INNOVATION CAPABILITIES OF LOGISTICS SERVICE PROVIDERS- AN INVESTIGATION OF DRIVERS FOR INNOVATION

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INTRODUCTION

The market for logistics services is characterized by changing customer demands regarding quality and higher service levels (Wagner 2008) (e.g. just-in-time delivery). An increasing number of customers requests for new and valuable services (for instance the provision of real-time data by using of Tracking & Tracing Systems (Arndt 2008)). Therefore, the competitiveness of Logistics Service Provider (LSP) depends on their ability to adapt their offered services to changing customer demands (Pfeiffer 2008). One general way to cope with changing customer demands and to ensure a company's competitiveness (Brockhoff 1996) can be innovations. Thereby, innovations can be understood as ideas, concepts, and practices to improve products as well as processes (Rogers 2003). If the improved products and processes are recognized as new and valuable by customers the innovations can lead to an increasing quality of the companies' service portfolio (Pfohl, Köhler & Röth 2008). A higher service level can have significant effects on a company's options for its positioning and differentiation from competitors and therewith on its corporate value (Song, Thieme 2006; Chapman, Hyland 2004). In conclusion, innovations can be seen as a key factor for economical growth and competitiveness (Pfohl, Köhler & Röth 2008) Thus, the competitiveness of LSP is related to their ability to be innovative (Wagner 2008). Hence, the question arises how LSP can increase their innovation capability. *Flint et al.* (2005) as well as *Wagner* state that in logistics research this question has been nearly ignored up to now (Flint et al. 2005; Wagner 2008).

Therefore, the overarching objective of this paper is to identify drivers of innovation capabilities for LSP in order to provide the logistics innovation management with an approach to develop and control its success factors. Hence, the objectives of the paper are threefold: Firstly, the paper aims for a comprehensive description of innovation and innovation capability in logistics. Furthermore, the paper intends to generally analyze potential drivers, which influence the innovation capability of a company. Finally, the paper will discuss hypotheses regarding the importance of changing customer demands and different drivers of innovations for LSPs.

Consequently, the paper will be structured as follows: In the second section, the innovation capability of LSPs will be characterized in order to deduce resulting deficits regarding their innovativeness. In the third section, drivers affecting the innovation capability of companies will be generally described by a broad review of innovation management literature. In section four, the identified drivers of innovation shall be adapted to specific conditions of the logistics context by a hypotheses discussing approach. The paper will conclude with a summary of the main findings.

SOME THOUGHTS ON LACK OF INNOVATIONS IN LOGISTICS

Specificity of Logistics Markets – Some 'Megatrends'

According to the Council of Logistics Management (2010) the term logistics can be defined as *"that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements"* (CLM).

Especially through worldwide progress and changes (e.g. open boundaries), a lot of industries are highly confronted with different drivers, which lead to new challenges and therewith to new requirements for the actors. These new challenges, which are often called megatrends, also exist and are investigated for the special case of logistics. *Arndt* (2008) lists among others **globalization, increasing customer demands**, and shortening **product-life-cycles** as these megatrends (Arndt 2008). *Klaus & Kille (2008, 2009)* also mention arising options for LSP caused by **technological progress** as well as **increased environmental sensibility** of customers (Klaus, Kille 2008/ 2009). These megatrends are also connected to different market changes, which constitute new conditions for LSP and lead to new challenges. Moreover, not only the increasing customer demands but also the other mentioned megatrends lead to new challenges due to a change in customer demands for LSP. That shall be described as follows: According to *Arndt* (2008), **globalization** leads to an increasing demand for services due to new customers as well as to an increase in market rivalry based on market entries of new competitors. The eastern European expansion of the EU is one example for this development, since the open boarders lead to new potential customers from other countries but also to new competitors on the own markets. An **increase of customer demands** is mentioned as another megatrend and results from the fact that new competitors on the markets lead to more options for the customer in choosing a LSP as well as to an increased market rivalry for the providers. Thus, a customer can increase his demands towards an outstanding quality of services, since he can choose between more providers offering the best service for him. Since customers are aware of the rivalry between the LSPs they can also expect low prices for services. The length of **product-life-cycles** is the time between introducing a new product to a market and the replacement by the next new product. Thus, it is directly related to the duration in which a product or a service can generate profits for a company. The life-cycle is influenced by changing demands of end customers, since the duration in which a product can generate profits depends on the behavior of the end-customer in buying the product (e.g. fashion depends on customer perception and becomes obsolete very fast). These shorter product-life-cycles lead to a change in the customer demands of the LSPs regarding adequate (fast but also cheap) solutions, resulting directly in new challenges for them. Thus, LSP have to adapt their transport services to these requirements (e.g. fashion has to be transported by plane since a ship transport lasts too long) (Arndt 2008). *Klaus & Kille* (2008, 2009) also mention **technological progress** triggered by the availability of new information and communication technologies as well as augmented use of handling technologies like RFID (Radio Frequency Identification) as logistical trends (Klaus, Kille 2008/2009). This technological development can result in new products and improved processes but also in the necessity for LSP to adapt to new technological standards (e.g. RFID in Supply Networks requires the use of RFID by all embedded Service Providers in order to handle the material and information flow). The LSPs adoption to technological change can also be triggered by a customer himself. That means that the customer can demand for a product or service, which bases on the technological progress (e.g. if the customer is aware of the "Tracking & Tracing System's" existence he can demand for it). The **environmental sensibility** of customers as well as political systems leads to a further megatrend in logistics. Customers are more and more demanding for "Greener" products and processes whish also results from the sensibility of their own customers/ end-customers (e.g. CO_2 Footprint for products). Moreover, governments have become more sensible regarding environmental topics, which leads to additional laws and requirements (e.g. emission trade) (Klaus, Kille 2008/ 2009).

In summary, each of the mentioned megatrends leads to an increase of customer demands. A successful fulfillment of these changing demands requires a changed focus on innovations for LSP in order to cope with the resulting challenges.

General Importance of Innovation Capability

According to *Ibrahim and Fallah* (2005), innovations can be regarded as a driver for a creation and maintenance of competitive advantages and economic growth (Ibrahim, Fallah 2005). One reason for the necessity of innovations lies in today's competitive challenges, like rapid pace and unforeseeable technological change that companies have to cope with (Betz 1997). That means that innovations can lead to flexibility in order to fit customer demands in rapid changing environments and technological advance regarding competitors. Therefore, companies, which are able to manage innovation in an adequate way, can gain success in comparison to competitors (Antoniou, Ansoff 2004). However, there is no common understanding and definition of innovation and innovation capability in the literature (Chieh-Yu Lin 2006). This research shall base on the approach of *Afuah* (2003), who states that an innovation is *"the use of new technical and administrative knowledge to offer a new product or service to customers. The product or service is new in that its cost is lower, its attributes are improved, it now has attributes it never had before, or it never existed in that market before"* (Afuah 2003). Following this, the innovation capability of a company can be described as company's ability to fulfill the prerequisites for a successful innovation process in order to generate new products or services. The process of technological innovation can either focus on the creation of new products (product innovations) or on the improvement of production processes (process innovation) (Auerswald, Kulkarni 2008). With recourse to *Ibrahim, Fallah* (2005), this paper works under the assumption that being innovative is a precondition for market success and obtaining competitive advantages.

Importance of Innovation Capability in Logistics

The changing customer demands require new services as well as improved processes to decrease costs and permit lower prices. In order to cope with the increasing customer needs regarding value adding services to low prices, innovations in services and improved processes are required as well. Changing life-cycles for products also require offering new services, which fulfill the customer demands (e.g. faster transportation services through optimization). The technological progress also enables innovation especially in new technologies in order to adopt to new industry standards (RFID in supply chain networks) or in improved processes (e.g. autonomous estimation of good conditions by sensor networks) in order to fit customer demands for value adding services (e.g. measuring good conditions during the container transport). The demand for "greener logistics" can also be faced by innovations in improved services (e.g. optimizations and measurement of CO_2 emissions), which can result in new services (offering CO_2 footprint for service) and which can base on the use of new technologies (e.g. highly efficient engines).

However, former research in the area of innovation has shown that low innovation expenditure is related to a low innovation capability (Mairesse, Mohnen 2001). An indicator for the extent of innovative activities is the innovation intensity, which describes the ratio between the total volume of innovation expenditure and the total revenue of all firms. It accounts for 2,1% in the market for transportation logistics in Germany in comparison to 8,5% in the German vehicle construction and 6,9% in the software and telecommunication industry (Wagner 2008). This low ratio shows a lack of innovation projects (new services or processes) in the logistics industry. Moreover, due to this low ratio of innovation expenditure a lack of innovation capability in the market for logistics services might be assumed. Thus, it might also be assumed that logistics companies are not able to fulfill the prerequisites for a successful innovation process in order to generate new products or services. Accordingly, this leads to the question how the innovation capability of LSPs can be increased in order to launch innovation projects and cope with the new customer demands, arising from the megatrends. To answer this question general drivers for the increase of a company's innovation capability in order to activate innovation projects shall be discussed as follows.

GENERAL DRIVERS FOR INNOVATION CAPABILITY

Innovations have been discussed regarding their possible drivers in several investigations in which different drivers have been identified. During the CIMA (Euro-Australian co-operation centre for Continuous improvement and innovation Management) research project, which should facilitate the transfer of knowledge respectively technology between European and Australian organizations (Boer et al. 2001), different categories of possible drivers for innovations have been identified. These categories are:

- available knowledge and information,
- performance measurement,
- human resource management systems,
- organizational structures,
- project planning and control,
- and technology (Soosay, Hyland 2004).

Since these categories provide a comprehensive overview including drivers from other research projects they shall be used as a basis for this investigation.

According to *Soosay & Hyland* (2004), the categories can be described as follows: **Available knowledge and information** means the relevant information and knowledge base a company has gained regarding customers, competitors or the application of processes. The gained knowledge can be used to improve organizational functions and to apply it in an innovative way, what can result in an improvement of fitting customer demands or competing with competitors. The knowledge and information can be gained by two different ways. On the one hand, the knowledge can base on information acquired from customers and suppliers, which is generated by the internal staff. On the other hand it can be gained by recruiting competitors' staff.

Performance measurement estimates the outcomes (e.g. of an investment) proportional to the input and is also transferable to the evaluation of innovation projects. In the context of innovations, one way can be to monitor improvements after innovative approaches in order to intervene if the current outcomes do not fit to the plan (Goh, Richards 1997). One possible indicator might be the financial position, which can be used to measure the effect of innovation regarding potentials of decreasing costs or respectively improving profits.

Human resource management (HRM) systems constitute the third category of innovation drivers and describe systems dealing with human resources regarding the acquisition, assessment, and development of human resources in an adequate manner (Klaus, Kille 2008/ 2009). Regarding innovations, it can assure the process of gaining new knowledge and new ideas within the organization by the recruitment of new members as well as by the motivation of current staff to bring in their ideas. Thus, the HRM can provide creative capacity for the company, which in turn can lead to innovations (Crossan, Lane & White 1999). An adequate HRM includes the structuring of working teams, human resource development as well as the recruitment of new staff.

The HRM is narrowly related to the next category, the **organizational structures** of the company, since the effective application of human capital requires adequate structures of the whole company. The organizational structures can affect innovations by driving knowledge distribution and learning. The learning process can lead to improvements in processes and therewith to better or rather new products. Thus, internal structures like temporary or cross-functional teams can enhance knowledge distribution and learning within a company.

The fifth category is **project planning and control**. This includes procedures and protocols, which are important for driving a project in the before planned way. Thereby, it can also drive innovation into the right and former fixed direction, since it sets the innovations direction and controls its progress (Cooper et al. 1999). That means that the start of an innovative project should also be accompanied by a procedure plan as well as control methods. Thus it becomes possible to identify variances and react by adopting the project.

Technology as the last category of drivers for innovations refers to the implementation of new technologies in order to improve services or processes (e.g. information and communication technologies can enhance processes like the collection of data and lead to

fast and safe data transfer). Thereby, they can lead to innovations in services as well as related processes. That means that they can enable companies to offer new services which base on the use of new technologies or they can lead to more efficient processes which can result in lower costs for a company. However, as mentioned above, a technology can be implemented as a process of adaption to technological standards or can base on former market analysis regarding customers' demand. If customers ask for special products which require the use of innovative technologies those demands can also trigger the implementation of new technologies (Soosay, Hyland 2004).
The drivers, which were outlined in this section in general, shall be investigated regarding their connection to logistics in order to investigate how to increase the innovation capability of LSP. Therefore, it shall be analyzed how the increase of customer demands affects the importance of the drivers for Logistics Service Providers.

INNOVATION DRIVERS AND THEIR IMPORTANCE TO COPE WITH INCREASING CUSTOMER DEMANDS IN LOGISTICS

Increasing customer demands in logistics markets affect the most important drivers of the innovation capability of LSP in several ways. The importance of each of these drivers, in turn, seems to increase, which leads to the following hypotheses:

Hypothesis 1: The more the customer demands are increasing the more important the ***available knowledge and information*** *becomes for LSP in order to be innovative.*
With recourse to the introduced understanding of innovation capability as the ability to use new technical and administrative knowledge in order to offer a new product or service to customers (Windt, Hülsmann 2007), this hypothesis can be exemplified by three reasons. LSP need to know the alterations of the demands of their customers in order to be able to fulfill them by adapting their logistics services. Second, LSP need to know how to fulfill the current as well as future customer demands so as to be able to adapt their services in the right way. Third, LSP need to know how to constantly update the knowledge and information on which demands have to be fulfilled in which way. Since it can be assumed that the customer demands are changing permanently (Arndt 2008) the resource as well as the knowledge base has to be updated constantly
Hence, the more the customer demands are increasing the more important does it get to know which demands are increasing (e.g. value added services), how to fulfill them (e.g. by means of which resources, like vehicles or individuals) and how to constantly update this knowledge- and information base in order to be able to offer new logistics services that, in turn, fulfill the increasing customer demands.

Hypothesis 2: The more the customer demands are increasing the more important the ***performance measurement*** *becomes for LSP in order to be innovative.*
A change in customer demands can lead to the expectation of new service features or new services (e.g. storage in addition to transport). That means that services become obsolete and are not able to gain profits any longer (product-life-cycle). Moreover, the customer can expect lower prices for a service, since his option to choose between different suppliers leads to increased bargaining power. Thus, a LSP can be forced to change his services regarding features or costs through innovations in order to fit the changing demands, what can lead to increasing costs for input (e.g. human resources, space for storage). Thus, innovation in services or processes can lead to high investments (e.g. new machines, new vehicles, storage space). Moreover, it is not sure to a degree of 100 percent to meet the customer demands by an innovation, since information regarding the demands can be incorrect what can in turn lead to unsuccessful innovation. Thereby, a risk for investments in innovation in order to fulfill customer demands can occur. Thus, a monitoring of the ratio between revenues and costs is of high relevance in order to avoid losses by the estimation of the cost structure of an implemented innovation project. Thereby, unsuccessful innovation projects, which bind resources (human beings, machine capacity) can be identified early in order to either close them or adopt them to changed requirements. Thus, the loss risk through unsuccessful innovation projects can be decreased.

Thus, the more innovation projects are implemented in order to fit the increasing customer demands the more an adequate performance measurement has to be considered.

*Hypothesis 3: The more the customer demands are increasing the more important are the **HRM systems** for LSP in order to be innovative.*
As mentioned above, increasing customer demands lead to an increase of the importance of the knowledge base for the innovation capabilities of LSPs. One important factor for gaining, maintaining, and sharing relevant knowledge regarding the characteristics of new and upcoming customer demands is the company's human resource base. An adequate HRM System provides an organization with creative capacity that can lead to innovation (Crossan, Lane & White 1999). Beside the necessity to develop a human resource base that is capable of acquiring adequate managers and employees, the HRM systems of LSP are required to create on the one hand an organizational culture, which promotes innovative and creative thinking of the individuals and gaining relevant knowledge (e.g. setting of incentives for innovative suggestions and ideas of employees). On the other hand, the organizational structures have to reflect this necessity through for instance implementing special project teams for a monitoring of trends in logistics markets and possibilities how to fulfill current and upcoming customer demands.
Hence, a human resources-based creation of organizational cultures and structures are the more important the more rapidly the organizational environment – the customer demands – is changing, in order to gain and maintain a LSPs innovation capability.

*Hypothesis 4: The more the customer demands are increasing the more important is the **organizational structure** for LSP in order to be innovative.*
The more the customer demands are increasing the more important it becomes for LSP to learn how to cope with them. The degree to which an organization is able to learn is influenced beside others by its organizational structure. *Burmann* (2005) for instance shows that an organization's learning ability can be maximized by balancing the organizational structure between centralized and decentralized decision-making (Burmann 2005). In associated literature on logistics, the degree of decentralization of decision-making is discussed in connection with autonomous co-operation as an organizational principle and associated technologies, such as RFID-tags or Sensor Networks (Gehrke et al. 2006). These technologies enable logistics agents to render their own decisions without asking a higher entity. Thus, they learn from their own decisions as well as the decisions of other agents since they get relevant information through interaction (Hülsmann, Cordes 2009). If decisions would only rendered by one entity (centralized) the learning ability would also be limited to only one agent. Thereby, decentralized decision making processes in logistics systems can lead to a higher rate of learning ability in the system. Hence, in the course of increasing customer demands the importance of logistics companies' organizational structure increases due to its contribution to the companies' learning abilities, which are necessary for being innovative.

*Hypothesis 5: The more the customer demands are increasing the more important is an adequate **project planning and control system** for LSP in order to be innovative.*
It seems likely that the complexity of logistics services as well as of innovation projects for alterations of these services might increase in the course of increasing customer demands. Customers demand either a higher quality of the services or lower costs. Finding and accomplishing associated solutions that enhance the service's quality without inappropriate cost increases or that are able to cut their costs without decreasing the quality requires an adequate planning and control of the respective innovation projects. One example are additional storage and distribution services of Service Providers for transport logistics that require a higher amount of information to be considered and handled (e.g. storage area and minimum durability). Being able to cope with this increasing complexity is therefore an essential requirement for LSPs to be innovative.

Thus, an adequate project planning and control system for innovation projects becomes more important for LSPs through increasing customer demands, since the systems must also be able to plan and control highly complex projects.

Hypothesis 6: The more the customer demands are increasing the more important is an appropriate usage of ***technologies*** *for LSPs in order to be innovative.*
One possibility to achieve service and process innovations in order to cope with increasing customer demands is the usage as well as the development of technologies. Autonomous co-operation technologies are part of logistics research in order to investigate them regarding their contributions for increasing the flexibility of logistics systems. Thereby, autonomous co-operation aims for the achievement of increased robustness and positive emergence by flexible coping with dynamics and complexity (Windt, Hülsmann 2007). Autonomous co-operation-based technologies like RFID tags or sensor networks for instance offer possibilities to LSP to flexibly react on environmental changes, such as customer demands (Wycisk 2009). Tracking and Tracing systems offer possibilities to satisfy the customers' demand for knowledge about their transported goods and for options for an intervention (Arnold 2008). On the contrary, the knowledge about an existence of certain technologies might lead to increasing customer demands regarding their usage. Customers know for instance about the possibilities of autonomous cooperation-based technologies and might demand for their usage and for an extension of their potentials. Both effects increase the importance of technologies for the innovation capabilities of LSPs.
Thus, technologies become more important for LSP in order to meet the increasing customer demands by services which base on the technologies implementation.
In summary, it can be stated that an increase in the demands of customers leads to a higher importance of innovation drivers for LSPs. That results from the fact that the requirements, which base on changing demands, are positively related to the drivers of innovation. Thus, focusing on innovation drivers can support logistics companies in facing the challenges triggered by the new customer demands.

CONCLUSION

Innovation Capabilities are important for a company's success but are often neglected especially from companies in logistics markets. Thus, this investigation investigated general drivers of innovation regarding their importance for LSPs in order to cope with increasing customer demands triggered by several megatrends in logistics. However, after pointing out an increasing importance of the drivers the question occurs how important the drivers are in comparison to each other and if a ranking is possible. Since this research did not base on empirical results this question could not be answered but can be a starting point for further research. Thus, an empirical study for the special case of LSPs would be required in order to estimate the degree of the drivers importance for the logistics industry.

REFERENCES

Afuah, A. 2003, *Innovation management : strategies, implementation, and profits,* Oxford Univ. Press, New York, NY [u.a.].

Antoniou, P.H. & Ansoff H.I. 2004, "Strategic Management of Technology", *Technology Analysis & Strategic Management,* vol. 16, no. 2, pp. 275-291.

Arndt, H. 2008, *Supply Chain Management : Optimierung logistischer Prozesse,* Gabler Verlag / GWV Fachverlage GmbH, Wiesbaden, Wiesbaden.

Arnold, D. 2008, *Handbuch Logistik,* Springer, Berlin [u.a.].

Auerswald, P. & Kulkarni, R. 2008, "Placing Innovation: an Approach to Identifying Emergent Technological Activity", *Economics of Innovation & New Technology,* vol. 17, no. 7, pp. 733-750.

Betz, F. (ed) 1997, *Managing Technological Innovation: Competitive Advantage from Change*, John Wiley & Sons, New York.

Boer, H., Caffyn, S., Corso, M., Coughlan, P., Gieskes, J., Magnusson, M., Pavesi, S. & Ronchi, S. 2001, "Knowledge and Continuous Innovation: The CIMA Methodology", *International Journal of Operations and Production Management,* vol. 21, no. 4, pp. 490-504.

Brockhoff, K. 1996, "Technology Management in the Company of the Future", *Technology Analysis & Strategic Management,* vol. 8, no. 2, pp. 175.

Burmann, C. 2005, *Management von Ad-hoc-Krisen : Grundlagen, Strategien, Erfolgsfaktoren,* Gabler, Wiesbaden.

Chapman, R. & Hyland, P. 2004, "Complexity and learning behaviors in product innovation", *Technovation,* vol. 24, no. 7.

Chieh-Yu Lin 2006, "Influencing Factors on the Innovation in Logistics Technologies for Logistics Service Providers in Taiwan", *Journal of American Academy of Business, Cambridge,* vol. 9, no. 2, pp. 257-263.

CLM *, Council of Logistics Management (CLM),* www.clml.org.

Cooper, R., Charlton, J., Roberst, C., Whitelock, J. & Souder, W. 1999, "New Product Development: Leadership and Learning. A comparison of of UK and US High-Technology Companies.", *International Journal of Continuous Engineering Education and Life-Long Learning,* vol. 9, no. 1, pp. 88-114.

Crossan, M.M., Lane, H.W. & White, R.E. 1999, "An Organizational Learning Framework: From Intuition to Institution", *Academy of Management Review,* vol. 24, no. 3.

Flint, D.J., Larsson, E., Gammelgaard, B. & Mentzer, J.T. 2005, "Logistics Innovation: a Customer Value-Oriented Social Process", *Journal of Business Logistics,* vol. 26, no. 1, pp. 113-147.

Gehrke, J.D., Behrens, C., Jedermann, R. & Kluge, E.M. 2006, "The Intelligent Container - Toward Autonomous Logistic Processes" in *KI 2006 Demo Presentations*Bremen, pp. 15-18.

Goh, S. & Richards, G. 1997, "Benchmarking the Learning Capability of Organizations", *European Management Journal,* vol. 15, no. 5.

Hülsmann, M. & Cordes, P. 2009, "Autonomous Co-operation and Control in Complex Adaptive Logistic Systems - Contributions and Limitations for the Innovation Capability of International Supply Networks" in *COMPLEX 2009, Part 1, LNICST 4 - Proceedings of the First International Conference on Complex Sciences: Theory and Application, Shanghai, China.*, ed. J. Zhou, Springer, Berlin, pp. 1023-1032.

Ibrahim, S. & Fallah, M.H. 2005, "Drivers of Innovation and Influence of Technological Clusters", *Engineering Management Journal,* vol. 17, no. 3, pp. 33-41.

Klaus, P. & Kille, C. 2008/ 2009, *Die TOP 100 der Logistik - Marktgrößen, Marktsegmente und Marktführer in der Logistikdienstleistungswirtschaft,* , Bremen und Hamburg.

Mairesse, J. & Mohnen, P. 2001, "To Be or Not To Be Innovative: An Exercise in Measurement", .

Pfeiffer, K. 2008, "Zuverlässigkeit zählt", *Logistik heute,* , no. 11.

Pfohl, H.-., Köhler, H. & Röth, C. 2008, "Wert- und innovationsorientierte Logistik - Beitrag des Logistikmanagements zum Unternehmenserfolg" in *Das Beste der Logistik: Innovationen, Strategien, Umsetzungen*, ed. H. Baumgarten, Springer, Berlin [u.a.], pp. 91-100.

Rogers, E.M. 2003, *Diffusion of innovations,* Free Press, New York, NY [u.a.].

Song, M. & Thieme, R.J. 2006, "A cross-national investigation of the R&D-marketing interface in the product innovation process", *Industrial Marketing Management,* vol. 35, no. 3.

Soosay, C.A. & Hyland, P.W. 2004, "Driving Innovation in Logistics: Case Studies in Distribution Centres", *Creativity & Innovation Management,* vol. 13, no. 1, pp. 41-51.

Wagner, S.M. 2008, "Innovation Management in the German Transportation Industry", *Journal of Business Logistics,* vol. 29, no. 2, pp. 215-231.

Windt, K. & Hülsmann, M. 2007, "Changing Paradigm in Logistics" in *Understanding Autonomous Co-operation and Control: The Impact of Autonomy on MAnagement, Information, Communication, and Material Flow*, eds. M. Hülsmann & K. Windt, Springer, Berlin, pp. 1-12.

Wycisk, C. 2009, *Flexibilität durch Selbststeuerung in logistischen Systemen : Entwicklung eines realoptionsbasierten Bewertungsmodells*, Gabler.