

Contents

1	Changing Paradigms in Logistics – Understanding the Shift from Conventional Control to Autonomous Cooperation and Control.....	1
	<i>Katja Windt, Michael Hülsmann</i>	
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
2.1	Perspectives on Initial Ideas and Conceptual Components of Autonomous Cooperation and Control.....	17
	<i>Katja Windt, Michael Hülsmann</i>	
2.2	Prologue to Autonomous Cooperation – the Idea of Self-Organisation as its Basic Concepts.....	23
	<i>Michael Hülsmann, Christine Wycisk, Robin Agarwal, Jörn Grapp</i>	
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
	<i>Markus Becker, Koojana Kuladinithi, Andreas Timm-Giel, Carmelita Görg</i>	
2.3.1	Ad hoc networks	46
2.3.2	Peer to peer networks.....	50
2.3.3	Autonomic computing	51

2.3.4	Autonomic communication.....	52
2.3.5	Conclusions and future directions.....	53
2.4	Catalogue of Criteria for Autonomous Control in Logistics.....	57
	<i>Felix Böse, Katja Windt</i>	
2.4.1	Introduction.....	57
2.4.2	Definition of autonomous control.....	58
2.4.3	System layers of autonomous control.....	61
2.4.4	Derivation of a catalogue of criteria.....	62
2.4.5	Operationalisation of the catalogue of criteria.....	64
2.4.6	Application of the catalogue of criteria.....	66
2.4.7	Conclusions and outlook.....	69
2.5	Business Process Modelling of Autonomously Controlled Production Systems.....	73
	<i>Felix Böse, Katja Windt</i>	
2.5.1	Introduction.....	73
2.5.2	Autonomous control in production systems.....	74
2.5.3	Business process modelling of autonomous control.....	75
2.5.4	Changes in order processing by autonomous control.....	77
2.5.5	Conclusions.....	82
2.6	Strategic Decisions for Autonomous Logistics Systems.....	85
	<i>Lars Arndt, Georg Müller-Christ</i>	
2.6.1	Introduction.....	85
2.6.2	Autonomous cooperation in logistics as delegation of decision making.....	86
2.6.3	Delegation of decision making as a process of boundary opening and its strategic relevance.....	89
2.6.4	Boundary management as an enabling tool for the implementation of autonomous cooperation.....	94
2.6.5	Conclusions.....	98
2.7	Autonomous Units: Basic Concepts and Semantic Foundation.....	103
	<i>Karsten Hölscher, Renate Klempien-Hinrichs, Peter Knirsch, Hans-Jörg Kreowski, Sabine Kuske</i>	
2.7.1	Introduction.....	103
2.7.2	Autonomous units.....	105
2.7.3	Sequential semantics.....	112

2.7.4	Parallel semantics	114
2.7.5	Concurrent semantics.....	116
2.7.6	Conclusions.....	117
2.8	Mathematical Models of Autonomous Logistic Processes	121
	<i>Bernd Scholz-Reiter, Fabian Wirth, Michael Freitag, Sergey Dashkovskiy, Thomas Jagalski, Christoph de Beer, Björn Rüffer</i>	
2.8.1	Introduction.....	121
2.8.2	Logistic processes	124
2.8.3	Mathematical modelling of logistic processes	126
2.8.4	Autonomous control and its effects on the dynamics of logistic processes	131
2.8.5	An illustrative example	132
2.8.6	Conclusions.....	136
2.9	Autonomous Decision Model Adaptation and the Vehicle Routing Problem with Time Windows and Uncertain Demand	139
	<i>Jörn Schönberger, Herbert Kopfer</i>	
2.9.1	Introduction.....	139
2.9.2	The vehicle routing problem with time windows and uncertain demand.....	140
2.9.3	Model-based planning in dynamic environments	146
2.9.4	Numerical experiments	154
2.9.5	Conclusions.....	158
3	Autonomous Control Methods for the Management, Information and Communication Layer	163
3.1	Approaches to Methods of Autonomous Cooperation and Control for the Management-, Information- and Communication-Layer of Logistics.....	163
	<i>Michael Hülsmann, Katja Windt</i>	
3.2	Self-Organization in Management Science	169
	<i>Michael Hülsmann, Jörn Grapp, Ying Li, Christine Wycisk</i>	
3.2.1	Introduction.....	169
3.2.2	Selected concepts using self-organization in management science	170

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
	<i>Michael Hülsmann, Christine Wycisk</i>	
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
	<i>Markus Becker, Andreas Timm-Giel, Carmelita Görg</i>	
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
	<i>Hagen Langer, Jan D. Gehrke, Otthein Herzog</i>	
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
	<i>Martin Lorenz, Boris Bemeleit, Otthein Herzog, and Jens Schumacher</i>	
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
	<i>Ingo J. Timm, Peter Knirsch, Hans-Jörg Kreowski, Andreas Timm-Giel</i>	
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
	<i>Bernd Scholz-Reiter, Jan Kolditz, Torsten Hildebrandt</i>	
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
4.1	Approaches to Methods of Autonomous Cooperation and Control and Examples for the Material Flow Layer.....	295
	<i>Katja Windt, Michael Hülsmann</i>	
4.2	Evaluation of Autonomous Logistic Processes – Analysis of the Influence of Structural Complexity.....	303
	<i>Thorsten Philipp, Christoph de Beer, Katja Windt, Bernd Scholz-Reiter</i>	
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
	<i>Bernd-Ludwig Wenning, Henning Rekersbrink, Andreas Timm-Giel, Carmelita Görg, Bernd Scholz-Reiter</i>	
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
	<i>Bernd-Ludwig Wenning, Henning Rekersbrink, Markus Becker, Andreas Timm-Giel, Carmelita Görg, Bernd Scholz-Reiter</i>	
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
	<i>Felix Böse, Katja Windt</i>	
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
	<i>Reiner Jedermann, Christian Behrens, Rainer Laur, Walter Lang</i>	
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
	<i>Reiner Jedermann, Jan D. Gehrke, Markus Becker, Christian Behrens, Ernesto Morales-Kluge, Otthein Herzog, Walter Lang</i>	
4.7.1	Scenario setting.....	393
4.7.2	Steps of the transport demonstration.....	396
4.7.3	Institutional cooperation	403
	Index.....	405

Understanding Autonomous Cooperation and Control in
Logistics

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

Hülsmann, M.; Windt, K. (Eds.)

2007, XXVIII, 417 p., Hardcover

ISBN: 978-3-540-47449-4