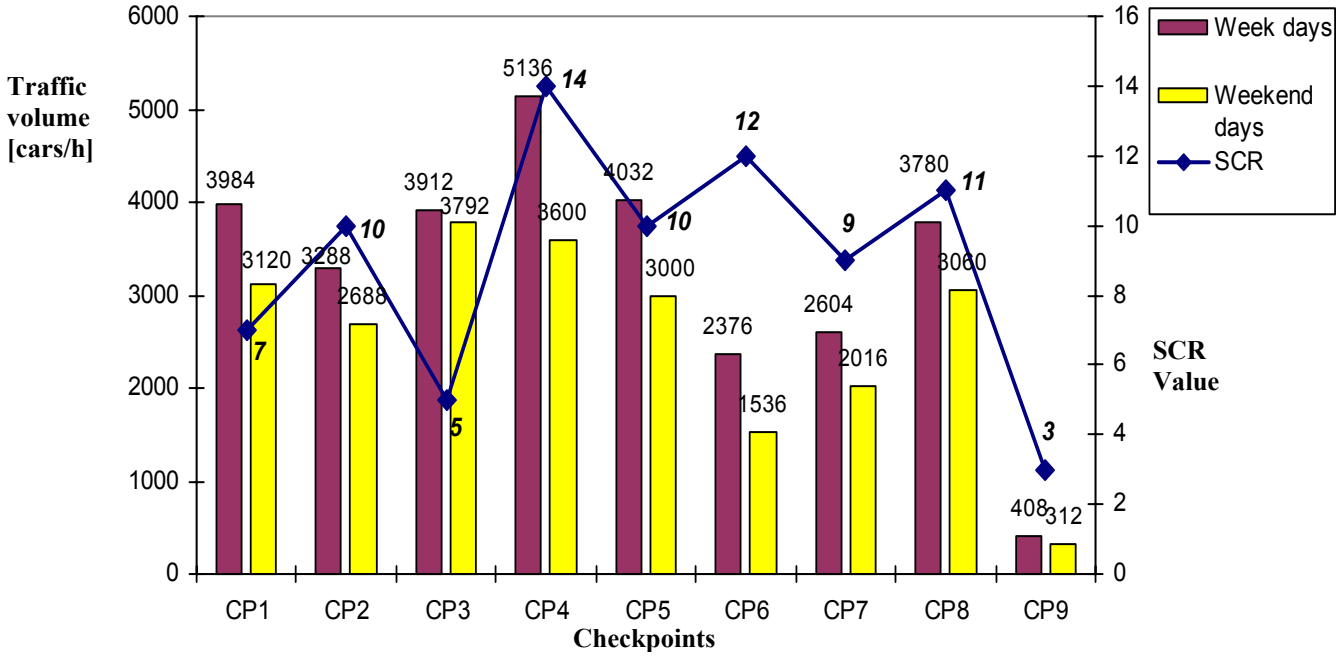
Because it is very hard to predict now what the factor might have been and to conduct once again the longer research, only the third possible cause of the discrepancy between the SCR and the traffic volume will be investigated further. In order to present clearly the traffic flows in the JUA, the flow line map can be used (Fig.6.). From the map several regularities can be observed:

a) The sections with the greatest traffic volumes are along either CBD approaches or thoroughfares. This may be a result of Commuters' movement from the outer residential areas and small towns located either West or North from research area which are not only the city's dormitories, but due to the lower cost of maintenance are very good locations for the branches of some Transnational Companies. As a result the movement between these branches and the city's residential areas will take place along the CBD approaches or thoroughfares.

b) The volume of the traffic is bigger in the outer sections than in the sections closer to the CBD. This may result from the fact that the sections outside the city are rather wide three- or two-lane roads constructed with respect to possible increase in traffic intensity, whereas the streets' layout closer to

CBD originates from the pre-automobile epoch and therefore is rather denser and the streets are narrow. Hence the whole traffic volume from one wide expressway must be divided among the greater number of narrow streets.

c) Traffic jams are rather present along the CBD approaches and thoroughfares, which may be the result of the increased traffic volume. What is more their most frequent occurrence can be noticed near the checkpoints, where the discrepancy between the traffic volume and the Synthetic Congestion Ratio was observed, so near CP3 and CP6. This may be a result of overloading the traffic network in these areas.

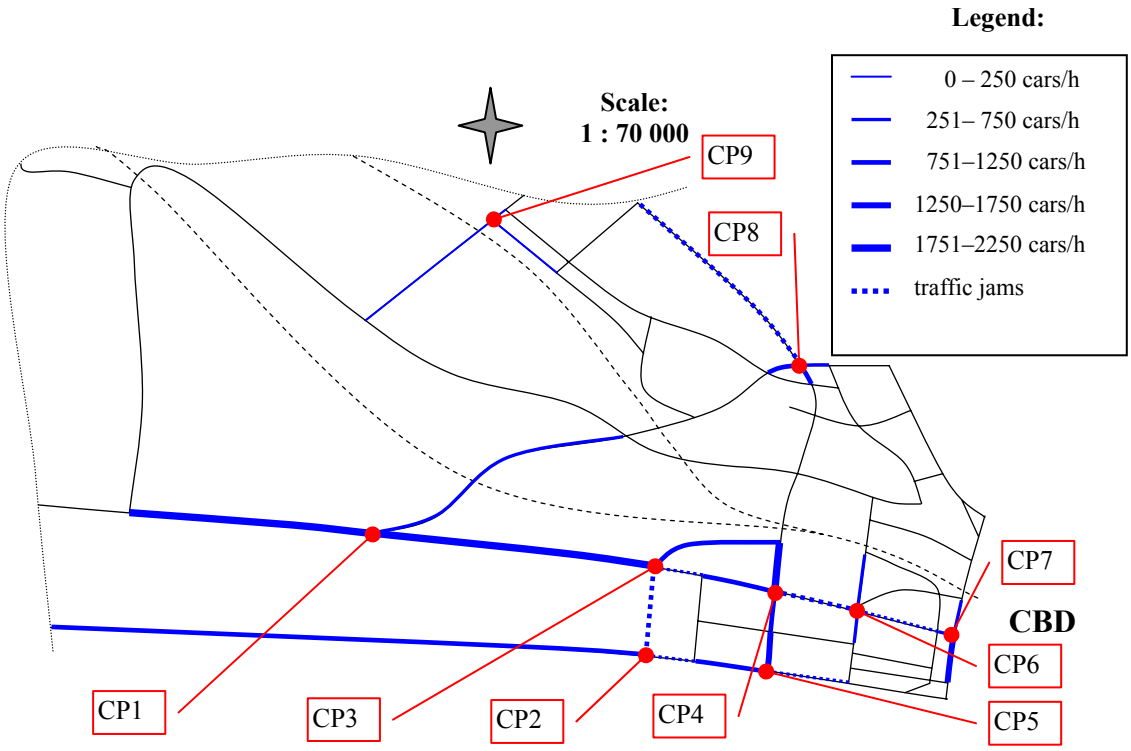


Source: Own elaboration based on own research.

Fig. 5. Traffic volume at the checkpoints on week and weekend days (cars/hour)and the Synthetic Congestion Ration values (SCR) for the given checkpoints
Rys. 5. Wolumen ruchu ulicznego w punktach pomiarowych w dni robocze i świąteczne [samochody/godz] oraz wartość Syntetycznego Wskaźnika Kongestii (SCR) w tych punktach

The regularity observed near Checkpoints CP3 and CP6 can therefore explain to some extent the discrepancy between the Synthetic Congestion Ratio predictions and the actual traffic volume as a result of traffic jams. These jams caused a sudden slowing down of the flows and therefore the rapid decrease in number of cars per one hour could have been observed. Nevertheless, it must be stated that other factors might have also caused that the predicted factors' influence (determined using SCR) does not fit the collected data. However, still the situation at Checkpoint 1 is not clear, because the difference between the predicted and the actual congestion level exists and no traffic problems were observed there. It therefore might be a result of a factor(s) that had not been anticipated e.g. car crash.

Last but not least regularity observed during the data collection was the difference between the traffic congestion intensity during week days and weekend days. According to the collected data the volume is generally lower, but the difference ranges from 3% (CP3) to even 30% (CP4). The general lower number of cars is probably a result of fact that majority of people either do not work on weekends or work less and therefore traveling with the car is limited rather to green areas or shopping centres located very often outside the city.



Source: Own elaboration

Fig. 6. Traffic flows within the Poznań-JUA on the week days during rush hours.
Rys. 6. Natężenie ruchu ulicznego w dni robocze w godzinach szczytu w obrębie Poznań-JUA

CONCLUSIONS

During the conducted research several factors' influence on the traffic congestion intensity was investigated using self-invented Synthetic Congestion Ratio. It appears that the anticipated impact and its strength of the investigated factors was to a large extent successful (the SCR in many cases fitting the collected data values), nevertheless in some cases the discrepancies between the predictions and the reality could have been observed as well. These discrepancies proved, however, that the occurrence of traffic problems i.e. jams (which were predicted to exist as well, for example using the beta index - β) may disturb the whole traffic flows' pattern and in such a case it is very hard to predict the influence of particular factors. However, it is also possible that the list of possible factors was incomplete and there are more influential factors (for example in case of CP1 where there is no hypothetical solution of the discrepancy) that can be still a subject of the research.

In the scale of the whole network the hypothesis was verified by conducting the research, that the most influential factors determining the management of the traffic congestion in the urban area are: road's significance as a communication route, central business district (CBD) approach or thoroughfare and road type (expressway, two-lane, multi-level junctions), whereas the other factors' influence is significantly smaller (streets' layout, facilities attracting people, location within a functional zone).

Still it may be true that providing the research were carried out over a longer period of time at more checkpoints (i.e. large scale research) the results might be different and therefore the unsolved problems resulting from this investigation could be solved. However, the issues like finding the further

factors influencing the intensity, traffic pattern changes or even traffic network modernization are problems for different investigation.

REFERENCES

Bulletin of Public Information of Poznań City Hall, 2006, http://www.city.poznan.pl

Dighby B., Bermingham S., Butt G., 2004, The Human Environment, Heinemann Education Publishers, Oxford.

London Travel Report 2004, by Group Transport Planning and Policy, Transport for London, London.

Pawlak Z., 2006, Geografia ekonomiczna dla biznesu (Wyd. III), INTER-INFORM, Poznań.

Szymczak M., 2002, Logistyka miejska, w: Kompendium wiedzy o logistyce, PWN, Poznań.

UN - The World Urbanization Prospects: The 2005 Revision, Annex Tables, New York 2005.

Vickrey W., 1969, Congestion Theory and Transport, American Economic Review 1969.

Waugh D., 2000, Geography An Integrated Aproach, Nelson Thornes, Cheltenham.

CZYNNIKI DETERMINUJĄCE ZARZĄDZANIE KONGESTIĄ RUCHU ULICZNEGO W OBSZARZE ZURBANIZOWANYM

STRESZCZENIE. Celem artykułu jest zbadanie czynników wpływających na zarządzanie kongestią ruchu ulicznego w obszarze zurbanizowanym. Zgodnie z zaprezentowanymi przewidywaniami teoretycznymi, czynniki takie jak: migracje (dojazdy do pracy), lokalizacja w obrębie danej strefy funkcjonalnej miasta, roboty drogowe, obecność obszarów użyteczności publicznej, układ sieci transportowej, suburbanizacja, znaczenie danego szlaku drogowego, rodzaj drogi, obecność i charakter skrzyżowań, przejazdy kolejowe, mosty oraz infrastruktura transportu publicznego w różnym stopniu wpływają na wzorzec kongestii ruchu ulicznego. Poziom wpływu danego czynnika w obszarze miejskim Poznania wyrażony został za pomocą wskaźnika własnego opracowania - Syntetycznego Współczynnika Kongestii (SCR). Dodatkowo zostało przewidziane, że natężenie ruchu ulicznego w dni robocze jest wyższe w porównaniu z weekendami. W celu zweryfikowania powyższych hipotez, zostało przeprowadzone badanie polegające na ustaleniu kilku punktów pomiarowych w pobliżu skrzyżowań charakteryzujących się obecnością wcześniej wspomnianych czynników. W tych miejscach zmierzono natężenie ruchu ulicznego, co umożliwiło dalsze analizy. Pozwoliło to na wyciągnięcie wniosków, że do najważniejszych czynników wpływających na zarządzanie kongestią ruchu ulicznego w obszarze zurbanizowanym należą: ranga danego szlaku ulicznego jako trasy komunikacyjnej, położenie na szlaku dojazdu do centrum biznesoewgo miasta (CBD) lub innego ważnego obszaru użyteczności poblicznej oraz rodzaj drogi (droga szybkiego ruchu, dwupasmowa, wielopoziomowe skrzyżowania). Z kolei wpływ innych czynników (układ ulic, obszary użyteczności publicznej, lokalizacja w obrębie danej strefy funkcjonalnej) jest znacznie mniejszy. Zaobserwowano również w jednym z punktów pomiarowych, pewną rozbieżność pomiędzy oczekiwanymi a uzyskanymi wynikami, co prawdopodobnie jest wynikiem oddziaływania dodatkowego, nieprzewidzianego czynnika np. wypadku drogowego.

Słowa kluczowe: zarządzanie, obszar zurbanizowany, kongestia ruchu ulicznego, syntetyczny wskaźnik kongestii.

EINFLUSSFAKTOREN FÜR DAS STAUVERHALTEN IN STADT-GEBIETEN

ZUSAMMENFASSUNG. Ziel des Artikels ist die Ermittlung von Faktoren, die das Stauverhalten in Stadtgebieten beeinflussen. Aus der Literatur ist bekannt, dass Faktoren wie: Pendler, Standorte innerhalb von funktionellen Zonen, Straßenbau, Anwesenheit öffentlicher Einrichtungen, Verkehrsnetzwerk, Vorstädte, Bedeutung der Strecke, Straßentyp,

Präsenz und Bedeutung von Knotenpunkten, Bahnübergänge, Brücken oder das Vorhandensein öffentlicher Verkehrsmittel können sehr unterschiedliche Einflüsse auf Verkehrsstauungen nehmen können.
Das Niveau dieser Einflüsse im Gebiet von Poznan (Polen) wird in einem selbst entwickelten Indikator - Synthetic Congestion Ratio (SCR) - erfasst. Außerdem wird vorhergesagt, dass das Verkehrsaufkommen während der Arbeitstage höher ist als am Wochenende. Um den Wahrheitsgehalt dieser Hypothesen zu prüfen, wurden Untersuchungen an bestimmten Kontrollpunkten in der Nähe besonderer Einflussfaktoren durchgeführt und später mit allgemeinen Verkehrsmessungen im Stadtgebiet ergänzt.
In der Zusammenfassung ist festzuhalten: Die Faktoren mit dem größten Einfluss auf das Stauverhalten sind: Bedeutung der Straße als Verbindungsstraße, Funktion der der Straße als Zufahrt zu zentralen Geschäftsvierteln und der Straßentyp (Autobahn, zweispurige Straßen, Hauptkreuzungen). Andere Faktoren wie Straßenlayout, Sehenswürdigkeiten oder Funktionsgebäude haben dagegen eine untergeordnete Bedeutung. Des Weiteren wurde an einem Kontrollpunkt eine Abweichung vom vorhergesagten Verkehrsvolumen beobachtet. Dies kann das Ergebnis eines vorher nicht berücksichtigten Einflussfaktors sein, wie zum Beispiel eines Verkehrsunfalls.

Codewörter: Management, Stadtgebiet, Verkehrsstau, Stauvorhersage, Synthetic Congestion Ratio (SCR)

doc.dr Zbyszko Pawlak
Wyższa Szkoła Logistyki/ Poznan School of Logistics
ul. Estkowskiego 6
61-755 Poznań, Polska
e-mail: zbyszko.pawlak@edu.wsl.com.pl
Akademia Ekonomiczna/ The Poznan University of Economics
Al. Niepodległości 10
60-967 Poznań, Polska
e-mail: z.pawlak@ae.poznan.pl