

# Lecture Notes in Logistics

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# Logistics and Supply Chain Innovation

Bridging the Gap between Theory  
and Practice

 Springer

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# Foreword by Minister Melanie Schultz van Haegen



The Netherlands: gateway to Europe. It is this short phrase that underlines the unique position of our country. Our maritime ports in Rotterdam and Amsterdam, for instance, import 536 million tons of goods every year. Most of these are shipped to destinations further inland, traveling by road, rail, or water. Germany as our most important trade partner is a vital destination. Both countries realize that a strong industry cannot survive without a healthy logistics and supply chain sector. Apart from investments in infrastructure as taking place in both countries, innovation in logistics also needs a strong knowledge base.

The fact that Germany and the Netherlands already rank positions 1 and 2 on the World Bank's Global Logistics Performance Index 2014 is no reason to lay back. Faced with a fierce competition, among others from emerging economies, smart innovation has been made a cornerstone of our economic policy, including innovation in logistics and supply chain control.

For that reason, I welcome the initiatives of two of the most important logistics knowledge clusters, the Dutch Institute for Advanced Logistics (Dinalog) and the Effizienzcluster LogistikRuhr in Nordrhein-Westfalen, to join hands and start a long-lasting cooperation—a cooperation which is based on public–private partnership programs in which industry and academic institutes closely work together to the benefit of our industrial and logistics sectors.

In June 2014, a cooperation agreement was signed at the Fraunhofer Institut für Materialfluss und Logistik, attended by King Willem Alexander and Queen Maxima of the Netherlands, as well as the Ministerpräsidentin Hannelore Kraft of Nordrhein-Westfalen. This book is a first proof of the fact that such a cooperation

bears fruit. It shows the richness and versatility of the logistics domain but above all it demonstrates that real logistics innovation can be achieved, when all partners are willing to join hands. I welcome the publication of this book and I sincerely hope that it may serve as a source of inspiration to both students and logistics practitioners.

Melanie Schultz van Haegen  
Minister of Infrastructure and the Environment  
The Netherlands

# Foreword by Minister Michael Groschek



This book contains exemplary and innovative contributions regarding the state of the art in logistics research as well as practice, all aiming at improving the contemporary processes in supply chains. This is very important for economic development in general—and especially so for the two involved regions, home of the two leading research clusters DINALOG and EffizienzCluster LogistikRuhr, as the Netherlands and especially North Rhine-Westphalia play a crucial role in the overall setup of global and European logistics concepts.

As incorporated with this book, the two regions—awarded the leading ranks also in the World Bank global Logistics Performance Index—are complementary regarding global seaports as well as excellent Hinterland connections and value-added services in integrated and resilient logistics concepts.

The state of North Rhine-Westphalia has supported the development of the logistics sector on a concept level as well as at important locations such as Duisburg, Cologne, or Dortmund in the best possible manner, as it features Europe’s largest inland port, the third largest German cargo airport as well as leading logistics research facilities as the University of Duisburg-Essen and the Fraunhofer Institute for Material Flow and Logistics in Dortmund.

In order to further strengthen the existing logistics excellence, our state is prepared and motivated to provide further support. This is implemented for example with the new ERDF program with the specific cluster support for “mobility and logistics.” This competition for the funding of innovative ideas in logistics was started in April 2015 and has submission options in 2015 and 2016.

Logistics researchers, entrepreneurs, and their partners in industry and commerce within our state and beyond proceed to strive for exceptional results in building the supply chains of the future and providing sustainable as well as resilient and responsible services to our society.

Düsseldorf  
July 2015

Michael Groschek  
Minister for Building, Housing  
Urban Development and Transport  
of North Rhine-Westphalia



# Preface

In today's global economies, logistics has been recognized as one of the key factors that determine the competitive position of both individual corporations and industry-based networks. At the same time, the very nature of supply chains and supply networks is changing rapidly, as a result of both technological and social developments. These developments include advances in ICT and industrial automation (sensors, robotics, 3D printing, and smart mobility) but also environmental concerns (scarcity of natural resources, carbon emission, and congestion) and finally new business models (e.g., e-commerce). The incorporation of these new technologies' potential in modern supply chain operations, while at the same time addressing environmental and societal concerns, is a formidable challenge for companies, economic clusters, and nations. But a challenge that has to be met: The importance of logistics as an indispensable factor of economic development is undisputed, as evidenced also by the annual publication of the World Bank Logistics Performance Index.

Innovation in logistics and supply chain management is a key to respond to the challenges outlined above. Such innovation requires intensive collaboration of industry and research and education institutes, to translate technological developments into sound business models and to train tomorrow's logistic engineer. For Germany and the Netherlands, the two focal innovation clusters are the Dinalog cluster and the EffizienzCluster LogistikRuhr. The editors of this book have ample experience in conducting projects that aim at the implementation of concepts and ideas in the day-to-day business environment (practicality gap). They also concluded there is a strong need in industry to understand the fundamentals of topics such as sustainable logistics, ICT integration, and Web-based businesses (theory gap).

From these experiences, the basic idea for this edited volume was born: to present state-of-the-art advances in logistics theory in different fields as well as to provide case studies for successful and promising logistics applications within important innovation areas in modern logistics management as best practice. This book reports on a number of studies carried out (and still ongoing) in the Dinalog cluster and the EffizienzCluster LogistikRuhr, bringing together different

perspectives of basic and applied research. Above all, it should serve to inform the broader logistics and supply chain sector on what can be achieved by implementing novel and smart innovative ideas and what is needed to make these implementations successful.

In order to support this approach of bridging theory and practice in modern logistics, a selected portfolio of theory outlines, practical examples and case studies and in particular project reports or knowledge management documentations within different areas of logistics and supply chain planning is presented in this volume. The editors have selected contributions from a wide variety of projects carried out in the Dinalog cluster and the Effizienzcluster LogistikRuhr. Contributions are grouped into five main parts, each representing key domains in the evolution of logistics and supply chain management:

- (A) Logistics innovation and sustainability;
- (B) Urban logistics;
- (C) Value chain management;
- (D) IT-based innovation; and
- (E) Logistics training and knowledge management.

Within each part, important topics are outlined and demonstrated through their application in a variety of case studies. This book is intended for both researchers and practitioners in the field of logistics and supply chain management, to serve as an important source of information for further research as well as implementation in practice and hence to stimulate further innovation.

The five parts are preceded by an introductory chapter by Henk Zijm and Matthias Klumpp. After a brief historical overview and a discussion of the need to design more sustainable supply chains, they list chances and opportunities and also discuss an approach advocated by the European Technology Platform for Logistics ALICE. The paper is completed with a discussion on training and competence management in logistics, including a preview on what may be expected.

Subsequently, Part I outlines *basic concepts and strategies* for sustainable and green logistics based on research and the implementation of new developments. Martijn Mes and Maria Iacob outline an approach of synchronodal transport planning in order to optimize transportation in light of greening the supply chain (“[Synchronodal Transport Planning at a Logistics Service Provider](#)”). In “[DAVINC<sup>3</sup>I: Towards Collaborative Responsive Logistics Networks in Floriculture](#)”, Jack van der Vorst, Robert Ossevoort, Marlies de Keizer, Tom van Woensel, Cor Verdouw, Edwin Wenink, Rob Koppes, and Robbert van Willegen describe research the results of a large research project on the development of a collaborative logistics network in the floriculture industry as a very high-value as well as high-quality example in terms of innovative logistics. In a larger perspective, sustainable multimodal hinterland networks, including the concept of extended gates, are discussed as a major approach toward green and cost-effective logistics by Albert Veenstra and Rob Zuidwijk (“[Towards Efficient Multimodal Hinterland Networks](#)”). Thomas Kjaergaard, Martin Schleper, and Christoph Schmidt suggest in “[Current Deficiencies and Paths for Future Improvement in Corporate](#)

**Sustainability Reporting**” that corporate sustainability reporting should be in the center of attention and management action in order to really achieve sustainable logistics. In an operational perspective, Simon Thunnissen, Luke van de Bunt, and Iris Vis are outlining the logistics impediments and chances of the use of LNG as a fuel for both the transport and maritime sector (“**Sustainable Fuels for the Transport and Maritime Sector: A Blueprint of the LNG Distribution Network**”). The final contribution in Part I comes from Raphael Heereman von Zuydtwyck and Holger Beckmann in “**Efficiency Optimization for Cold Store Warehouses Through an Electronic Cooperation Platform**”, in which they discuss a specialized but promising approach regarding the use of online cooperation in cold store warehousing in order to reduce the environmental impact of this important section of transportation.

Parts II and III outline different levels of the logistics chain and optimization perspective. Whereas Part II deals with the local level in *urban logistics* concepts, Part III addresses the global level of *value chain design* and optimization. In Part II, challenges, failures, and successes of urban freight transportation are discussed by Goos Kant, Hans Quak, René Peeters, and Tom Van Woensel (“**Urban Freight Transportation: Challenges, Failures and Successes**”). In “**The Role of Fairness in Governing Supply Chain Collaborations—A Case-Study in the Dutch Floriculture Industry**”, Robbert Janssen, Ard-Pieter de Man, and Hans Quak provide an insight into the impact of fairness considerations on local transport regimes in the floriculture industry. A further important aspect of urban logistics is last-mile parcel distribution, increasing steadily with e-commerce—and therefore the contribution of Theodoros Athanassopoulos, Kerstin Dobers, and Uwe Clausen is a welcome contribution that suggests options to reduce its environmental impact (“**Reducing the Environmental Impact of Urban Parcel Distribution**”). In “**Order Fulfillment and Logistics Considerations for Multichannel Retailers**” of this part, Kees Jan Roodbergen and Inger Kolman present a framework for decision making on order fulfillment and logistics in multichannel retail distribution.

In Part III, attention is paid to maintenance and service logistics. Maarten Driessen, Jan Willem Rustenburg, Geert-Jan van Houtum, and Vincent Wiers develop control structures for integrating decision making on inventory control and repair shop control for rotatable spare parts (“**Connecting Inventory and Repair Shop Control for Repairable Items**”). In “**Knowledge Lost in Data: Organizational Impediments to Condition-Based Maintenance in the Process Industry**”, Ronald van de Kerkhof, Henk Akkermans, and Nils Noorderhaven present a pilot study on the introduction of condition-based maintenance in the process industry, as a tool to increase asset availability. Jan Willem Rustenburg discusses the merits of a control tower approach for spare parts management as a radical new business model in “**Planning Services: A Control Tower Solution for Managing Spare Parts**”. Finally, in “**Impediments to the Adoption of Reverse Factoring for Logistics Service Providers**”, Christiaan de Goeij, Alexander Onstein, and Michiel Steeman focus on the adoption of supply chain finance methods, in particular reverse factoring, by suppliers in the logistics service businesses, as a tool to enhance chain liquidity.

Part IV is dedicated to the *information technology* enhancements driving many innovations in logistics and supply chain management. In “**Towards an Approach**

for [Long Term AIS-Based Prediction of Vessel Arrival Times](#)”, Alexander Dobrkovic, Maria Iacob, Jos van Hillegersberg, Martijn Mes, and Maurice Glandrup address how automatic information system data can be used to accurately predict vessel arrival times and thereby optimize logistics. More generally, the use of information technology as a tool for supply chain design, integrating various formerly isolated modules, is discussed and illustrated with case examples by Matthias Parlings, Tobias Hegmanns, Philipp Sprenger, and Daniel Kossmann in [“Modular IT-Support for Integrated Supply Chain Design”](#). Even more into current information technology research is the use of multi-agent systems, i.e., in transport coordination as presented by Frank Arendt, Oliver Klein, and Kai Barwig ([“Intelligent Control of Freight Services on the Basis of Autonomous Multi-agent Transport Coordination”](#)). Also the supply chain-wide implementation of RFID is still on the table for logistics innovation and value optimization as Kerem Oflazgil, Christian Hocken, Fabian Schenk, Oliver Teschl, Thorsten Lehr, Mareike de Boer, Christoph Schröder, and Rainer Alt outline in [“Smart.NRW—RFID as Enabler for an Intelligent FMCG Supply Chain”](#). The need to improve compliance to external regulations (e.g., customs) in supply chains, without delaying the flow more than necessary, presents a further challenge to smart information system design as Melissa Robles, Juan Diego Serrano, Maria Laura Maragunic, and Bernd Noche argue in [“Developing Support Tools for Compliance in Supply Chains”](#). A logistic assistance system to support quality control and quality management for logistic processes is presented by Markus Zajac and Christian Schwede ([“Cross-Process Production Control by Camera-Based Quality Management Inside a Logistic Assistance System”](#)). The last contribution of Part IV, [“Logistics Mall—A Cloud Platform for Logistics”](#) by Damian Daniluk, Maren Wolf, Oliver Wolf, and Michael ten Hompel, discusses the logistics mall, an approach for a domain-specific cloud platform for the trading and usage of logistics IT services and logistics processes.

Last but not least, the final Part V highlights the importance of *competencies and knowledge management for logistics* in bringing most innovation and technology approaches to full fruit. Therein, an approach for problem-oriented knowledge management in logistics is discussed by Natalia Straub, Christoph Besenfelder, and Sandra Kaczmarek ([“Problem-Oriented Knowledge Management for Efficient Logistics Processes”](#)). In [“Logistics Qualification: Best-Practice for a Knowledge-Intensive Service Industry”](#), Matthias Klumpp is providing an overview regarding measurement concepts as well as political initiatives directed toward best-practice approaches in logistics training and education. Finally, in [“Serious Games for Improving Situational Awareness in Container Terminals”](#), Alexander Verbraeck, Shalini Kurapati, and Heide Lukosch discuss the concept of situational awareness at container terminals as a basis for online (re)planning; they have developed various serious gaming-based instruments that have proven their value in the training of both students and practitioners in industry.

We would like to stress that many contributions include pilot or case studies at a large spectrum of industrial companies, which therefore essentially contribute to the objective of this volume: to bridge the gap between theory and practice in logistics and supply chain management. At this place, we extend our appreciation to their

willingness to share current processes and data and to jointly work with academic partners toward improving business processes. But most of all, we are grateful to all the authors for their highly valued contributions; working with them was a rewarding experience. Finally, we express the hope that the projects discussed in this book may be of interest to practitioners in industry as well as to industrial engineering and logistics students, and that they may serve as a source of inspiration for further research. We look forward to the further application and implementation of the innovative concepts presented in this volume in industry.

June 2015

Henk Zijm  
Matthias Klumpp  
Uwe Clausen  
Michael ten Hompel

# Collaboration Agreement: Signing Ceremony

On May 27, 2014, the Effizienzcluster LogistikRuhr and the Dutch Institute for Advanced Logistics (DINALOG) signed an agreement to jointly work on logistics and supply chain innovation, in close collaboration with industries and the logistics sector in Germany and the Netherlands. The signing ceremony was attended by their Majesties King Willem Alexander and Queen Maxima of the Netherlands, the Prime Minister of North-Rhine Westphalia, Mrs. Hannelore Kraft, The Minister of Economic Affairs of the Netherlands, Mr. Henk Kamp, and the Mayor of Dortmund, Mr. Ulrich Sierau.



*At the table (from left to right):*

Mr. Willem Heeren, Chairman of the Board of the Dutch Institute for Advanced Logistics

Prof. Dr. Michael ten Hompel, Chairman of the Board of the Effizienzcluster LogistikRuhr

*Standing behind the table (from left to right):*

Mr. Henk Kamp, Minister of Economic Affairs, the Netherlands

Dr. Thorsten Hülsmann, Director of the Effizienzcluster LogistikRuhr

Mr. Ulrich Sierau, Mayor of Dortmund

Mrs. Hannelore Kraft, Prime Minister of the State of North-Rhine Westphalia

His Majesty King Willem-Alexander of the Netherlands

Her Majesty Queen Maxima of the Netherland

Prof. Dr. Henk Zijm, Scientific Director of the Dutch Institute for Advanced Logistics

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