

Thorsten Blecker / Wolfgang Kersten (Eds.)

Complexity Management in Supply Chains

Concepts, Tools and Methods



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Edited by

Thorsten Blecker, Wolfgang Kersten

With Contributions by

Nizar Abdelkafi, Alexander Archipov, Ozlem Bak,
Frank Bates, Thouraya Benna, Juan Manuel Besga,
Thorsten Blecker, Helmut Bliem, Eduardo Castellano,
Felix T. S. Chan, Tsung-Sheng Chang, C. F. Cheung,
C. M. Cheung, Jörg Dalhöfer, Luis Jacob Escobar-Saldivar,
Fernando Eizaguirre, Ozlem Ertugrul, Manfred Gronalt,
Akio Imai, Dmitry Ivanov, Bernd Kaluza, Alexey Kashevnik,
Nafisa Hambilbhai Kattarwala, Wolfgang Kersten, Ulrich Killat,
Niraj Kumar, S. K. Kwok, Hendrik Lamsali, Frank Laue,
W. B. Lee, Christian M. Meyer, Etsuko Nishimura,
Nazak Nobari, Stratos Papadimitriou, Martin Posset,
Klaus Rall, Eduardo Saiz, Sami Ben Sassi, Boris Sokolov,
Nikolay Shilov, Neale R. Smith, Alexander Smirnov,
Meike Tilebein, Vera Tolkacheva, Heike Vogeley,
Herwig Winkler, Isik Ozge Yumurtaci, Iñaki Zugasti

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Preface

Supply chains are faced with a rising complexity of products, structures and processes. This effect is based on a number of different reasons. Company specific causes like for instance inefficient organizational structures or weak standardization efforts are leading to a raised complexity in both the whole supply network and the single company. On the other hand industry wide trends such as globalization, a concentration on core competencies, shortened product lifecycles or a stronger customer orientation accompanied by heterogeneous and specific customer demands are also strengthening the complexity.

The effects of a raised complexity in Supply Chains are manifold. Operations of Supply Chain and Logistics Management are carried out at interfaces between divisions, different operations and diverse companies. Due to this reason they are faced with a large part of the complexity impacts such as raising costs, enlarged efforts for indirect operations or increased forecast uncertainties. Because of the strong link between a supply chain's complexity and its efficiency supply chain complexity management becomes a major challenge of today's business management.

Supply Chain and Logistics Management often do not have the necessary tools to directly influence the fundamental reasons of complexity. Concepts like "Design for Logistics" are developed but far away from a comprehensive implementation. Anyhow, Logistics and the Supply Chain Management can play a significant role in mastering and managing complexity. Several kinds of theoretic approaches and methods to manage complexity in Logistics and Supply Chain exist and are highlighted in the first section of his book. The second section is illustrating concepts for a complexity management in the area of transportation. Complexity and its effects are phenomena which can often be observed in networks. Due to this the third chapter is dealing with complexity in networks. The last chapter is presenting approaches and methods for a complexity management in Supply Chains. The main aim of this book is to exemplify the current progress in complexity management research. Therefore, actual trends and recent approaches are presented and discussed. Applicable solutions, practical examples and use cases are presented to illustrate complexity management and its application in Logistics and Supply Chain Management.

We would like to thank the authors for their excellent contributions to this book. All papers show a high quality and provide a part to the scientific progress in complexity management research. An additional thank should be given to the publishing company, the Erich Schmidt Verlag, especially to Dr. Joachim Schmidt who has convinced ourselves with his very professional, friendly and cooperative man-

ner. This book would not exist without a good organization and preparation. We would like to thank Dipl.-Ing. oec. Christian Martin Meyer and Dipl.-Ing. oec. Philipp Hohrath for their efforts to prepare, structure, and finish this book.

Hamburg, August 2006

Thorsten Blecker and Wolfgang Kersten

Table of Content

Preface	V
Table of Content	VII

Theoretical Approaches for Managing Complexity

Strategies and Metrics for Complexity Management in Supply Chains.....	3
<i>B. Kaluza, H. Bliem, and H. Winkler</i>	
Decentralized Supply Chain Management: A View from Complexity Theory.....	21
<i>Meike Tilebein</i>	
Managing the Complexity of Warehouse Material Handling Services within the Supply Network.....	37
<i>Frank Bates, Ozlem Ertugrul, and Isik Ozge Yumurtaci</i>	
Analysing Supply Chain Complexity via Agent-Based Negotiation.....	51
<i>Alexander Smirnov, Nikolay Shilov, and Alexey Kashevnik</i>	
Complexity in Variety-Rich-Production Systems	67
<i>Thorsten Blecker and Nizar Abdelkafi</i>	

Complexity in Transportation

An International Intermodal Routing Problem.....	87
<i>Tsung-Sheng Chang</i>	
Container Storage Problem on the Container Yard for Transshipment Containers.....	103
<i>Etsuko Nishimura, Akio Imai, and Stratos Papadimitriou</i>	
Stowage Planning of Container Ships	121
<i>Ulrich Killat, Frank Laue, and Heike Vogeley</i>	
Systematic Study of the Complexities Involved in Loading and Transportation of Air-Cargos	141
<i>Felix T. S. Chan and Niraj Kumar</i>	

Networks Modelling to Manage Complexity

Global and Flexible Supply Networks Modelling and Simulation..... 161
Eduardo Saiz, Eduardo Castellano, Juan Manuel Besga, Iñaki Zugasti, and Fernando Eizaguirre

Methodological Framework for Complexity and Uncertainty Factors
Embedding Into the Enterprise Network Modelling 189
Dmitry Ivanov

Decision Making Framework under Integrated Risk Modelling
in Collaborative Enterprise Network..... 203
Dmitry Ivanov, Boris Sokolov, Alexander Archipov, and Vera Tolkacheva

A Study of Visibility and Complexity of Supply Chain Using EPC
and RFID Technologies..... 215
C. M. Cheung, C. F. Cheung, W. B. Lee, and S. K. Kwok

SimConT Simulation of Hinterland Container Terminal Operations..... 227
Manfred Gronalt, Thouraya Benna, and Martin Posset

Complexity in Supply Chains

The Role of ICT in Solving Logistic Complexity: An Economic Point
of View 247
Sami Ben Sassi

Variety Management in the Painted Sheet Metal Industry 259
Neale R. Smith and Luis Jacob Escobar-Saldivar

Complexity and Impact of Internet Technologies, a Study
on Supply Chain Management 265
Ozlem Bak

A Human Capital Management Model to Optimize Resource Efficiency
of Logistics & Supply Chain Management 285
Nafisa Habilbhai Kattarwala

Performance Measurement of Green Supply Chain Management
(PM/GSCM) 303
Hendrik Lamsali

Developing Human Resource Strategy for Complex Supply Chains..... 313
Nazak Nobari

Complexity Management in Logistics and ETO-Supply Chains 325
Wolfgang Kersten, Klaus Rall, Christian M. Meyer, and Jörg Dalhöfer

Authors 343

Strategies and Metrics for Complexity Management in Supply Chains

B. Kaluza, H. Bliem, and H. Winkler

1 Problem Description

It is evident that in today's marketplace competition is no longer fought by single enterprises but by entire supply chains. Thus, supply chain management has emerged as an imperative for modern companies, in which the managements' emphasis has to amplify from the single enterprise to the entire supply chain. This leads to a dramatic increase of the perceived complexity for the management. (Wildemann, 2000b, pp. 1; Pfohl, 2000a, pp. 1)

The complexity of a supply chain is related to the numerousness, the variety of business processes in the supply chain, as well as to the number of interacting par pp. 10) Supply chain complexity is driven by internal and external drivers. (Milgate, 2001, pp. 106)

The internal drivers are mainly the managerial decisions and the tendency of organisational systems to create intricacy. They occur at each node of the supply chain as well as on the co-operation level. Exemplary managerial decisions that influence the numerousness and variety of the processes in the supply chain are decisions regarding the division of labour, co-operation, sourcing, product programme, and technology. (Seuring et al., 2004, pp. 108)

External drivers for supply chain complexity are uncertain demands and the high dynamics in today's marketplace. (Wilding, 1998b) They directly lead to a great number of different customer orders in terms of quantity, variety, quality, and time. Very often, it is difficult for the supply chain partners to fulfil such a broad range of different requirements because they cannot resort back to infinite competencies and capabilities. To cope with this problem they tend to extend the supply chain and to integrate additional partners. Thus, the total number of entities in the supply chain increases. Besides for this, dynamic customer requirements claim more frequent interactions with each of the supply chains' partners in order to align the supply chain. (Adam/Johannwille, 1998, pp. 6; Dooley/Ven, 1999, pp. 358) In other words, the number of managed business relations, business processes increases, as well as the number of managed interfaces and systems. This leads to a high degree of complexity for all of the involved partners and hampers the supply chains' performance. (Fisher et al, 1997, pp. 318; Vachon/Klassen, 2005, pp. 218)

Consequently, there is a strong need to integrate complexity management into supply chain management. (Childerhouse/Towill, 2004, pp. 585; Tan et al. 1999, pp. 1034)

2 Basics of Supply Chain Management and Complexity Management in Supply Chains

2.1 Basics of Supply Chain Management

The subject of supply chain management (SCM) is the strategic and operative planning and controlling of all materials, service flows, information, and money flows along the entire supply chain. This modern concept integrates all of the suppliers and customers up to the final consumer. Therefore, a single enterprise no longer competes alone, but the supply chain companies plan and realise the value added process in close co-operation. (Hanfield/Nichols, 1999, pp. 1) The targets of this co-operation are deducted directly from the customers' requirements. Hence, remarkable improvements in customer orientation can be achieved. This means that the alignment of the demand with supply and the production flexibility are both improved. (Pfohl, 2000b, pp. 1) Besides for this, the implementation of SCM leads to a more efficient allocation of resources and comprehensive stock reductions in the supply chain.

The basic targets of SCM are the effective design and efficient optimisation of the entire supply chain. In pursuing these targets, all of the supply chains' enterprises concentrate on their core competencies, share resources, and achieve a high level of integration with their partners in the supply chain. The actions of integration encompass, for example, the design of inter-organisational planning and controlling systems, the co-operative product design, the synchronisation of stocks and transports, as well as the co-operative design of packages. (Wildemann, 2000b; Lambert/Cooper, 2000, pp. 65)

Although the concept of SCM pursues various actions for the improvement of the supply chains' performance, important deficits can be highlighted, especially from the perspective of complexity. (Hahn, 2000, pp. 9)

First of all, SCM only poorly supports the resolution of important target conflicts. It mainly focuses on improvements in quality and delivery time as well as in the improvements of supply chain flexibility. However, the pursuit of these targets endangers the fulfilment of another important imperative of each supply chain, its cost efficiency. As aforementioned, measures to improve the supply chain flexibility, for example, extend across the integration of additional partners, the installation of redundant resources, and the increase of coordinating interactions in the supply chain. All of these measures result in the dramatic increase of supply chain complexity, which directly hampers the supply chains' cost efficiency. Additionally, a high supply chain complexity hampers the flexibility, quality, and delivery performance of the supply chain. Even though, the target conflicts between

complexity and the main strategic imperatives are obvious, they are actually out of the scope for SCM. Up to now, SCM has not strategically aimed at the reduction of supply chain complexity. (Klaus, 2005, pp. 360)

Another important deficit that can be highlighted in the field of SCM is closely related to this problem. Traditional SCM does not provide any strategic or operative recommendations regarding the optimal extent and manner of measures of SCM under different business circumstances that are characterised by the specific levels of supply chain complexity. This very often leads to an undifferentiated implementation of SCM. (Miragliotta et al., 2002, pp. 381) Subsequently, SCM does not consider the specific business characteristics of the supply chain enough and realises the inadequate SCM measures. However, these inadequate measures of SCM are not qualified to reach the supply chains' targets and to improve its overall performance. Instead, they increase the supply chain complexity dramatically because they increase the numerousness, variety, and connectivity of the elements of business partners, processes, and systems in the supply chain.

In addition, complexity management is poorly integrated into SCM up to now. This means that today, complexity is managed only on the company level, but not on the co-operation level of the supply chain. (Bliss, 2000, pp. 1) Thus, a high number of improvement initiatives realised by the supply chain companies has only a limited impact on supply chain performance. Resources along the entire supply chain are allocated ineffectively and the potential to decrease complexity cannot be realised sufficiently. (Towill/Naim, 1993, pp. 38)

2.2 *Basics of Complexity Management in Supply Chains*

The complexity of a system always relates to the numerousness, variety, and connectivity of its elements and the opacity of the relations between these elements as well as to the dynamics that act on this system. (Kirchhof, 2003, pp. 8; Schuh/Schwenk, 2001, pp. 10)

Therefore, the numerousness, variety, connectivity, opacity, and dynamics of the supply chain are important parameters of supply chain complexity. These parameters are the main turnkeys for SCM to master complexity and relate to certain objects in the supply chain. These objects have to be managed by SCM. (Miragliotta et al, 2002, pp. 381) The objects for complexity management are the processes in and between the supply chain companies, products and services, exchanged information, employed systems, business partners, as well as the business dynamics that act on the supply chain. (Turner/Williams, 2005, pp. 447) A manipulation of any of the parameters' effects on the objects of complexity directly influences the degree of complexity in the supply chain. (Seuring et al., 2004, pp. 180) The degree of complexity itself affects the supply chains' performance. (Beamon, 1999, pp. 275) Figure 1 depicts this well.

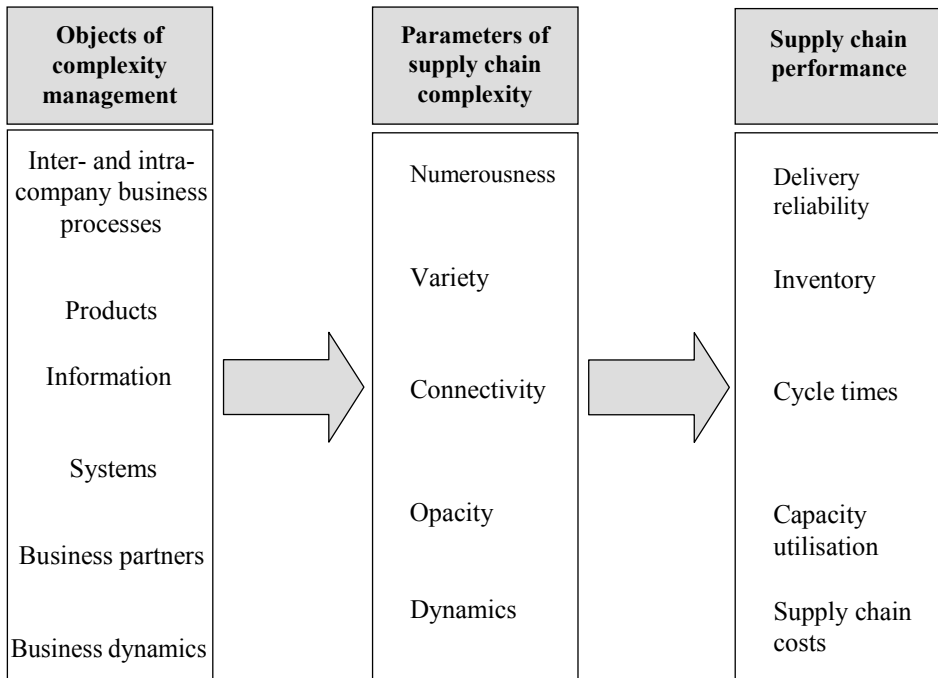


Figure 1: Objects and parameters of complexity management in supply chains

As can be seen in the picture above, SCM has the task to ensure an effective and efficient realisation of complexity management by the systematic controlling and manipulation of the parameters of supply chain complexity. (Cooper et al., 1992, pp. 38) Therefore, integrated complexity management has to support the resolution of target conflicts within the target system of the supply chain, to derive syntonised recommendations for the realisation of SCM measures in dependence on appearing business characteristics of the supply chain and to ensure an effective management of complexity within the entire supply chain. (Homburg/Raum, 1997a, pp. 306; Homburg/Raum 1997b, pp. 384)

We regard complexity management as an integral part of supply chain management and a mandatory prerequisite for the successful implementation of SCM in today's complex competitive environments. Complexity management in supply chains no longer has to be executed on the company level, but rather in an integrated manner on the co-operation level of the supply chain. This further development of complexity management aids in the avoidance of the inefficiencies along the entire supply chain. (Kirchhof, 2003, pp. 57)

To realise adequately integrated complexity management by the effective implementation of SCM in the supply chain, the business characteristics of the supply chain first have to be systematically analysed. (Lott, 2001; Schuh, 2004, p. 42) These characteristics determine, on the one hand, the potential impact of integrated

complexity management on supply chain performance, and on the other hand, constitute the required effort to realise integrated supply chain management. Outgoing from either a high or a small potential impact of integrated complexity management on supply chain performance, the supply chain companies have to decide as to whether they intend on implementing SCM with a small or high-required effort. (Vorst/Beulens, 2002, pp. 409)

Consequently, four different cases for complexity management can be distinguished. (Turner/Williams, 2005, pp. 447) For each case the integrated complexity management has the task to deduct clear strategic implications for the realisation of SCM. (Stacey, 1995, pp. 447) The following figure illustrates what we call the “complexity strategy matrix”. This matrix demonstrates the described dimensions to determine the optimal strategy for complexity management in supply chains. Additionally, it introduces the four resulting basic strategies for SCM to manage complexity, namely accepting, controlling, reducing, and avoiding complexity. (Seuring et al, 2004, pp. 180; Wildemann, 2000a) We will describe each of the strategies in the next chapter of this manuscript.

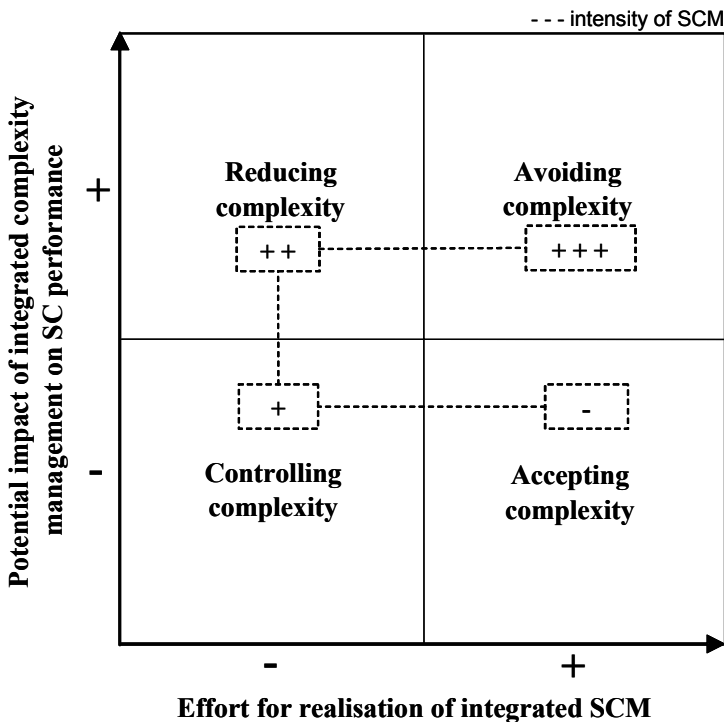


Figure 2: Complexity strategy matrix

▮ Supply chains are faced with a rising complexity with manifold effects. Because of the strong link between a supply chain's complexity and its efficiency, supply chain complexity management becomes a major challenge of today's business management. Therefore logistics and the supply chain management can play a significant role in mastering and managing complexity.

This book, edited by Thorsten Blecker and Wolfgang Kersten, is exemplifying the current progress in complexity management. Separate chapters are dedicated to clarify complexity management in transportation, networks and supply chains. You gain important insights of

- global and flexible network modelling to manage complexity
- complexity in supply chains – developing human resource strategy
- performance measurement of green supply chain management
- complexity in transportation by means of containers and air-cargos.

The volume, written by well-known experts of supply chain management from all over the world, shows you applicable solutions, practical examples and use cases to illustrate complexity management and its application in logistics and supply chain management. It presents the central perspectives for a modern complexity management in supply chains. Therefore the book offers a fundamental understanding for workable complexity management concepts their implementation to practitioners.

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