

Michael Hülsmann
Bernd Scholz-Reiter
Katja Windt *Editors*

Autonomous Cooperation and Control in Logistics

Contributions and Limitations –
Theoretical and Practical Perspectives

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Editors

Michael Hülsmann
Jacobs University Bremen
Systems Management - International Logis
Campus Ring 1
28759 Bremen
Germany
m.huelsmann@jacobs-university.de

Katja Windt
Jacobs University Bremen
Global Production Logistics - Internatio
Campus Ring 1
28759 Bremen
Germany
k.windt@jacobs-university.de

Prof.Dr. Bernd Scholz-Reiter
Universität Bremen
BIBA GmbH
Bremer Institut für Messtechnik
Automatisierung und Qualitätswiss.
Hochschulring 20
28359 Bremen
Germany
bsr@biba.uni-bremen.de

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Preface

The edited volume “Autonomous Cooperation and Control in Logistics: Contributions and Limitations – Theoretical and Practical Perspectives” consequently continues the previous publication “Understanding Autonomous Cooperation and Control in Logistics – The Impact of Autonomy on Management, Information, Communication, and Material Flow”, edited by Michael Hülsmann and Katja Windt. This first volume focuses on collating various understandings of self-organisation. It intends to establish a common perspective on basic ideas and their adoption and adaptability to logistics. Additionally, that publication identifies and compares the scope and depth of autonomous cooperation and control resulting from various, interdisciplinary understandings of self-organisation. Therefore, the first edited volume aims for developing a conceptual system for autonomous cooperation and control, which allows to interpret discipline-specifically, to functionalise, and to apply autonomous cooperation and control in the context of logistic systems. It is dedicated to provide logistics research as well as practice with first impulses for answering the question how logistics management can better cope with complexity and dynamics in supply chains and networks. All in all, the first edited volume “Understanding Autonomous Cooperation and Control in Logistics – The Impact of Autonomy on Management, Information, Communication, and Material Flow” provides a terminological, taxonomical, and analytical framework to examine, explain, and apply the principles of self-organisation in the context of complex, dynamic logistics processes.

Consistently, the second edited volume “Autonomous Cooperation and Control in Logistics: Contributions and Limitations – Theoretical and Practical Perspectives” uses the developed framework to approach the challenge of finding an optimal degree of autonomous cooperation and control of logistics processes. Therefore, this publication seeks to determine analytically the upper and lower boundaries of autonomous cooperation and control. This focus should lead to a common understanding of the enablers and impediments of applying the idea of self-organisation as a paradigmatic principle to logistics and the design, planning, and control of its processes. Hence, this edited volume is dedicated to identify, describe, and investigate – in the context of production and distribution logistics – the effects, feasibility, outcomes, barriers, driving forces, cause-effect-relations, etc. of concepts, methods, technologies, and routines, that are based on and linked with the idea of self-organisation in logistics. Therefore, it is the major objective of this edited volume

to give a broad overview about the contributions and limitations of autonomous cooperation and control of logistics processes. Furthermore, this publication should outline a first answer to how the abstract idea of self-organisation can substantially contribute to a better performance and robustness of complex and dynamic logistics systems in versatile and volatile environments. In this regard this edited volume comprises first implementations in real industrial scenarios as well and demonstrates on practical examples the logistic potential and its limitations.

Both research objects – logistics as well as the idea of autonomous cooperation and control – need an interdisciplinary approach, which can cover all their heterogeneous characteristics (e.g. technological and organisational). Therefore, this edited volume combines the different perspectives of production technology, electronics and communication engineering, informatics and mathematics, as well as management sciences and economics. The solid foundation for the necessary integration of these diverse points of view is built on the interdisciplinary research within the Collaborative Research Centre 637 (CRC 637) “Autonomous Cooperating Logistic Processes – A Paradigm Shift and its Limitations” at the University of Bremen since 2004. The CRC 637 intends to identify the rules of autonomous cooperation and control in order to develop a “theoretical backbone” for applying this paradigm on all levels of logistics systems: on the managerial decision-making level, on the information processing and communication level, and on the material flow level. Therefore, this publication edited volume covers all perspectives and levels addressed above in order to provide a comprehensive and profound picture of contributions and restrictions of autonomous cooperation and control of logistics processes – which might help to understand the related paradigm-shift and its limitations.

This publication is the result of a fruitful and pleasant cooperation, collaboration, and communication between many actors, whose invaluable work made this edited volume possible. First of all, we like to thank our colleagues and doctoral students within the CRC 637 and around this institution for the inspiring, intriguing discourses, reflections, and exchanges of ideas within the last seven years. During our debates and conversations we had the outstanding opportunity to learn from other disciplines. This included also the challenge to develop shared perspectives on the same object (i.e. autonomous cooperation and control in logistics) from the background of different scientific cultures, theoretical frameworks, and methodological approaches. Therefore, it was always an honour and contentment for us having the chance to edit this volume and we are very grateful for this exciting experience in our academic career. Secondly, we are tremendously happy and grateful for the contributions of the voluntary reviewers, who spent their limited and valuable time for improving the quality of the contributions in this edited volume. Without any doubt, the reviewers’ comments formed the various collections of a good idea, an appropriate research conception, and all the other ingredients of a scientific article into the shape of consistent and solid argumentation. There are also very helpful and important hands, which backed us up by thoroughly taking care of all the supporting activities. For this, we would like to express our appreciation to Dipl.-Wi.-Ing. Anne Schwientek, who coordinated the compilation and

editing of all articles; to Dipl.-Oec. Philip Cordes for supporting and reviewing; to Lore Zander and Dipl.-Inf. Jacob Piotrowski for handling the administrative side; to Susanne Benner and Caroline Hannemann for proof-reading and editing. Naturally, we would like to say thank you to our publisher SpringerPhysica, represented by Thomas Lehnert, for his motivating feedbacks and for giving us the chance to publish our edited volume “Autonomous Cooperation and Control in Logistics: Contributions and Limitations – Theoretical and Practical Perspectives” at SpringerPhysica’s. Finally, we would like to thank the German Research Foundation (DFG), which supported this research as part of the Collaborative Research Centre 637 “Autonomous Cooperating Logistic Processes – A Paradigm Shift and its Limitations”.

*Michael Hülsmann
Bernd Scholz-Reiter
Katja Windt*

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Contributors

Linda Austerschulte Systems Management, International Logistics, School of Engineering and Science, Jacobs University Bremen, Bremen, Germany

Till Becker Global Production Logistics, International Logistics, School of Engineering and Science, Jacobs University Bremen, Bremen, Germany, t.becker@jacobs-university.de

Jan Ole Berndt TZI IS, Universität Bremen, Am Fallturm 1, 28359 Bremen, Germany, joberndt@tzi.de

Philip Cordes Systems Management, International Logistics, School of Engineering and Science, Jacobs University Bremen, Germany, p.cordes@jacobs-university.de

Sergey Dashkovskiy ZeTeM, Universität Bremen, Bibliothekstr.1, 28359 Bremen, Germany, dsn@math.uni-bremen.de

Farideh Ganji Department of Planning and Control of Production Systems, BIBA, University of Bremen, Bremen, Germany

Nicolas Gebhardt Global Production Logistics, International Logistics, School of Engineering and Science, Jacobs University Bremen, Bremen, Germany, n.gebhardt@jacobs-university.de

Jan D. Gehrke TZI – Center for Computing Technologies, University of Bremen, Bremen, Germany

Carmelita Görg Communication Networks, University of Bremen, Bremen, Germany

Michael Görges Department of Planning and Control of Production Systems, BIBA, University of Bremen, Germany

Carl Hans Department of Planning and Control of Production Systems, BIBA, University of Bremen, Bremen, Germany

Ottohein Herzog TZI – Center for Computing Technologies, University of Bremen, Bremen, Germany, herzog@tzi.de

Jantje Hoppert Department of Planning and Control of Production Systems, BIBA, University of Bremen, Bremen, Germany

Karl A. Hribernik Department of Planning and Control of Production Systems, BIBA, University of Bremen, Bremen, Germany, hri@biba.uni-bremen.de

Michael Hülsmann Systems Management, International Logistics, School of Engineering and Science, Jacobs University Bremen, Campus Ring 1, 28759 Bremen, Germany, m.huelsmann@jacobs-university.de

Amir Jabbari Microsystems Center Bremen, University of Bremen, Bremen, Germany

Thomas Jagalski Department of Planning and Control of Production Systems, BIBA, University of Bremen, Germany

Reiner Jedermann Microsystems Center Bremen, University of Bremen, Bremen, Germany, rjedermann@imsas.uni-bremen.de

Oliver Jeken Global Production Logistics, International Logistics, School of Engineering and Science, Jacobs University Bremen, Bremen, Germany

Ernesto Morales Kluge Department of Planning and Control of Production Systems, BIBA, University of Bremen, Bremen, Germany

Heiko Wieland Kopfer Institute of Machine Elements, Fastening Systems and Product Innovation, University of Siegen, Siegen, Germany, heiko.kopfer@uni-siegen.de

Herbert Kopfer Chair of Logistics, University of Bremen, Bremen, Germany

Benjamin Korsmeier Systems Management, International Logistics, School of Engineering and Science, Jacobs University Bremen, Bremen, Germany

Christoph Kramer Department of Planning and Control of Production Systems, BIBA, University of Bremen, Bremen, Germany

Hans-Jörg Kreowski Department of Computer Science, University of Bremen, Bremen, Germany, kreo@tzi.de

Sabine Kuske Department of Computer Science, University of Bremen, Bremen, Germany

Walter Lang Microsystems Center Bremen, University of Bremen, Bremen, Germany

Hagen Langer TZI – Center for Computing Technologies, University of Bremen, Bremen, Germany

Melanie Luderer Department of Computer Science, University of Bremen, Bremen, Germany

Rainer Malaka TZI – Center for Computing Technologies, University of Bremen, Bremen, Germany

Andrii Mironchenko ZeTeM, Universität Bremen, Bibliothekstr.1,
28359 Bremen, Germany, andmir@math.uni-bremen.de

Lars Naujok ZeTeM, Universität Bremen, Bibliothekstr.1, 28359 Bremen,
Germany, larsnaujok@math.uni-bremen.de

Javier Palafox-Albarran Microsystems Center Bremen, University of Bremen,
Bremen, Germany

Jakub Piotrowski Department of Planning and Control of Production Systems,
BIBA, University of Bremen, Bremen, Germany, pio@biba.uni-bremen.de

Robert Porzel TZI – Center for Computing Technologies, University of Bremen,
Bremen, Germany

Henning Rekersbrink Department of Planning and Control of Production
Systems, BIBA, University of Bremen, Bremen, Germany

Daniel Rippel Department of Planning and Control of Production Systems, BIBA,
University of Bremen, Bremen, Germany

Carmen Ruthenbeck Department of Planning and Control of Production
Systems, BIBA, University of Bremen, Bremen, Germany

Bernd Scholz-Reiter Department of Planning and Control of Production Systems,
BIBA, University of Bremen, Bremen, Germany, bsr@biba.uni-bremen.de

Jörn Schönberger Chair of Logistics, University of Bremen, Bremen, Germany,
jsb@uni-bremen.de

Arne Schuldt TZI IS, Universität Bremen, Am Fallturm 1, 28359 Bremen,
Germany, as@tzi.de

Anne Schwientek Systems Management, International Logistics, School of
Engineering and Science, Jacobs University Bremen, Bremen, Germany,
a.schwientek@jacobs-university.de

Steffen Sowade Department of Planning and Control of Production Systems,
BIBA, University of Bremen, Bremen, Germany

Michael Teucke Department of Planning and Control of Production Systems,
BIBA, University of Bremen, Bremen, Germany

Klaus-Dieter Thoben Department of Planning and Control of Production
Systems, BIBA, University of Bremen, Bremen, Germany

Marius Veigt Department of Planning and Control of Production Systems, BIBA,
University of Bremen, Bremen, Germany, vei@biba.uni-bremen.de

Caroline von Totth Department of Computer Science, University of Bremen,
Bremen, Germany

Xin Wang Chair of Logistics, University of Bremen, Bremen, Germany

Tobias Warden TZI – Center for Computing Technologies, University of Bremen, Bremen, Germany, warden@tzi.de

Bernd-Ludwig Wenning Communication Networks, University of Bremen, Bremen, Germany, wenn@comnets.uni-bremen.de

Katja Windt Global Production Logistics, International Logistics, School of Engineering and Science, Jacobs University Bremen, Bremen, Germany, k.windt@jacobs-university.de

Christian Zabel Department of Planning and Control of Production Systems, BIBA, University of Bremen, Bremen, Germany

Associated Editors

Enzo Morosini Frazzon Department of Production and Systems Engineering, Technology Center - CTC, Federal University of Santa Catarina, Caixa Postal 476 - Campus Universitário UFSC, Trindade, CEP 88040-970, Florianópolis, Santa Catarina, Brazil

David Gouyon Centre de Recherche en Automatique de Nancy, Faculté des Sciences et Techniques, Université Henri Poincaré, BP 70239, 54506 Vandoeuvre les Nancy Cedex, France

Norbert Gronau Lehrstuhl für Wirtschaftsinformatik und Electronic Government, Universität Potsdam, August-Bebel-Str. 89, 14482 Potsdam, Germany

Hans-Dietrich Haasis Lehrstuhl für Allgemeine Betriebswirtschaftslehre und Industriebetriebslehre, Fachbereich Wirtschaftswissenschaft, Universität Bremen, Wilhelm-Herbst-Straße 12, 28359 Bremen, Germany

Hamid Reza Karimi Faculty of Engineering and Science, University of Agder, Postboks 509, 4898, Grimstad, Norway

Kap Hwan Kim Department of Industrial Engineering, Pusan National University, Changjeon-dong, Kumjeong-ku, Pusan 609-735, Korea

Simone Kirpal Zentrum für Sozialpolitik – Geschlechterpolitik im Wohlfahrtsstaat – UNICOM-Gebäude, Universität Bremen, Mary-Somerville-Straße 5, 28359 Bremen, Germany

Dirk Christian Mattfeld Lehrstuhl Decision Support, Institut für Wirtschaftsinformatik, Technische Universität Braunschweig, Mühlenpfordstraße 23, 38106 Braunschweig, Germany

William McKelvey UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA 90095, USA

Nariaki Nishino Department of Technology Management for Innovation, School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

Ranjit Perera Department of Electrical Engineering, University of Moratuwa, Katubedda, Moratuwa, Sri Lanka

Mykhaylo Postan Lehrstuhl für Management und Marketing, National Odessa Maritime University, Mechnikov Str. 34, 65029 Odessa, Ukraine

Christian Prins Laboratoire d'Optimisation des Systèmes Industriels, Institut Charles Delaunay, Université de technologie de Troyes, 12, Rue Marie Curie, BP 2060, 10010 Troyes Cedex, France

Johannes Schöning Innovative Retail Laboratory, DFKI GmbH Campus D3_2, Stuhlsatzenhausweg 3, 66123 Saarbrücken, Germany

Jens Schumacher Wirtschaftsinformatik, FH Vorarlberg, Hochschulstraße 1, 6850 Dornbirn, Austria

Gabriele Taentzer Fachbereich Mathematik und Informatik, Philipps-Universität Marburg, Hans-Meerwein-Straße, 35032 Marburg, Germany

Ingo J. Timm Wirtschaftsinformatik I, Universität Trier, Universitätsring 15 54296 Trier, Germany

Ipke Wachsmuth AG Wissensbasierte Systeme, Technische Fakultät, Universität Bielefeld, Universitätsstr. 25, 33615 Bielefeld, Germany

Hans-Peter Wiendahl Institut für Fabrikanlagen und Logistik, Leibniz Universität Hannover An der Universität 2, 30823 Garbsen, Germany

Authors

Austerschulte, Linda

Dipl.-Wi.-Ing. Linda Austerschulte studied Industrial Engineering and Management at the University of Bremen. She received her diploma in 2006. From 2006 to 2009, she worked as a research associate and PhD student at the University of Bremen in the working group “Sustainable Systems Development.” Since then, Linda Austerschulte is a research associate at Jacobs University Bremen in the working group “Systems Management” of Prof. Dr. M. Hülsmann. Her research interests include Strategic Management of Organizational Capabilities and the Measurement of Intangible Assets.

Becker, Till

Till Becker studied Information Systems at the University of Münster, Germany. After graduation, he worked for 2 years as an IT auditor and consultant before he returned to academia. He is now a member of the Global Production Logistics workgroup of Prof. Dr.-Ing. Katja Windt at Jacobs University Bremen. As a research associate and PhD student, he focuses his research on graph representations of logistics networks and computer simulations.

Berndt, Jan Ole

Jan Ole Berndt received his Diploma in Computer Science from the Universität Bremen in 2009. He is a member of the Artificial Intelligence research group of Prof. Otthein Herzog at the Universität Bremen, holding a scholarship granted by the International Graduate School for Dynamics in Logistics.

Cordes, Philip

Dipl.-Economist Philip Cordes completed his Diploma in Business Sciences at the University of Bremen in 2008. He is a research associate and PhD student of Prof. Dr. Michael Hülsmann in the department “Systems Management” in the School of Engineering and Science at the Jacobs University Bremen. Since May 2008, Philip Cordes is working for the Collaborative Research Centre 637 “Autonomous Cooperating Logistics Processes – A Paradigm Shift and Its Limitations” funded by the German research foundation (DFG).

Dashkovskiy, Sergey

Sergey Dashkovskiy received the MSc degree in Applied Mathematics and Mechanics from the Lomonosov Moscow State University, Moscow, Russia, in 1996 and the PhD degree in Mathematics from the University of Jena, Jena, Germany, in 2002. He is the head of the research group Mathematical Modeling of Complex Systems at the Center of Industrial Mathematics, University of Bremen, Germany. His research interests are in the field of nonlinear control theory and partial differential equations.

Ganji, Farideh

Dipl. -Ing. Farideh Ganji works as a technical assistant at the BIBA – Bremer Institut für Produktion und Logistik GmbH in the University of Bremen in the division Intelligent Production and Logistic Systems.

Gebhardt, Nicolas

Nicolas Gebhardt studied Mechanical Engineering at Hamburg University of Technology (TUHH). After his studies, he joined the work group of Prof. Dr.-Ing. Katja Windt for Global Production Logistics at Jacobs University Bremen as a research associate. His main research interest is logistics-oriented design and autonomous control.

Gehrke, Jan

Jan D. Gehrke received his diploma degree in Computer Science from the University of Bremen in 2005 with a thesis on knowledge-based scene analysis for intelligent vehicles. He joined the research group of Otthein Herzog as a research assistant in 2005 and is since then affiliated to the CRC 637. His research focuses on intelligent agents in logistics as well as knowledge representation and management in MAS.

Görg, Carmelita

Prof. Dr. rer. nat. habil. Carmelita Görg is the head of the Communication Networks group (ComNets) at the University of Bremen within the TZI (Center for Computer Science and Information Technology). She is a member of the board of the ITG (Information Technology Society, Germany) and speaker of the ITG working group 5.2.1 on “System Architecture and Traffic Engineering.”

Görges, Michael

Dipl.-Wi.-Ing. Michael Görges works as a research scientist at the BIBA – Bremer Institut für Produktion und Logistik GmbH in the University of Bremen in the division Intelligent Production and Logistic Systems.

Hans, Carl

Dr.-Ing. Carl Hans is the head of the department “Intelligent ICT for Co-operative Production” at BIBA. As a research scientist, he focuses on the development and integration of ICT solutions in industrial and research projects in areas including Computer Simulation, Artificial Intelligence, and Knowledge Management.

Herzog, Otthein

Dr. Otthein Herzog, professor em. of Artificial Intelligence at the Universität Bremen, and professor of Visual Information Technologies at Jacobs University Bremen. His research interests are: Multiagent-Systems, Knowledge Management, Wearable Computing, and Content-Based Multimedia Analysis. He (co-)authored 190+ scientific papers and is a member of the German Academy of Science and Engineering.

Hoppert, Jantje

M.A. Kult. Jantje Hoppert is a member of the CRC 637 at the University of Bremen. She included the organizational perspective on limitations of autonomous control into the investigated projects.