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Understanding Autonomous Cooperation and Control in Logistics
Understanding Autonomous Cooperation and Control in Logistics

The Impact of Autonomy on Management, Information, Communication and Material Flow

With 91 Figures
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Preface

The idea and results of the edited volume “Understanding Autonomous Cooperation and Control in Logistics – The Impact of Autonomy on Management, Information, Communication, and Material Flow” are based on the interdisciplinary research of the working group “Autonomous Cooperation” within the Collaborative Research Centre 637 (CRC 637) “Autonomous Cooperating Logistic Processes – A Paradigm Shift and its Limitations” at the University of Bremen.

The starting point of this research is to lay foundations for building a theory concerning the concept of autonomous cooperation and control (including technologies and instruments) in logistics. A further aim is to gain valid knowledge about the involved causal relations so as to apply the concept in practice. Therefore, the research of the CRC 637 tries to identify rules of the paradigm of autonomous cooperation and to find the means, whereby the degree of autonomous cooperation can be designed on all levels of logistic systems:

- On the decision making level;
- On the information and communication level;
- On the material flow level of logistics management.

It is expected that a higher degree of autonomous cooperation in logistic processes could be one approach to dealing with the increasing complexity and dynamics in logistic systems. This might be possible because on the one hand autonomous cooperation might lead to an increasing flexibility, which could further lead to positive emergency and improvement in process quality (i.e. robustness). On the other hand, autonomous cooperation could also have contradictory effects on productivity, which might be attributed to the immanent redundancy in resources as well as structures and the delegation of decision power. Thus, the CRC 637 is striving for the answer to the question what the optimal degree of autonomous cooperation might be.

In order to enable the implementation of self-organisation ideas as a principle of autonomous cooperation, control and organisation for logistic systems, it is the overarching aim of this edited volume to gain an interdisciplinary understanding of it. Therefore, the contributions in this edited volume try to develop an approach from different perspectives of production technology, electronics and communication engineering, informatics
and mathematics, as well as business studies to determine how the concept of autonomous cooperation and control can be applied to logistics. This includes the individual description of the phenomena and principles of autonomous cooperation as well as an analysis of its implications for management, information, communication, and material flow. Therefore, the edited volume is to accomplish the following tasks:

- To collate various understandings of self-organisation, which have a comprehensive and differentiable description of its basic ideas and its adoption to logistics as an organisational principle;
- To identify and compare the scope and depth of autonomous cooperation and control resulting from various understandings of self-organisation, in order to summarise the commonness and differences and to allow development of an applicable understanding of autonomous cooperation and control for logistics;
- To establish an overarching conception of autonomous cooperation and control, which gives impulses for the research within different disciplines to answer the question, as to how logistics management can cope with complexity and dynamics in supply chains and networks in a better way;
- To develop a conceptual and terminological system for autonomous cooperation and control, but without a too detailed concretisation, which allows discipline-specific interpretation, functionalisation and application in the context of logistic systems.

Like most publications this edited volume is also based on the invaluable work and contributions of many helpful hands. Therefore, we, the editors, have the great honour and pleasure to thank everybody, who made this book possible. Firstly, we want to express our deep gratitude to the colleagues from the Collaborative Research Centre 637 (CRC 637) “Autonomous Cooperating Logistic Processes – A Paradigm Shift and its Limitations”. Their contributions to this publication did not only shed light on our understanding of what autonomous cooperation and control is all about, what it implies for the design of logistics processes and systems, and what we can learn from other disciplines for the analysis of complexity and dynamics in logistics. It was also personally for us a real delight to work together with them on this edited volume. Secondly, we had the helpful support of the members of the board of the CRC 637, Prof. Dr. Carmelita Görg, Prof. Dr. Otthein Herzog, and Prof. Dr.-Ing. Bernd Scholz-Reiter. Their backing up was always an excellent motivation for us to proceed with our edited volume. They provided several inspiring ideas which helped us very much to realise this project. Thirdly, the always-courteous
Lore Zander handled many administrative duties. Many thanks for their inestimable help. Additionally, we could constantly rely on the cooperative coordination, careful editing, proof reading and accurate layout of Jan Tell, Dipl.-Ing. Thorsten Phillip, Ying Li, M.A., and Dan Smith. For this dependable support we, the editors, are greatly indebted. And of course, we want to express our appreciation to the publisher SpringerPhysica, represented by Thomas Lehnert. It was a constant source of stimulation to know, that we had been offered the occasion to publish our edited volume “Understanding Autonomous Cooperation and Control in Logistics – The Impact of Autonomy on Management, Information, Communication and Material Flow” 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”.

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Contents

1 Changing Paradigms in Logistics – Understanding the Shift from Conventional Control to Autonomous Cooperation and Control........................................................................................................1

Katja Windt, Michael Hülsmann

1.1 Introduction..........................................................................................1
1.2 Drivers and enablers of autonomous cooperation and control in logistic processes .................................................................2
1.3 Autonomous cooperation and control – a general understanding..........................................................................................7
1.4 Aims of the edited volume..................................................................11
1.5 Structure of the edited volume..........................................................12

2 Fundamental Basics and Concepts of Autonomous Control and Cooperation.....................................................................................17

Katja Windt, Michael Hülsmann

2.1 Perspectives on Initial Ideas and Conceptual Components of Autonomous Cooperation and Control....................................................17

2.2 Prologue to Autonomous Cooperation – the Idea of Self-Organisation as its Basic Concepts...............................................................23

Michael Hülsmann, Christine Wycisk, Robin Agarwal, Jörn Grapp

2.2.1 Introduction.....................................................................................23
2.2.2 Concepts of self-organisation .....................................................24
2.2.3 Characteristics of self-organizing systems.................................35
2.2.4 Conclusions..................................................................................38

2.3 Historical Development of the Idea of Self-Organisation in Information and Communication Technology .................................45

Markus Becker, Koojana Kuladinithi, Andreas Timm-Giel, Carmelita Görg

2.3.1 Ad hoc networks ............................................................................46
2.3.2 Peer to peer networks......................................................................50
2.3.3 Autonomic computing .................................................................51
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3.4</td>
<td>Autonomic communication</td>
<td>52</td>
</tr>
<tr>
<td>2.3.5</td>
<td>Conclusions and future directions</td>
<td>53</td>
</tr>
<tr>
<td>2.4</td>
<td>Catalogue of Criteria for Autonomous Control in Logistics</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Felix Böse, Katja Windt</td>
<td></td>
</tr>
<tr>
<td>2.4.1</td>
<td>Introduction</td>
<td>57</td>
</tr>
<tr>
<td>2.4.2</td>
<td>Definition of autonomous control</td>
<td>58</td>
</tr>
<tr>
<td>2.4.3</td>
<td>System layers of autonomous control</td>
<td>61</td>
</tr>
<tr>
<td>2.4.4</td>
<td>Derivation of a catalogue of criteria</td>
<td>62</td>
</tr>
<tr>
<td>2.4.5</td>
<td>Operationalisation of the catalogue of criteria</td>
<td>64</td>
</tr>
<tr>
<td>2.4.6</td>
<td>Application of the catalogue of criteria</td>
<td>66</td>
</tr>
<tr>
<td>2.4.7</td>
<td>Conclusions and outlook</td>
<td>69</td>
</tr>
<tr>
<td>2.5</td>
<td>Business Process Modelling of Autonomously Controlled Production Systems</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Felix Böse, Katja Windt</td>
<td></td>
</tr>
<tr>
<td>2.5.1</td>
<td>Introduction</td>
<td>73</td>
</tr>
<tr>
<td>2.5.2</td>
<td>Autonomous control in production systems</td>
<td>74</td>
</tr>
<tr>
<td>2.5.3</td>
<td>Business process modelling of autonomous control</td>
<td>75</td>
</tr>
<tr>
<td>2.5.4</td>
<td>Changes in order processing by autonomous control</td>
<td>77</td>
</tr>
<tr>
<td>2.5.5</td>
<td>Conclusions</td>
<td>82</td>
</tr>
<tr>
<td>2.6</td>
<td>Strategic Decisions for Autonomous Logistics Systems</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Lars Arndt, Georg Müller-Christ</td>
<td></td>
</tr>
<tr>
<td>2.6.1</td>
<td>Introduction</td>
<td>85</td>
</tr>
<tr>
<td>2.6.2</td>
<td>Autonomous cooperation in logistics as delegation of decision making</td>
<td>86</td>
</tr>
<tr>
<td>2.6.3</td>
<td>Delegation of decision making as a process of boundary opening and its strategic relevance</td>
<td>89</td>
</tr>
<tr>
<td>2.6.4</td>
<td>Boundary management as an enabling tool for the implementation of autonomous cooperation</td>
<td>94</td>
</tr>
<tr>
<td>2.6.5</td>
<td>Conclusions</td>
<td>98</td>
</tr>
<tr>
<td>2.7</td>
<td>Autonomous Units: Basic Concepts and Semantic Foundation</td>
<td>103</td>
</tr>
<tr>
<td></td>
<td>Karsten Hölscher, Renate Klempien-Hinrichs, Peter Knirsch, Hans-Jörg Kreowski, Sabine Kuske</td>
<td></td>
</tr>
<tr>
<td>2.7.1</td>
<td>Introduction</td>
<td>103</td>
</tr>
<tr>
<td>2.7.2</td>
<td>Autonomous units</td>
<td>105</td>
</tr>
<tr>
<td>2.7.3</td>
<td>Sequential semantics</td>
<td>112</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>2.7.4</td>
<td>Parallel semantics</td>
<td>114</td>
</tr>
<tr>
<td>2.7.5</td>
<td>Concurrent semantics</td>
<td>116</td>
</tr>
<tr>
<td>2.7.6</td>
<td>Conclusions</td>
<td>117</td>
</tr>
<tr>
<td>2.8</td>
<td>Mathematical Models of Autonomous Logistic Processes</td>
<td>121</td>
</tr>
<tr>
<td>2.8.1</td>
<td>Introduction</td>
<td>121</td>
</tr>
<tr>
<td>2.8.2</td>
<td>Logistic processes</td>
<td>124</td>
</tr>
<tr>
<td>2.8.3</td>
<td>Mathematical modelling of logistic processes</td>
<td>126</td>
</tr>
<tr>
<td>2.8.4</td>
<td>Autonomous control and its effects on the dynamics of logistic processes</td>
<td>131</td>
</tr>
<tr>
<td>2.8.5</td>
<td>An illustrative example</td>
<td>132</td>
</tr>
<tr>
<td>2.8.6</td>
<td>Conclusions</td>
<td>136</td>
</tr>
<tr>
<td>2.9</td>
<td>Autonomous Decision Model Adaptation and the Vehicle Routing Problem with Time Windows and Uncertain Demand</td>
<td>139</td>
</tr>
<tr>
<td>2.9.1</td>
<td>Introduction</td>
<td>139</td>
</tr>
<tr>
<td>2.9.2</td>
<td>The vehicle routing problem with time windows and uncertain demand</td>
<td>140</td>
</tr>
<tr>
<td>2.9.3</td>
<td>Model-based planning in dynamic environments</td>
<td>146</td>
</tr>
<tr>
<td>2.9.4</td>
<td>Numerical experiments</td>
<td>154</td>
</tr>
<tr>
<td>2.9.5</td>
<td>Conclusions</td>
<td>158</td>
</tr>
<tr>
<td>3</td>
<td>Autonomous Control Methods for the Management, Information and Communication Layer</td>
<td>163</td>
</tr>
<tr>
<td>3.1</td>
<td>Approaches to Methods of Autonomous Cooperation and Control for the Management-, Information- and Communication-Layer of Logistics</td>
<td>163</td>
</tr>
<tr>
<td>3.2</td>
<td>Self-Organization in Management Science</td>
<td>169</td>
</tr>
<tr>
<td>3.2.1</td>
<td>Introduction</td>
<td>169</td>
</tr>
<tr>
<td>3.2.2</td>
<td>Selected concepts using self-organization in management science</td>
<td>170</td>
</tr>
</tbody>
</table>
3.2.3 Major characteristics of self-organization in management science ........................................................183
3.2.4 Conclusions .................................................................................................................................186

3.3 Autonomous Cooperation –
A Way to Vitalize Organizations? .................................................................193

*Michael Hülsmann, Christine Wycisk*

3.3.1 Complexity and dynamics of social systems – the problem of unlocking .......................................................193
3.3.2 The concept of autonomous cooperation ..........196
3.3.3 Flexibility out of a competence-based-view ..........199
3.3.4 The contribution of autonomous cooperation to a flexibilization of social systems from a competence-based perspective ...........................................................................200
3.3.5 Conclusions .................................................................................................................................202

3.4 Self-Organization Concepts for the Information- and Communication Layer of Autonomous Logistic Processes .........207

*Markus Becker, Andreas Timm-Giel, Carmelita Görg*

3.4.1 Autonomic communication, autonomic computing and self-star ............................................................................207
3.4.2 Service discovery and gateway discovery ..........209
3.4.3 Ad hoc routing .................................................................................................................................211
3.4.4 Conclusions .................................................................................................................................212

3.5 Distributed Knowledge Management in Dynamic Environments ...........................................................................215

*Hagen Langer, Jan D. Gehrke, Otthein Herzog*

3.5.1 Introduction ........................................................................................................................................215
3.5.2 Intelligent agents ..................................................................................................................................216
3.5.3 Agent-based logistics ..........................................................................................................................216
3.5.4 Knowledge management based on roles and parameters .................................................................218
3.5.5 Conclusions ........................................................................................................................................229

3.6 Proactive Knowledge-Based Risk Management .................233

*Martin Lorenz, Boris Bemeleit, Otthein Herzog, and Jens Schumacher*

3.6.1 Introduction ........................................................................................................................................233
3.6.2 Risk management for autonomous decision-making ........................................................................239
3.6.3 Requirements for risk management for autonomous systems..............................243
3.6.4 Implementation of proactive risk management for autonomous logistic entities..............................247
3.6.5 Conclusions..................................................................................................................252

3.7 Autonomy in Software Systems.................................................................255


3.7.1 Introduction.................................................................................................................255
3.7.2 Ideas of Agency ..........................................................................................................256
3.7.3 Ideas of autonomous units ..........................................................................................264
3.7.4 Relationship between autonomous units and agents..............................................265
3.7.5 Advanced concepts of agency.....................................................................................267
3.7.6 Conclusions..................................................................................................................270

3.8 Specifying Adaptive Business Processes within the Production Logistics Domain – A new Modelling Concept and its Challenges ................................................................................275

Bernd Scholz-Reiter, Jan Kolditz, Torsten Hildebrandt

3.8.1 Introduction..................................................................................................................275
3.8.2 Autonomous control of logistic processes .................................................................275
3.8.3 Development of a logistics system based on autonomous cooperating processes..............................................277
3.8.4 Modelling autonomous control....................................................................................281
3.8.5 Fulfilment of requirements ..........................................................................................290
3.8.6 Conclusions..................................................................................................................292

4 Autonomous Control Methods and Examples for the Material Flow Layer .................................................................295

Katja Windt, Michael Hülsmann

4.1 Approaches to Methods of Autonomous Cooperation and Control and Examples for the Material Flow Layer.................................................................295

4.2 Evaluation of Autonomous Logistic Processes – Analysis of the Influence of Structural Complexity.....................303

Thorsten Philipp, Christoph de Beer, Katja Windt, Bernd Scholz-Reiter

4.2.1 Introduction..................................................................................................................303
4.2.2 Autonomy in production logistic ........................................ 305
4.2.3 Complexity of production systems .................................... 305
4.2.4 Measurement and evaluation of logistic objectives ............ 309
4.2.5 Shop floor scenario .......................................................... 314
4.2.6 Conclusions and outlook .................................................. 322

4.3 Autonomous Control by Means of Distributed Routing ....... 325
Bernd-Ludwig Wenning, Henning Rekersbrink, Andreas Timm-Giel, Carmelita Görg, Bernd Scholz-Reiter
4.3.1 Introduction...................................................................... 325
4.3.2 Routing algorithms in communication networks .......... 326
4.3.3 Comparison of logistic and communication networks .... 328
4.3.4 A distributed routing concept .......................................... 330
4.3.5 Conclusions and outlook .................................................. 334

4.4 Dynamic Transport Reference Scenarios................................. 337
Bernd-Ludwig Wenning, Henning Rekersbrink, Markus Becker, Andreas Timm-Giel, Carmelita Görg, Bernd Scholz-Reiter
4.4.1 Introduction...................................................................... 337
4.4.2 Traditional scenarios........................................................ 337
4.4.3 Components of dynamic transport logistic scenarios ..... 338
4.4.4 Evaluation criteria for transport scenarios ..................... 341
4.4.5 Example scenarios ........................................................... 343
4.4.6 Conclusions...................................................................... 349

4.5 Autonomously Controlled Storage Allocation on an
Automobile Terminal ............................................................... 351
Felix Böse, Katja Windt
4.5.1 Introduction...................................................................... 351
4.5.2 Initial situation ................................................................. 353
4.5.3 Opportunities for improvement........................................ 354
4.5.4 Objective target................................................................. 355
4.5.5 Simulation model............................................................... 357
4.5.6 Results.............................................................................. 360
4.5.7 Conclusions and outlook.................................................. 361
4.6 Intelligent Containers and Sensor Networks Approaches to apply Autonomous Cooperation on Systems with limited Resources ................................................................. 365

Reiner Jedermann, Christian Behrens, Rainer Laur, Walter Lang

4.6.1 Introduction .............................................................................. 365
4.6.2 Local data pre-processing ........................................................ 369
4.6.3 Relation to the definition of autonomous cooperation .. 373
4.6.4 Linking quality information and transport planning .... 374
4.6.5 Measurement of spatial distributed environmental parameters ........................................................................ 376
4.6.6 Applying autonomous cooperation in sensor networks ... 379
4.6.7 Conclusions and outlook ...................................................... 389

4.7 Transport Scenario for the Intelligent Container ............... 393

Reiner Jedermann, Jan D. Gehrke, Markus Becker, Christian Behrens, Ernesto Morales-Kluge, Otthein Herzog, Walter Lang

4.7.1 Scenario setting ..................................................................... 393
4.7.2 Steps of the transport demonstration ................................. 396
4.7.3 Institutional cooperation ....................................................... 403

Index ........................................................................................................ 405
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