
ISC
ISC'2010
Industrial Simulation Conference' 2010
EDITED BY
Gábor Lencse
and
László Muka
June 7-9, 2010
Ramada Plaza Hotel
Budapest, Hungary
ORGANIZED BY
eti
European Technology Institute
SPONSORED BY
eurosis
CREAX
AEKI
UNIVERSITEIT GENT
UNIVERSIDAD POLITECNICA DE VALENCIA
A PUBLICATION OF
eurosis

In: Lencse, Gábor/Muka, László (eds.): 8th Industrial Simulation Conference 2010 (ISC´2010) Budapest
07.06. - 09.06.2010, p. 195-200, EUROSIS-ETI (Eigenverlag), Ostend, Belgium ISBN: 978-90-77381-5-57

GREEN SUPPLY CHAIN EVENT MANAGEMENT

Matthias Klumpp
Sascha Bioly
Institute for Logistics and Service Management (ild)
FOM University of Applied Sciences
Leimkugelstraße 6
D-45141 Essen, Germany
E-Mail: matthias.klumpp@fom-ild.de

Alexandra Saur
Stephan Zelewski
Institute for Production and Industrial Information Management (PIM)
University of Duisburg-Essen
Universitätsstraße 9
D-45141 Essen, Germany
E-Mail: alexandra.saur@pim.uni-due.de

KEYWORDS
Green Supply Chain Event Management, Sustainability, Green Logistics, Supply Chain Event Management.

ABSTRACT

Sustainable logistics concepts mainly focus on strategic decision levels for example in supply chain design, warehouse location and standard transport mode selection decisions. This paper is addressing a more operative approach and analyzing green concepts for day-to-day logistics decisions, commonly discussed as supply chain event management concepts in order to speed up and improve such decisions e.g. by semi-automated software and decision systems. As the authors show in such automated operative decisions systems a green approach at least in information providing has to be discussed and can bring huge benefits for sustainable logistics in practice. As decisions will include provided information about environmental impacts operative logistics solutions are assumed to be more environmentally friendly than before.

1. INTRODUCTION

In general green and sustainable logistics concepts are focused on *strategic* decisions as e.g. location and general transport mode decisions. But nevertheless for future improvements and concept development also the dimension of *operative* logistics decisions is an important field of improvement. As practical example day-to-day situations as e.g. a production delay at an Asian factory often leads to hurried short-term transports via airplane. Thus a significant environmental impact in this decision arena can be assumed as in most cases environmental impact worsens as time pressure is increasing and speed has to be enhanced.
Therefore the concepts of supply chain event management have to be evaluated regarding sustainable information and decision making. As a guiding principle such day-to-day decisions (even automated ones in SCEM systems) should consider sustainable aspects as for example the implicated CO_2 emission by changes in transport modes (e.g. air instead of seaway). Therefore existing calculation models addressing transport mode comparisons with emission criteria (see Klumpp et al., 2009; Zelewski et al., 2009) have to be merged with existing SCEM concepts. This is the core topic of the following research paper.

2. LITERATURE REVIEW

The development of concepts in supply and logistics management towards more sustainability is driven by a *multitude* of factors:

- *Political influences* as e.g. the Kyoto Protocol of 1997 (to be followed by the Copenhagen Protocol) and emissions trading (UNFCCC, 2009).
- *Media influences* expecting data, concepts and reactions from companies in order to prove their sustainable management concept (especially regarding PR concepts).
- *Management influences* integrating the expected future raw material prices driven by shortages in raw materials due to restricted resources.

But nevertheless relevant management concepts are at best in an *early stage* of development, described by the fact that most of them describe a single perspective instead of holistic management views.
It can be recognized that the term *Green Logistics* itself already is a trend in global logistics research and is also present in agendas of companies worldwide for more than 15 years with the first authors starting to publish from 1990 onwards. Therefore the following literature review is taking into account the last 15 years.
Literature regarding logistics, supply management and supply chain management is in many cases *cost* driven (Wiedmann et al., 2008, p. 63), *quality* (Bogaschewsky et al., 2008, p. 244) and *risk* oriented (Goll et al., 2008, p. 150). Sustainability concepts are to date only implemented as *sub-factors* in concepts within these three specific perspectives or for a specified industry sector (e.g. the food sector; Hamprecht, 2005, p. 2). Even optimization models with a per se *integrated* approach are missing sustainable parameters in their objectives (Kohler, 2008, p. 10). The following literature survey is describing this in table 1. In this structure *four perspectives* were analyzed if addressed in the selected literature (by key word “green logistics”, “sustainable logistics” and “CSR” depending on availability). If a paper addressed the named perspective this is marked in the table. In order to specify the four perspectives the following description is given:

- The *Operational Event Perspective* is addressed in articles concerning logistics process management, event management and decision making as e.g. routing, scheduling or exception management.
- The *Customer Quality Perspective* is a topic in articles concerning customer and industry needs, quality aspects as e.g. cost effectiveness and low goods damage levels.

In: Lencse, Gábor/Muka, László (eds.): 8th Industrial Simulation Conference 2010 (ISC´2010) Budapest
07.06. - 09.06.2010, p. 195-200, EUROSIS-ETI (Eigenverlag), Ostend, Belgium ISBN: 978-90-77381-5-57

- The *Logistics Perspective* is addressed in articles with the topics like e.g. transport, network and warehousing concepts, fleet management and bundling strategies, location decisions and concepts aimed at reducing delays.
- The *Green Perspective* is addressed in articles coping with improving the sustainability and CSR in general – with subtopics as e.g. CO_2 and emissions reduction or minimizing energy consumption by transport and warehousing facilities.

In a specific overview therefore table 1 shows that until today there is no broad discussion about the *operational* event management perspective in sustainable logistics which we term green supply chain event management. There clearly is a need for an integrated concept bringing together operational, customer, logistics and sustainability expectations

Table 1: Literature Synopsis Green Logistics

Author(s)	Specific Perspective			
	Operational Event Perspective	Customer Quality Perspective	Logistics Perspective	Green Perspective
Al-Mansi et al. (2008)	X		X	
Anderson et al. (2009)		X		X
Archel et al. (2008)				X
Bowen et al. (2001)			X	X
Carter et al. (2008)				X
Darnall et al. (2008)			X	X
Fleischmann et al. (1997)			X	
Fabig et al. (2008)				X
Hamprecht (2005)		X	X	
Hussain (1999)		X		X
Kohler (2008)	X	X	X	
Koplin et al. (2007)		X		X
Krause et al. (2009)	X			X
Middendorf (2008)			X	X
Rodrigue et al. (2001)			X	
Seuring et al. (2008)	X			X
Siepermann et al. (2009)				X
Steven (2004)			X	X
Straube et al. (2008)		X	X	X
Tate (1996)		X	X	
Vieira et al. (2008)			X	X
Walton et al. (1998)			X	X
Wu et al. (1995)			X	X

3. TRANSPARENCY IN SUPPLY CHAIN OPERATIONS: SCEM

Existing supply chain event management concepts focus on real-time information and decision management aided by computer systems. Basic functions are existing *tracking and tracing tools* as transparency can be seen as a prerequisite for semi-automated or automated supply chain event management systems (SCEM). The task of SCEM mostly lies in gradually realizing all data along a supply chain. Those develop in an enterprise and have to be exchanged between enterprises (Nissen, 2002, p. 477). OKHRIN describes the task of SCEM systems as follows (Okhrin, 2008, p. 111): „Event oriented systems enable the monitoring of stocks, orders and goods deliveries along the entire delivery chain. They identify expected events as well

In: Lencse, Gábor/Muka, László (eds.): 8th Industrial Simulation Conference 2010 (ISC´2010) Budapest
07.06. - 09.06.2010, p. 195-200, EUROSIS-ETI (Eigenverlag), Ostend, Belgium ISBN: 978-90-77381-5-57

as unplanned disturbances and inform the decision maker about their status with the goal of a punctual identification of the disturbances and the states of emergency to guarantee."

Supply chain management (SCM) needs a smooth information flow for an efficient functionality within a delivery chain. The event oriented process management reaches this goal by giving information about the real commodity flow to all involved. SCEM has to realize thereby a permanent monitoring of material and goods flows along the entire chain and additionally has to make coordinated management action possible in case of supply disturbances and exceptional cases (Beckmann, 2003, p. 113). An example SCEM model shows *figure 1* (Schenk et al., 2007, p. 224).

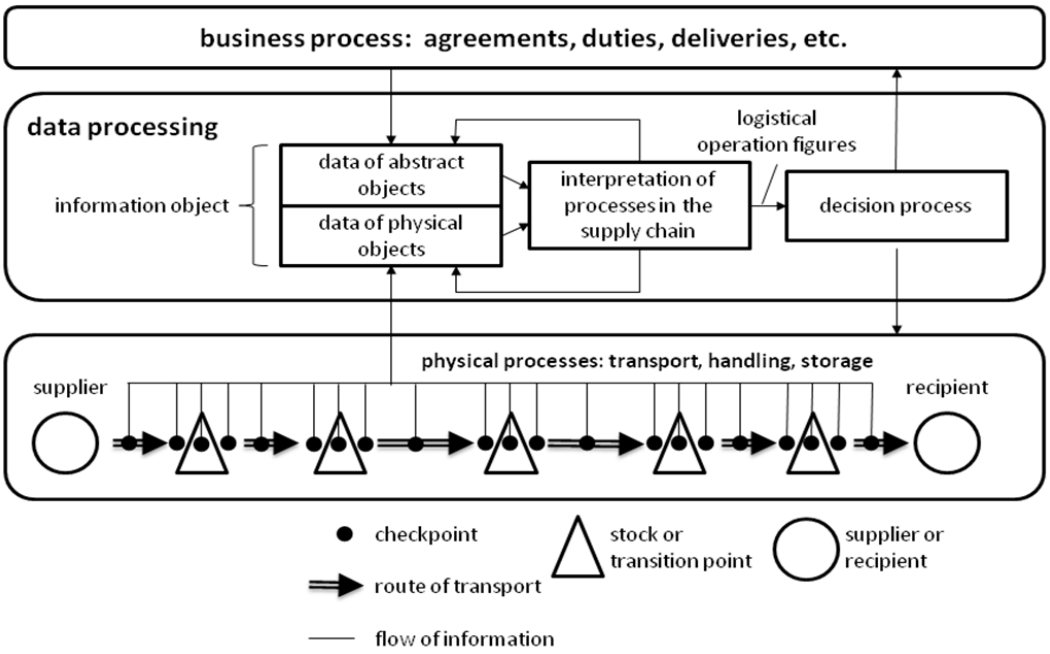

Figure 1: SCEM Strategy Model

The task of SCEM is an active and customer oriented monitoring of the delivery chain to recognize disturbances and give possible solutions. Thus SCEM increases the flexibility and capacity of reaction of the entire supply chain.

The first theoretical bases of SCEM were already compiled in the form of elaboration about management by exception (MBE) in the middle of the last century, whereby beginnings of practical field use can be found in the bases of the tracking and tracing (Hunewald, 2005, p. 9; Wildemann, 2007, p. 13). Characteristic for the MBE approach is the fact of reducing control and steering activities of the responsible person. An intervention is only necessary if an event cannot be processed and/or settled independently by the SCEM system (Bittel et al., 1964, p. 5). With SCEM an interface is provided between the pre-defining supply chain planning (SCP), the planned process and the real operational sequence along the supply chain execution (Arnold et al., 2008, p. 481; Nissen, 2002, p. 477).

If deviations between the current actual condition of the process and the planned process are observed, SCEM introduces immediately a set of reaction measures, which serve for the recovery of the disturbances and a regular continuation of the process and/or suggest alternative solution types. Things like tracking and tracing, the traceability and on-line arrangement of goods, charge carriers and vehicles are bundled with additional functions (e.g. warning functions) for the better control and decision support provided. SCEM cannot replace the fundamental SCP but builds further on this (Bretzke, 2002, p. 28).

A SCEM system can extend the functionality of tracking and tracing applications. The generated status messages are passed on to the decision maker in real time. These of all participants of the supply chain collected data are supervised and interpreted by the event management system. In the further process SCEM accomplishes a comparison of nominal and actual values and designates the signals in planned events or unplanned disturbances (Klaus, 2004, p. 13). This is the main task of the SCEM system: If the system registers an incident, thus a plan deviation from the defined specified condition, it tries to make a rapid reorganization of the process available on the basis of pre-defined solution alternatives. However this is only possible if a potential scenario is programmed in the event system and possible alternative solutions are implemented (Karrer, 2003, p. 188).

The biggest advantage of SCEM is transparency over several stages of the delivery chain, since ideally all individual shipments can be constantly supervised and steered. High complexity and dynamics of the processes in a value chain, however, make the effective implementation of SCEM difficult. Thus it is required that all processes are integrated along a supply chain in the event management system, because only with completely integrated and not partly omitted processes can an optimal reaction of the event management take place (Wildemann, 2007, p. 41). As a condition for this a greatest possible information transparency along the entire supply chain has to be ensured (Wildemann, 2007, p. 44). In the course of constantly growing requirements of participants in the supply chain (shipper - service provider - customer) gains in particular the use of SCEM increasingly in meaning. Tracking and tracing, warning functions and further telematic components increase the quality and topicality of information about the whole

In: Lencse, Gábor/Muka, László (eds.): 8th Industrial Simulation Conference 2010 (ISC´2010) Budapest
07.06. - 09.06.2010, p. 195-200, EUROSIS-ETI (Eigenverlag), Ostend, Belgium ISBN: 978-90-77381-5-57

supply chain. In direct consequence these tools permit optimal planning extending reactivity and effectiveness with deviations and exceptional cases. SCEM can improve the efficiency and security of logistics processes. SCEM deployment optimizes the yield situation and customer satisfaction. The information gain concerning business processes secures a positive prognosis for the enterprise used by SCEM.

4. GREEN SUPPLY CHAIN EVENT MANAGEMENT MODEL

In order to *integrate* all the specified perspectives needed in a Green SCEM system a holistic management model has to be drafted – drawing structure from the perspectives described in the literature review above. First there has to be a *sustainability* or *green perspective* as described above containing the following:

- *Input Reduction* objective calling for lower inputs of non-renewable materials as e.g. energy and raw materials needed for transport equipment and transport and logistics services.
- *Safety* objective describing the absence of harmful events such as oil and other dangerous goods spills in natural habitats or human injuries.
- *Pollution efficiency* objective determining a reduction of emissions of e.g. greenhouse gases or other pollutants in relation to logistics service outputs.

A *logistics perspective* is underpinned by the following three important factors:

- *Availability* objective describing the basic function of logistics to ensure availability of the right goods at the right place and on time.
- *Quality* objective addressing the need for unharmed goods transport and smoothness of logistics *services* (service orientation, security awareness).
- *Transparency* objective in logistics depicting the aim to provide accurate and real-time information about transport, goods status and overall logistics performance for customers and other partners in the supply chain.
- The *customer perspective* is described further by the following three objectives:
- *Value* objective addressing the ration of costs and *product* quality in purchasing to be guarded and improved.
- *Risk* objective defining an overall risk management approach in order to avoid situations threatening company existence.
- *Process efficiency* objective determining the process time and internal process costs to be reduced in supply management e.g. by E-Procurement.

The *event and flexibility perspective* is outlined by the following three factors:

- *Speed* objective according to standard events in supply chains as usually disruptions in the transport chain create a need for higher speed.
- *Acceptance* objective mentioning that with increasing technology impact on all steps, persons and companies in a supply chain there has to be more emphasizing of acceptance.
- *Implementation* objective determining the fact that future technologies will need even more education and training efforts in order to fledge their full potential in supply chain event management (*implementation hurdle*).

Altogether these factors build an integrated view and would enable a "Green SCEM Cockpit" for logistics decisions – for the first time including sustainable decision facts. This could lead to more sustainable operational logistics decisions e.g. in transport modes. A simulation of this planned data is currently run by the athors with example data from DACHSER in Cologne/Germany.

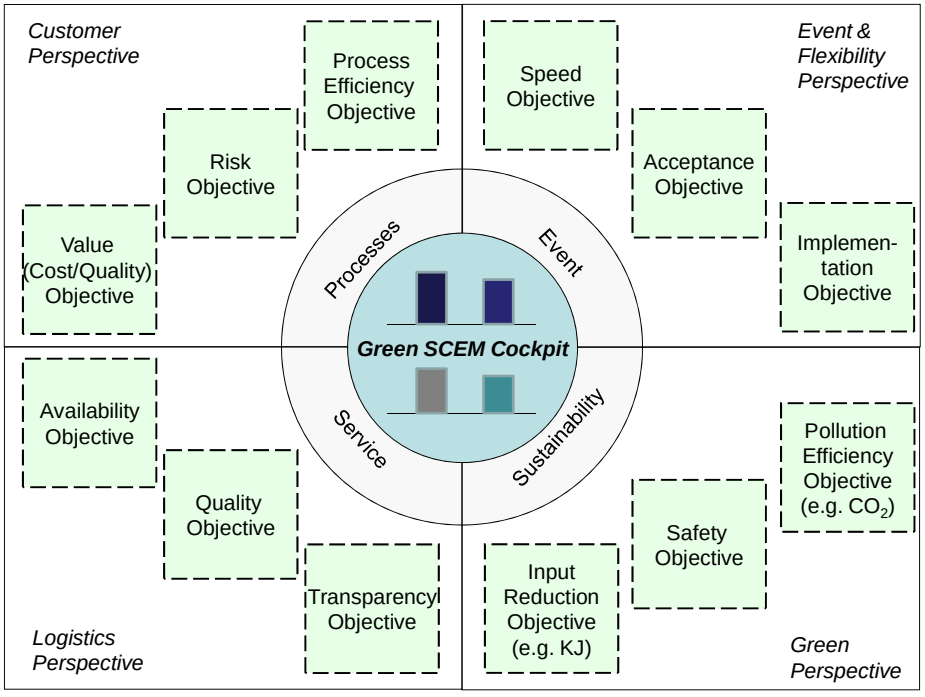

Figure 2: Green Supply Chain Event Management Model

In: Lencse, Gábor/Muka, László (eds.): 8th Industrial Simulation Conference 2010 (ISC´2010) Budapest
07.06. - 09.06.2010, p. 195-200, EUROSIS-ETI (Eigenverlag), Ostend, Belgium ISBN: 978-90-77381-5-57

5. OUTLOOK AND FUTURE DEVELOPMENT

Future developments will bring a *further interest in sustainability* concepts as for example the visitors of the largest European logistics fair in Munich predicted (DB Schenker Laboratories, 2009, p. 1). These experts see green and sustainable logistics concepts as the *most important trend* for 2015. Therefore research has to adapt to this trend and also to an increasing number of questions asked by practitioners in supply and logistics management regarding green concepts. This research demand will have to be answered in three areas:

- *Measurement* and indicator concepts have to be established and validated as suggested in this article.
- *Management* concepts for Green SCEM have to be developed in order to guarantee for an integrated perspective on green supply and logistics.
- *Implementation and education* concepts have to be detailed in order to secure the impact of such research and management theory concepts.

If research is fostering these challenges there will be enough chances to contribute to the global task of sustainability also by operative logistics and SCEM.

Grant Support Notice
The research for this article was supported by research funding in the projects *LOGFOR* (German NRW Department MWME as well as EU - ERDF) and *MAEKAS* (German Federal Department BMWi).

REFERENCES

Al-Mansi, A., Aldarrat, H., Rhoma, F., Goudz, A., Lorenz, M., and Noche, B. (2008). “Design of an Environmental Supply Chain Network: A Biosolid Waste Case Study”. In *Global Logistics Management*, Kersten, W., Blecker, T., and Fläming, H. (Eds.). ESV: Berlin, 87-98.

Anderson, M., and Skojett-Larsen, T. (2009). “Corporate Social Responsibility in Global Supply Chains”. In *Supply Chain Management - An International Journal*, 14 (2), 75-86.

Archel, P., Fernandez, M., and Larringa, C. (2008). “The Organizational and Operational Boundaries of Triple Bottom Line Reporting: A Survey. In *Environmental Management*, 41, 106-117.

Arnold, D., Isermann, H., Kuhn, A., Furmans, K., and Tempelmeier, H. (Eds.) (2008). *Handbuch Logistik*. Springer: Berlin.

Beckmann, H. (Eds.) (2004). *Supply Chain Management*, Springer: Berlin.

Bittel, L. R., and Maynard, H. B. (1964). *Management by Exception: Systematizing and simplifying the managerial job*. McGraw-Hill: New York.

Bogaschewsky, R., and Müller, H. (2008). „Stand und Weiterentwicklung des E-Procurement in Deutschland“. In *Best Practice in Einkauf und Logistik, 2nd edition*. BME (Eds.). Gabler: Wiesbaden, 237-254.

Bowen, F. E., Cousins, P. D., Lamming, R. C., and Faruk, A. C. (2001). “The role of supply management capabilities in green supply”. In *Production and Operations Management*, 10 (2), 174-189.

Bretzke, W.-R. (2002). “SCEM – Entwicklungsperspektive für Logistikdienstleister”. In *Supply Chain Management*, 2 (3). 27-31.

Carter, C. R., and Rogers, D. S. (2008). “A framework of sustainable supply chain management: Moving toward new theory”. In *International Journal of Physical Distribution & Logistics Management*, 38 (5), 360-387.

Darnall, N., Jolley, G. J., and Handfield, R. (2008). “Environmental Management Systems and Green Supply Chain Management: Complements for Sustainability?”. In *Business Strategy and the Environment*, 18, 30-45.

DB Schenker Laboratories (2009). Ergebnisse der Messebefragung ”transport logistic 2009“, Eigenverlag: Berlin.

Fabig, K,. and Pinnau, H. (2008). “Wassereinsparung im Sanitärbereich öffentlicher Einrichtungen in Hamburg“. In *Best Practice in Einkauf und Logistik, 2nd edition*. BME (Eds.). Gabler: Wiesbaden, 304-316.

Fleischmann, M., Bloemhof-Ruwaard, J. M., Dekker, R., van der Laan, E. A., van Nunen, J. A. E. E., and van Wassenhove, L. N. (1997). *Quantitative models for reverse logistics: A review, European Journal of Operational Research*, 103, 1-17.

Goll, L., and Haupt, S. (2008). “Corporate Governance, Risk- and Compliance Management in der Beschaffung”. In *Best Practice in Einkauf und Logistik*. BME (Eds.). Gabler: Wiesbaden, 149-168.

Hamprecht, J. (2005). *Sustainable Purchasing Strategy in the Food Industry*. DiFo: Bamberg.

Hunewald, C. (2005). *Supply Chain Event Management – Anforderungen und Potentiale am Beispiel der Automobilindustrie*. DUV: Wiesbaden.

Hussain, S. S. (1999): “The Ethics of ‚Going Green‘: The Corporate Social Responsibility Debate”. In *Business Strategy and the Environment*, 8, 203-210.

Karrer, M. (2003). “Supply Chain Event Management – Impulse zur ereignisorientierten Steuerung von Supply Chains”. In *Innovationen im E-Business, series Innovative Produktion und Logistik*. Dangelmaier, W. (Eds.). Vol. 10, ALB-HNI: Paderborn, 187-198.

Klaus, O. (2004). “Geschäftsregeln im Supply Chain Event Management”. In *Supply Chain Management*, 4 (2), 13-19.

Klumpp, M., Zelewski, S., and Saur, A. (2009). “Increasing Rail Cargo Transport Performance”. In *High-Performance Logistics*. Blecker, T., Kersten, W., and Meyer, M. (Eds.). ESV: Berlin, 17-30.

Kohler, K. (2008). *Global Supply Chain Design*, CfSM: Estenfeld.

Koplin, J., Seuring, S., and Mesterharm, M. (2007). “Incorporating sustainability into supply management in the automotive industry – the case of the Volkswagen AG”. In *Journal of Cleaner Production*, 15 (2007), 1053-106.

Krause, D. R., Vachon, S., and Klassen, R. D. (2009). “Special Topic Forum on Sustainable Supply Chain Management: Introduction and Reflections on the Role of Purchasing Management”. In *Journal of Supply Chain Management*, 45 (4), 18-25.

Middendorf, K. (2008). “Logistik im Spannungsfeld zwischen Globalisierung und Nachhaltigkeit”. In *Das Beste der Logistik*. Baumgarten, H. (Eds.). Springer: Berlin, 405-414.

Nissen, V. (2002). „Supply Chain Event Management“. In *Wirtschaftsinformatik*, 44 (5), 477-480.

Okhrin, I. (2008). “Supply Chain Event Management”. In *Handbuch Logistik*. Arnold, D., Isermann, H., Kuhn, A., Furmans, K., Tempelmeier, H. (Eds.) Gabler: Berlin, 481-485.

Rodrigue, J.-P., Slack, B., and Comtois, C. (2001). “Green Logistics (The Paradoxon of)”. In *The Handbook of Logistics and Supply-Chain Management*. Brewer, A. M., Button, K. J., and Hensher, D. A. (Eds.) Pergamon: London, 339-350.

Schenk, M., Tolujew, J., Barfus, K., and Reggelin, T. (2007). “Grundkonzepte zu logistischen Echtzeitsystemen: Monitoring, Event Management und Frühwarnung”. In *Jahrbuch der*

Logistik 2007. Wolf-Kluthausen, H. (Eds.). Korschenbroich, 222-226.

Schneider, C. (2004). *Controlling für Logistikdienstleister – Konzepte, Instrumente, Anwendungsbeispiele, Trends*. DVV: Hamburg.

Seuring, S., and Müller, M. (2008). "From a literature review to a conceptual framework for sustainable supply chain management". In *Journal of Cleaner Production*, 16/2008, 1699-1710.

Steven, M. (2004). "Network in Reverse Logistics". In *Supply Chain Management and Reverse Logistics*. Dyckerhoff, H., Lackes, R., and Reese, J. (Eds.). Springer: Berlin, Heidelberg, New York, 163-180.

Straube, F., and Borkowski, S. (2008). *Global Logistics 2015+ - How the world´s leading companies turn their logistics flexible, green and global and how this affects logistics service providers*. BVL: Berlin.

Tate, K. (1996). "The elements of a successful logistics partnership". In *International Journal of Physical Distribution & Logistics Management*, 26 (3), 7-13.

UNFCCC (2009). http://www.unfccc.int, date 12.02.2010.

Vahrenkamp, R., and Siepermann, C. (Eds.) (2007). *Risikomanagement in Supply Chains – Gefahren abwehren, Chancen nutzen, Erfolg generieren*. ESV: Berlin.

Vieira, D. R., da Silva, H. A. and dos Santos, A. (2008). "Integrated Engineering – The Case of Sustainable Development of Packaging in the Food Industry". In *A New Wave of Innovation in Collaborative Networks*. Pawar, K., Thoben, K. D., and Goncales, R. (Eds.). Nottingham University: Nottingham, 325-332.

Walton, S. V., Handfield, R. B., and Melnyk, S. A. (1998): "The Green Supply Chain: Integrating Suppliers into Environmental Management Processes". In *International Journal of Purchasing and Materials Management*, 1998 (1), 2-11.

Wiedmann, H., and Teichmann, J. (2008). "Next Level Purchasing: Erfolgsfaktor eines aktiven Kostenmanagements". In *Best Practice in Einkauf und Logistik, 2nd edition*. BME (Eds.). Gabler: Wiesbaden, 56-65.

Wildemann, H. (2007). *Event Management in der Supply Chain – Leitfaden zur Steuerung geplanter und zufälliger Ereignisse entlang der Supply Chain*. TCW: München.

Wu, H.-J., and Dunnin, S. C. (1995). "Environmentally responsible logistics systems". In *International Journal of Physical Distribution & Logistics Management*, 25 (2), 20-35.

Zelewski, S., Klumpp, M., and Saur, A. (2009). "Leerfahrtenoptimierung und Kapazitätserweiterung durch Kooperationen von Eisenbahnverkehrsunternehmen". In *Höchstleistung im spurgeführten System*. Schütte, J. (Eds.). Eigenverlag: Dresden, 1-29.