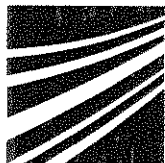


Sihn/Kuhlang [Ed.]

Sustainable Production and Logistics in Global Networks

43rd CIRP International Conference
on Manufacturing Systems
26 – 28 May 2010, Vienna

Proceedings



Fraunhofer



TECHNISCHE
UNIVERSITÄT
WIEN
Vienna University of Technology





TECHNISCHE
UNIVERSITÄT
WIEN
Vienna University of Technology



Fraunhofer

PROCEEDINGS

International Conference on Manufacturing Systems



Organised by

Vienna University of Technology
Institute of Management Science
Division Production Engineering and System Planning

Fraunhofer Austria Research GmbH
Division Production and Logistics Management
www.fraunhofer.at / office@fraunhofer.at

Editors:

Wilfried Sihm Peter Kuhlmann



TECHNIK

Vienna · Graz 2010

Bibliographic information published by the Deutsche Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

All rights reserved.

ISBN 978-3-7083-0686-5

Neuer Wissenschaftlicher Verlag GmbH Nfg KG

Argentinierstraße 42/6, 1040 Wien

Phone: +43 1 535 61 03-24, Fax: +43 1 535 61 03-25

e-mail: office@nwv.at

Geidorfgürtel 20, 8010 Graz

e-mail: office@nwv.at

Internet: www.nwv.at

© NWV Neuer Wissenschaftlicher Verlag, Vienna · Graz 2010

Druck: Széchenyi István Nyomda Kft., Győr (HU)

Table of Contents

Foreword.....	III
Committees.....	IV
Acknowledgements.....	V
A short view on CIRP.....	VI
Key-notes.....	1
Should CIRP develop a Production Theory? Motivation • Development Path • Framework	3
<i>H.-P. Wiendahl, P. Nyhuis, W. Hartmann</i>	
Manufacturing Systems Sustainability Through Perfect Co- evolution	19
<i>H.A. ElMaraghy</i>	
Production & logistic networks	29
A Production Planning and Scheduling Architecture for Networked- manufacturing System based on Available-to-Promise.....	31
<i>Wenhao Wang, Jie Zhang</i>	
Adaptive evaluation method for relocation activities in global production networks.....	38
<i>S. Lohmann, P. Ponton, M. Jaehne, R. Riedel, E. Mueller</i>	
An Approach for Systematic Production Network Configuration	45
<i>A. Kampker, G. Schuh, B. Schittny, D. Kupke</i>	
Analysis of Lead-Time Regulation in an Autonomous Work System	53
<i>N. Duffie, H. Rekersbrink, L. Shi, D. Halder, J. Blazei</i>	
Collaboration in Value Creation Networks to improve Material Cycles	61
<i>S. Heyer, M. Grismajer, G. Seliger</i>	
Development of organizational models for cross-company transport bundling	69
<i>Margarethe Prochazka, René Leitner, Felix Meizer, Wilfried Sihn</i>	
Impact of influence factors on logistics planning in the Automotive Industry.....	77
<i>D. Palm, W. Sihn</i>	

Table of Contents

Improving the distribution of value-added activities in complex business networks considering qualitative factors	85
<i>A. Prinz, S. Ost, J. Mandel</i>	
An Integrated Approach to Sustainable Multimodal Transportation in Logistics Networks	93
<i>G. Confessore, G. Galiano, G. Liotta, G. Stecca</i>	
Concept of transport-oriented scheduling for reduction of inbound logistics traffic	101
<i>M. Florian, J. Kemper, W. Sihn, B. Hellingrath</i>	
Internet Based Collaboration in the Manufacturing Supply Chain	110
<i>D. Mourtzis</i>	
Nearshoring, Sustainability and Free Trade Facilitation for Global Logistics Networks	121
<i>Eleftherios Iakovou, Dimitrios Vlachos, Maria Chatzipanagioti and Ioannis Mallidis</i>	
Networked Manufacturing Control: an Industrial Case	129
<i>P. Valckenaers, H. Van Brussel, B. Saint Germain, J. Van Belle</i>	
Use of the real options analysis to value new supplier development – a South Korean case study	137
<i>G. Lanza, S. Weiler, J. Möhlmann</i>	
Self-Configuring Service Network for Decision Support in Sustainable Smart Logistics	145
<i>A. Smimov, N. Shilov</i>	
Sustainability	153
A modular LCA framework for the eco-effective design of production systems	155
<i>C. Brondi, E. Carpanzano</i>	
Environmental Assessment of Automotive Joining Processes	163
<i>J. Pandremenos, J. Paralikas, A. Fysikopoulos, K. Salonitis and G. Chrysosolouris</i>	
Fostering sustainability using Sustainable Supply Chain Networks (SSCN)	171
<i>H. Winkler</i>	
Green supply chain management in Korean major industries	179
<i>S. Sim, J. Oh, B. Kim, J. Choi, B. Jeong</i>	

Impact of Manufacturing Supply Chains on the Embodied Energy of Products.....	187
<i>S. Kara, S. Manmek</i>	
Integrating sustainability into supply chain management – a stakeholder perspective	195
<i>N. Vojdani, M. Knop</i>	
Life Cycle Approaches on Product Realization: meeting the challenges of future production research	204
<i>M. Wiktorsson, G. Sivard, T. Kjellberg</i>	
Main drivers of ecological innovation performance	212
<i>M. Zwainz</i>	
A Framework for Modelling Energy Consumption within Manufacturing Systems	220
<i>Y. Seow, S. Rahimifard</i>	
A new Approach for Controlling Disassembly Systems	228
<i>G. Zülch, J. Hrdina</i>	
Polymer Water as Optimal Cutting Fluid - Technological Analysis	236
<i>C. Hermann, A. Zein</i>	
Industrial Smart Metering – Application of Information Technology Systems to Improve Energy Efficiency in Manufacturing	244
<i>C. Hermann, G. Bogdanski, A. Zein</i>	
Tactical planning of sustainable transportation by logistics service providers for the automotive industry	252
<i>M. Preuss, B. Hellingrath</i>	
Product and service development/management - special session: IPS²	263
Analysis of Optimization Algorithms' Usability for the Operational Resource Planning of Industrial Product-Service Systems (IPS ²).....	265
<i>H. Meier, B. Funke</i>	
Approach for intelligent design and manufacturing of footwear for diabetic persons.....	273
<i>M. Germani, M. Mengoni, E. Montiel, R. Raffaeli</i>	
Design Method for Life Cycle Oriented Product-Service Systems Development.....	281
<i>K. Kimita, F. Akasaka, S. Hosono, Y. Shimomura</i>	

Table of Contents

Industrial experience with Life Cycle Costing and the potential of Product-Service Systems.....	289
<i>J. Van Ostaeyen, J. Duflou</i>	
Intelligent Process Data Management for product-service-systems in the European Tooling Industry	299
<i>Günther Schuh, Wolfgang Boos, Moritz Rittstieg</i>	
Managing Uncertainties in Life Cycle Evaluation of various Manufacturing Alternatives for a Product.....	307
<i>D. Janz, E. Westkämper, S. Rahimifard</i>	
Product Development Strategy in Markets with Network Externalities	316
<i>N. Nishino, T. Takenaka, K. Ueda</i>	
Reference Model for IPS ² Service Supply Chains.....	324
<i>H. Meier, O. Völker</i>	
Production systems – special session: SPECIES	333
A Method for the Joint Design of Quality and Production Control in Manufacturing Systems	335
<i>M. Colledani, T. Tolio</i>	
A novel method for the development of modular product architectures	343
<i>J. Pandremenos, A. Natsis, G. Chryssolouris</i>	
A Web-services oriented workflow management system for integrated production engineering.....	351
<i>K. Alexopoulos, S. Makris, V. Xanthakis and G. Chryssolouris</i>	
Cognitive Controlling Systems for Tolerance Optimization	359
<i>R. Schmitt, C. Wagels, N. Matuschek, M. Isermann</i>	
Developing Sustainable Competitive Edge for Small to Medium Size Businesses through Realizing Agility	367
<i>M. Gadalla, A. Deif</i>	
Development of a Manufacturing Equipment Configurator and an NC Simulator	375
<i>I. Németh, J. Püspöki</i>	
Evaluation of RFID implementation in manufacturing systems. A case study in automotive industry.....	383
<i>I. Baffo, M. Carlino, G. Confessore, G. Stecca</i>	

Maintenance of Intralogistics-Systems – Introduction of the Pilot Installation “Log CoMo-Tec Lab”	391
<i>S. Wenzel, A. Wötzel, G. Bandow</i>	
Production System for the Automated Finishing in Die and Mold Making	399
<i>C. Brecher, R. Tuecks, C. Wenzel</i>	
Ramp-up of hybrid manufacturing technologies.....	407
<i>F. Klocke, H. Wegner, A. Roderburg, B. Nau</i>	
Rule-based Engineering Change Mechanisms in Production Systems	416
<i>R.C. Malak, J.C. Aurich</i>	
Simulation-based Assessment of the Productivity of Adaptive and Selective Production Systems	425
<i>C. Herrmann, P. Halubek, J. Stehr, J. Kayasa</i>	
Step-NC Compliant Approach for Workpiece Setup Planning Problem on Transfer Line	433
<i>S. Borgia, S. Pellegrinelli, T. Tolio</i>	
Lean Engineering & Assembly	441
A new methodical approach to increase productivity in production-logistical processes	443
<i>P. Kuhlmann, T. Edtmayr, W. Sihn</i>	
Analyzing Production Systems: Combining Perspectives of ‘Process’ and ‘Work Activity’	452
<i>Klaus-Peter Schulz</i>	
Development of a “convergent” order control for small and medium-sized production companies in the context of a turbulent market environment	461
<i>E. Okhan, T. Denner, M. Schubert, W. Sihn</i>	
Lean process analysis in administration and production.....	470
<i>A. Schloske, P. Thieme</i>	
Measuring the Complexity of Manual Products Assembly	478
<i>S.N. Samy, H.A. ElMaraghy</i>	
Optimization of the material flow using the principles of the Toyota Production System.....	488
<i>K. Tracht, J. Wrehde, T. Seuguep Kouamo</i>	

Table of Contents

Problems of Lean Production Implementation in the Croatian Enterprises.....	496
<i>I. Veza, N. Gjeldum, L. Celent, N. Stefanic</i>	
Highly Extensible Life-Cycle Oriented Placement of the Order Penetration Point in International Supply Chains.....	504
<i>Y. Uygun, B. Sieben, A. Kuhn</i>	
Using BPMN for Modeling Manufacturing Processes	515
<i>S. Zor, K. Görlach, F. Leymann</i>	
Value Stream Mapping for the Optimization of Maintenance Processes	523
<i>K. Matyas, F. Hagmair, W. Sihn</i>	
Technology in production & logistics	533
Automation of Driving Process in Copying manual Manipulations	535
<i>Z. Yang, F. Echtler, D. Scherer, M. Golle, H. Hoffmann, G. Klinker</i>	
Cognitive Agent based Control of a Machining Shop.....	543
<i>H.S. Park, N.H. Tran, J.Y. Song, D.H. Kim</i>	
Development of Chatter Vibration Detection System utilizing Sensor-less Process Monitoring	551
<i>Y. Sudo, Y. Kakinuma, T. Aoyama (2), K. Ohnishi</i>	
Hardware-Accelerated Measurement of Particle Velocities in Thermal Spray Processes.....	559
<i>L. Rockstroh, J. Hillebrand, W. Li, M. Wroblewski, S. Simon, R. Gadow</i>	
Identification of RFID Application Potentials in Manufacturing Processes	567
<i>M. Faltin, F.A. Gómez Kempf, J.C. Aurich</i>	
A comparison of the logistics performance of autonomous control methods in production logistics.....	576
<i>K. Windt, T. Becker, I. Kolev</i>	
Monitoring of the Welding Station Cluster.....	584
<i>A. Lebar, L. Selak, D. Bračun, A. Sluga, D. Husenagić, P. Butala</i>	

Knowledge management in production & logistics591

A Knowledge Management Concept for Product Ramp-up in
Automotive Industry593

C. Hermann, H. Bruns, P. Halubek, A. Wenda, S. Altuner

Education in Industrial Automation in an Innovative Learning
Factory601

E. Carpanzano, A. Cataldo

Holistic Approach against product piracy609

H. Meier, C. Siebel

Knowledge Flows in Early Stages of Product Development617

D. Spath, L. Wagner, F. Goll, P. Ohlhausen

Mastering Production Processes on the Basis of Management of
Measurement Processes625

R. Schmitt, J. Lose, M. Harding

Semantic integration by means of a graphical OPC Unified
Architecture (OPC-UA) information model designer for
Manufacturing Execution Systems633

M. Schleipen, O. Sauer, J. Wang

Process modelling and process planning641

A Distributed Routing Concept for Dynamic Flexible Flowshop
Problems with Unrelated Parallel Machines643

B. Scholz-Reiter, H. Rekersbrink, B.-L. Wenning

A methodology to support the design of multi-stage material
separation systems for recycling651

M. Colledani, S.B. Gershwin, T. Gutowski, M.I. Wolf

Analysis of NC data based on feature information model of shape
and process for retaining machining information659

F. Tanaka, S. Igari, T. Kawaguchi, M. Onosato

Assessment of an Organization for Digital Production Planning
Validation with Axiomatic Design667

M. Manns, K.-J. Wack

Automotive Supply Chain Flexibility Evaluation675

D. Mourtzis, L. Rentzos and S. Makris

Cognitive Process Planning683

B. Denkena, L.-E. Lorenzen, S. Kröning

Table of Contents

Empirical and Neural Network Modelling of Tool Wear Development in Ni-Base Alloy Machining	691
<i>C. Leone, D. D'Addona, R. Teti</i>	
Modelling and analysis of an autonomous control method based on bacterial chemotaxis	699
<i>B. Scholz-Reiter, M. Görges, T. Jagalski, L. Naujok</i>	
Modelling of Tool Wear in Gear Hobbing with Coated Tools for Facilitating Process Planning	707
<i>K.-D. Bouzakis, S. Kombogiannis, E. Bouzakis</i>	
Production of a variable cross sectional profile from AHSS – A sequential roll forming approach	717
<i>J. Paralikas, K. Salonitis, G. Chrysosolouris</i>	
Routing model refinement in large-scale manufacturing environment by using data mining	725
<i>D. Kamok, L. Monostori</i>	
The mathematical structure of CAPP within the software application developed at FMT in Presov	735
<i>K. Monkova, P. Monka</i>	
Understanding and Improvement of the Piston Insertion Operation	743
<i>Arnaud Robert, Serge Tichkiewitch</i>	
Utilization of a Bioinformatics Algorithm for the Comparison of Process Chains	751
<i>F. Reichert, A. Kunz, C. Bender, R. Moryson, K. Wegener</i>	
Factory planning	759
AMOR – An Agent for Assisting Monitoring, Optimization and (Re-)Design in Factory Design	761
<i>D. P. Politze, N. Jufer, J. Bathelt, A. Kunz, K. Wegener</i>	
Approach for planning of unit cost-optimal manufacturing and transport systems	769
<i>R. Schulze, A. Opitz, A. Krauß, E. Müller</i>	
Cross-Functional Digital Production Validation Framework for Automotive Industry	779
<i>J. Kiefer, M. Manns, K.-J. Wack</i>	
Energy Efficiency at Manufacturing Plants – A Planning Approach	787
<i>E. Müller, T. Löffler</i>	

Participatory Design of Communication and Information Flows in Plant Layouts	795
<i>D. Jentsch, D. Menzel, R. Riedel, K.-P. Schulz</i>	
Production planning	803
A Key Performance Indicator System of Process Control as a Basis for Relocation Planning.....	805
<i>F. Reichert, A. Kunz, R. Moryson, K. Wegener</i>	
A proposal of socio-inspired manufacturing scheduling concept and its application into flexible flowshop	813
<i>T. Kaihara, N. Fujii, S. Toide, H. Ishibashi, T. Nakano</i>	
An approach to avoid collisions in sheet metal forming during early stages of production planning	821
<i>D. Metz, M. Grauer, O. Reichert, W. Schäfer</i>	
A New Approach for Cost Modelling and Performance Evaluation within Operations Planning	829
<i>J. Malta, P.F. Cunha</i>	
Assessment of Products Eco-Efficiency for the purpose of Eco-Design.....	837
<i>Snezhana Kostova, Peter Mitrouchev and Nonka Georgieva</i>	
Collaborative Planning with Dynamic Supply Loops	844
<i>P. Egri, A. Döring, T. Timm, J. Váncza</i>	
Considering Worst-case Scenarios within Final Assembly Planning.....	852
<i>L. Weyand, H. Bley</i>	
Efficient Phase-Out Planning by Alignment of Lot Sizes in Supply Chains.....	860
<i>F. Hertrampf, R. Nickel, P. Nyhuis</i>	
Exploiting Repetitive Patterns in Practical Scheduling Problems	868
<i>A. Kovács, J. Váncza</i>	
Flexible and Autonomous Production Planning Directed by Product Agents.....	876
<i>M. Matsuda, N. Sakao, Y. Sudo, K. Kashiwase</i>	
Hybrid evolutionary optimization in efficient assembly task planning	884
<i>T. Jankowski, J. Jędrzejewski</i>	
Improved logistics performance through the use of locked flexibility potentials	892
<i>K. Windt, O. Jeken, F. Arbabzadah</i>	

Table of Contents

Integration of Personnel and Production Programme Planning in the Automotive Industry	900
<i>S. Auer, T. Winterer, W. Mayrhofer, L. März, W. Sihn</i>	
Long-term Capacity Planning in the Shipbuilding Industry.....	909
<i>M.-C. Wanner, J. Sender, U. Kothe, R. Bohnenberg</i>	
Inventory Allocation with Consideration of Component Commonality and Risk Management	917
<i>A.M. Radke, M.M. Tseng</i>	
Methodology for Structure-Analysis of Automotive Manufacturing.....	925
<i>C. Löffler, A. Lakeit, E. Westkämper</i>	
Process Harmonisation in Digital Manufacturing	933
<i>J. Schallow, D. Petzelt, J. Deuse</i>	
Product Variety in the Brazilian Cosmetic Industry	941
<i>L.F. Scavarda, A.C. Reis, S. Brafmann, H. Winkler</i>	
Leveling of Low Volume and High Mix Production based on a Group Technology Approach	949
<i>F. Bohnen, J. Deuse</i>	
Rolling Horizon and online optimization in discrete lotsizing production	957
<i>W. Dangelmaier</i>	
Simulation-based, energy-aware production planning	964
<i>S. Chiotellis, N. Weinert, G. Seliger</i>	
Total Quality Assurance, Productive Maintenance	973
An Approach to Workflow Based Quality Management	975
<i>D.C. ten Dam, D. Lutters</i>	
An efficient use of quality engineering techniques for analysis and improvement of industrial processes.....	983
<i>V. Majstorovic, T. Sibalija</i>	
Determination Of The Overall Equipment Effectiveness For Assembly Systems On The Base Of Product Data	991
<i>R. Neugebauer, D. Kreppenhof, T. Langer</i>	
Transparency in Production by Sensor Equipped Molds and Dies	999
<i>R. Schmitt, M. Harding, J. Lose</i>	

ICT in production & logistics1007

Design and Analysis of A Simulation, Monitoring and Control
System of 4-DOF Modular Reconfigurable Robot.....1009

D. Zhang, J. Lei

A Robust Multiple Logistic Objectives-oriented Manufacturing
Control (RMLOO).....1017

K. Windt, B. Scholz-Reiter, Huaxin. Liu

Achieving Distributed Control Applications Using IEC 61499 and
Communication Standards.....1028

G. Morán, F. Pérez, E. Estevez, D. Orive, M. Marcos

Agent-based Simulation Modeling of an Interaction Mechanism for
Detailed Design of Autonomic Manufacturing Execution Systems.....1036

Milagros Rolón, Ernesto Martínez

CAM System Development for Multi-tasking Machine Tools1044

T. Kotani, K. Nakamoto, T. Ishida, Y. Takeuchi

Sensible Ergonomics Network in Smart Environment (SENSE) — A
Step to Human Safety and Productivity Sensitive in Smart Factory.....1052

C.F. Kuo, M.J. Wang, C.H. Su

Implementation of practice-oriented IT Frameworks for knowledge
based configuration and design of customised products1060

C. Lutz, D. Gerhard

iPod touch – an ICT tool for operators in factories of the future?1070

T. Fässberg, G. Nordin, Å. Fasth, J. Stahre

Lightweight IT support for ad-hoc-processes in production and
logistics1078

Martin Böhringer, David Jentsch

Modular INFELT STEP; An Integrated and Interoperable Platform
for collaborative product development based on STEP Standard.....1085

O. Fatahi Valilai, M. Houshmand

Seasonal Demand on the Array of Spare Parts in the Aviation
Industry1093

K. Tracht, P. Schuh, F. Weikert

Production Simulation in Virtual Worlds1101

S. Seitz, M. Hermann, D. Wimpff

Rule based Expert System with Quality Control Charts to support a
Logistic Strategy on Operational Level1109

M. Elsweier, P. Nyhuis, R. Nickel

Table of Contents

Introducing SOA into Production Environments – The Manufacturing Service Bus	1117
<i>J. Minguéz, D. Lucke, M. Jakob, C. Constantinescu, B. Mitschang, (†) E. Westkämper</i>	
Wireless Field Bus Communication with UWB for Manufacturing Environments.....	1125
<i>M. Masini, M. Jakob, M. Berroth</i>	

Impact of influence factors on logistics planning in the Automotive Industry

D. Palm¹, W. Sihn (2)²

¹ Fraunhofer Austria Research GmbH, Theresianumgasse 7, 1040 Vienna, Austria

² Vienna University of Technology, Theresianumgasse 27, 1040 Vienna, Austria

Abstract

Logistics planning in the Automotive Industry has a variety of tasks with a strong impact on the resulting cost of a car. Especially during the vehicle development phase before the start of production (SOP), the logistics planning determines the resulting costs and the flexibility of the logistics system in the production phase (after SOP).

Influence factors on the logistics system are constantly changing not only during planning but also in the production phase. The paper examines the nature of these influence factors and the impact of changes on the logistics system during the planning and the production phase.

It can be noticed, that some influence factors and changes are neglected during production phase what can lead to a non-optimized logistics system with higher costs than necessary. Therefore a new holistic planning model is introduced.

Keywords:

Logistics planning, automotive industry, integrated planning

1 INTRODUCTION

The effective planning of logistic systems is an undisputed success factor in any given company. In the automobile industry in particular, planning quality is a massively cost relevant factor. In the modern automobile production, logistics account for about 10% of the costs entailed in the product price – the majority of these costs are specified within the product development process before the Start of Production (SOP).[1]

The planning process and with that the determination of planning objects begins up to 60 months before serial start, depending on planning complexity and manufacturer.[2] This lead time to the actual serial production is followed by a period between five to seven years of production during which the logistics system is maintained unaltered for the most part, bringing the total time frame of the logistics system to up to 10 years.

Changes in the logistics system and of the framework conditions can be divided into internal, external and global factors of the two main processes in automotive industry – the product development process and the production process.

Main purpose of this paper is to look at changes and influence factors of the logistics system of automotive manufacturers (OEM) during the planning and product lifecycle, identify a possible impact on the logistics system to find an answer if the planning aim – to minimize logistics costs – is still fulfilled.

2 AIMS OF LOGISTICS PLANNING AND INFLUENCE FACTORS DURING PLANNING STAGE

Logistic planning involves the development, evaluation and selection of concept alternatives for the future design and optimization of logistic systems and logistic processes.”[3]

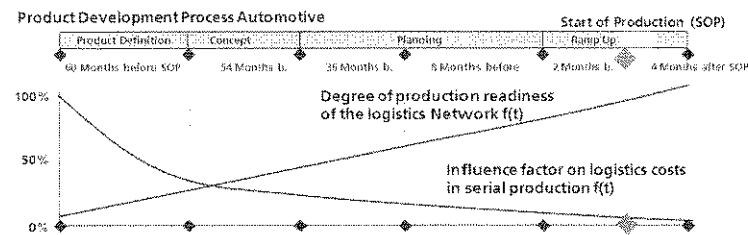


Figure 1: Connection between production readiness of the logistics system and possibility to influence logistics costs

The aim of a logistic planning process is primarily geared to maximizing logistic performance, while simultaneously minimizing logistic costs.[4] The fundamental goal setting is thus the economic planning of logistics systems, that explicitly includes the influence on the product from a logistic perspective.[5] Thus, the logistics planning must kick-off at an early planning stage, where the possibility to influence costs is highest. On the other hand, these are moments in which the maturity of the product, the logistical network and processes are however minimal [6] (Figure 1).

Multiple run-through's of the steps involved in the planning process are mandatory, due to assumptions, which have to be made at the beginning of the planning process and are altered or modified in the course of the planning process. Given the complexity of an automotive network that includes suppliers, service providers and manufacturers, a complete methodical support across departmental and company borders is a prerequisite for securing quality in the planning process. Most especially due to the high number of planning partners comprising of suppliers, external service providers, transportation planners, structural or resource planners, all with individual targets. As an example the supplier regards his own production container as optimal, since he has not to change it for the OEM. From a transport perspective the container that optimizes the corresponding dimensions of truck capacity is optimal. From a handling perspective within

an OEM manufacturing plant, the largest possible available container contributing to effort reduction and from an assembly perspective as the smallest available container contributing to minimizing the capital tied up and optimizing the bundled utilized buffer space.

The logistics planning process must therefore while taking account of the interdependence of influence factors, implement and align the company objectives within the logistics system. The result of a logistics planning process can therefore only be a total optimum within the system limits. For sub-systems no specific optimum will be targeted, if this does not lead to an optimum for the entire system as a result.[7]

For multiple-staged, multiple-structured logistic systems, such as in the automobile industry, with different companies and associated companies goals and as such with a large number of independent decision makers, interest balancing and cooperative solutions have priority. The optimization process starts with the function optimization of the individual subsystems and then on to the entire system. This requires continuous feedback with the performance of all stakeholders in the logistic chain, which includes suppliers, manufacturers, external logistics service provider all the way to the customer.[7]

The dynamics during the whole planning phase by the three factors of influence (internal, external and global, see Figure 2) is therefore usually high. But the planning process has to take alterations into consideration and until the end of the planning process the planning result aims to a global optimum integrating these changes. Assuming that the result of the planning process is optimal, the logistics system can be considered as optimal at the end of the planning process.

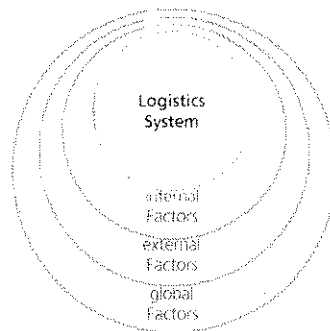


Figure 2: Influencing Factors on the Logistics System

3 DYNAMICS WITHIN THE LOGISTICS NETWORK AND OTHER EXTERNAL OR GLOBAL FACTORS

The structure of logistics networks in the automobile industry is to a large extent a reflection of the complexity of the cars produced. The most diverse companies are networked with one another through several overlapping and in themselves interpenetrating enterprise networks. Sydow describes company networks in the automobile industry as complex poly-

centric systems, that are regulated over several hierarchically structured control centers [8]. Each supplier has in addition a supplier network, which as a rule increases in complexity with each corresponding higher level in the value creation chain.

Each of the companies is however embedded in the networks of other companies and the automobile industry can thus be understood as a network of networks. The supplied parts are mostly specifically designed to the needs of the purchasers and can therefore usually not be alternatively used, this specificity increases downstream in the value creation chain.[9]

These complex networks not only have a great dynamism but also a great impact on the logistics system. Changes such as in the delivery location of a supplier have major implications for the time schedule and the corresponding delivery form (Warehousing, Just-in-time supply or direct delivery), the transport chain, the inventory level within the manufacturing plant etc.

Other external influence factors have to be searched for within the market. Here are notably: competition, changes in client needs and demand fluctuations, that from logistical perspective result in quantity alterations of purchased and delivered parts or of finished cars for distribution. In particular in the procurement process quantities of parts are highly relevant planning parameters, which also substantially influence planning related outcomes.

So influence factors on a structural level (supplier location as source) as well as on parameter level (quantities) are critical for the costs of a logistics system.

A further area addresses the factors of influence that Gudehus categorizes under "environment" and "law".[10] Changes in this area have varying effects on the logistics system. The general introduction of a truck-toll (Vignette) generally has a cost increasing effect, without however having an influence on the outcome of the planning process. The introduction of distance dependent transport costs would on the contrary alter the planning process outcome to favour less remotely located suppliers.

An also very extensive area is within the field of "technological progress". This can refer to technological changes within the field of logistics (IT systems for tracking and tracing, ordering, RFID systems for material flow tracking), technological changes within the product field (battery packages for Hybrid motor units), or even the availability of newer planning systems within logistic planning process itself (digital factory models). In practice, these changes, as far as they must not be rapidly implemented due to legal reasons, are in most cases curtailed for the next planning cycle.

So it can be noticed that some external or global influence factors have no, others a general impact (cost increasing for the whole system but not result changing) and others a specific influence with result changing character. In practice the latter means, that higher logistic costs then necessary incur, when the logistics system experiences no adjustments.

4 DYNAMICS WITHIN THE LOGISTICS NETWORK AND OTHER EXTERNAL OR GLOBAL FACTORS

Gudehus divides the internal influence factors on the planning process into product, process and production, structure and area, employees as well as business strategy.[10] With a direct connection between product and the logistics planning process. The production is the customer of procurement logistics and each product alteration also simultaneously brings about an adaptation in logistics process. Here processes of phase in and phase out of parts in serial operation are established and also the parallel product development and logistics planning process during the product development process generates a direct connection with a mutual influence. However, this feedback only curtails for physical product changes. Deviations to the planning assumptions such as those involving part variants have from logistical perspective a significant impact. The decision on sequenced delivery of parts, depends greatly on the number of variants of the respective part.[11]

There is a similarly close connection between the production process and the logistics system to another - a change in the order of production or in the position of the assembly of a part on the assembly line, inevitably brings about a re-planning of the logistics system because the position of line-side presentation of the part at the assembly line changes.

Nevertheless, as mentioned before, the number of units produced per unit time unit is also logistically massively relevant to the planning process – here however there are often no adjustments made to the logistics system. Reason for this absence of adaptation can be found in the lack of knowledge at what specific quantity other forms of supply are more cost effective than the existent one.

Structures and areas are undergoing permanent alterations in assembly plants. In particular in manufacturing plants in which several different models are parallel produced, not only new or dis-continued models but also current serial production is modified due to the re-planning process.

Employees naturally have a considerable high degree of dynamism not only within companies in general as a resource but also in logistics planning process with their experience and knowledge. In the long term the performance potential of the company is determined by the regulation of staff capacity in the various areas of the company.[12] There may be adjustments such as in the shift models, which usually also lead to re-planning the logistics system. The planning knowledge in the logistics planning process is mostly documented in planners specification guide, where results of the planning in the form of service concepts or within the planning system are also documented. Some studies in the recent past focus on improving planning outcomes through appropriate planning knowledge management systems in order to achieve a sustainable improvement in planning quality and to anchor the know-how of planners within the company.

The company strategy and the company goals play a great role in the general design of the logistics systems since the logistics objectives are derived from the company objectives. Thus, a change in the aims of the

company also leads to a corresponding alteration of the logistics objectives and -systems. The changes are not in reference to for individual elements of the logistics system but rather in reference to long-term changes in the product, production program or sourcing strategies.[12]

5 CONCLUSIONS

In conclusion it can be said, that the dynamism of the factors of influence during the planning period and the process of serial production is very high. These changes are systematically included in the system design during planning phase in the vehicle development process. During production process only specific relevant changes lead to changes in the logistics system. Other relevant changes are neglected in operative practice. Adjustments are in particular made, where the physical material flow is changed and as such makes re-planning an inevitable necessity. Otherwise in the operative practice, a worst-case scenario is formed and this determines the interpretation of the logistics system. It sets the maximum number of produced cars per time unit, the theoretically possible number of variants per part, the maximum space requirements. This inevitably results in a sub-optimal condition with respect to the cost objectives of the logistics system.

In the analysis of the scientific literature on the logistics planning for serial production it is noticeable that a holistic view on the whole lifecycle from planning over start of production to production process until end of production is not used very often. Schneider is stating, that the logistic planning process in the product development process significantly less space, as the planning in serial operation.[13] Scheuchl [11] empirically examines how various factors influence the planning process, the dependence of the quality of planning on planning triggers and factors of influence and introduces a planning environment, which makes it possible to make scenarios to forecast some effects, the feedback of influences in the production phase to the logistics system is however not explicitly envisaged.

Dürschmidt [14] suggests a model, in which the scenarios for influence criteria in the planning stage are defined in terms of variants, quantity flows or logistics performance metrics and pre-planned. During the operational phase options of choice between different predefined logistics systems can be made. If not pre-planned, parts or the whole system must be re-planned. He as such combines planning and operational phases in a holistic adaptive model. This model is however very general and is not based on the logistics planning process of the automobile industry.

That is why it can be said that existing methods of the logistics planning process in the automobile industry only inadequate curtail for the dynamics of the factors of influence during the planning and the serial operation.

The present paper shows on the one hand the necessity and relevance of methodical logistic planning in the automobile industry over the entire life cycle of a vehicle and on the other hand the deficits entailed in the known models. A holistic integrated planning must have the following features:

- ability to provide methodical support from the commencement of planning before SOP to the end of production (EOP),

- ability to take into account the dynamics within the environment and adaptively react to changing factors in planning processes before SOP as well as during serial process.

Thus the following model for integrated adaptive logistics planning shall be introduced (see Figure 4):

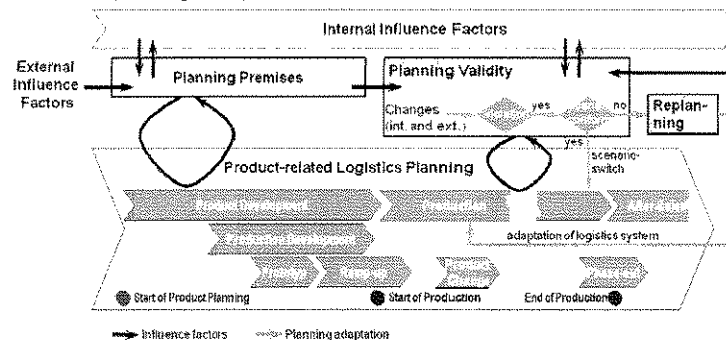


Figure 3: Integrated Logistics Planning

The product related logistics planning spans from start of product planning over the start of production to the end of production and includes the planning of after sales parts and structures after the production cycle of the car. It contains not only planning activities in the product and production development phase but also in the prototyping (ex. provision of prototypes) and ramp-up-phase (ex. adjustments in the logistics system as result of the try-out production). During the product development phase, a repository with all planning premises, methods, processes and data is held and constantly updated due to changes internally and externally. The planning phase reacts adaptively to the internal and external influence factors.

During the planning, several states in the lifecycle of the production process in terms of production quantities, variants and significant changes in structure of the plant or plants are pre-planned (ex. introduction of a new derivate or model in the plant with impact on space, material flow or structure). Each scenario has not only a planning result but also a validity concerning the main parameters of the planning (ex. part geometry, number of parts, number of variants, supplier etc.). This validity is transferred to a repository for the production phase.

During production this main figures are monitored. In cases of a deviation, either a switch in an appropriate pre-planned scenario is executed or a re-planning initiated. This leads to an integrated adaptive logistics planning which fulfills all above mentioned demands.

6 REFERENCES

- [1] Dudenhöffer, Ferdinand, Wortberg, Jan (2008): Gandhi-Logistik statt Just-in-sequence. In: *Beschaffung aktuell*, 6/2008, S.38-39.

- [2] Klug, Florian (2004): Beschaffungslogistik. FH München, Skript, 2004.
- [3] Weidt, Stefan (2004): Intraorganisationales Kompetenzmanagement für die Logistikplanung. Universität Dortmund, Diss, 2004.
- [4] Wiendahl, H.-P. (1997): Betriebsorganisation für Ingenieure. 4. Aufl. München, Hanser, 1997.
- [5] Bracht, U.; Bierwirth, T.: Virtuelle Logistikplanung. In: ZWF, 5/2003, s. 219-223.
- [6] Pfeiffer, W.; Weiss, E. (1994): Lean Management – Grundlagen der Führung und Organisation lernender Unternehmen, Berlin, Erich Schmidt Verlag GmbH & Co., 1994.
- [7] Laffert, Jens (2000): Informations- und Materialflüsse in internationalen Logistiksystemen der Volkswagen AG. Kassel, Kassel univ. press, 2000.
- [8] Sydow, J. (2003): Management von Netzwerkorganisationen – Zum Stand der Forschung, Sydow, J. (Hrsg.): Management von Netzwerkorganisationen: 293-354. 3. Aufl. Wiesbaden: Gabler, 2003.
- [9] Schöffner, Oliver (2005): Grenzen virtueller Vernetzung in der Automobilindustrie: Einflüsse elektronischer Marktplätze auf Zuliefer-Abnehmer-Beziehungen. Bonn, Univ., Diss., 2005.
- [10] Gudehus, T. (1999): Logistik: Grundlagen, Strategien, Anwendungen. Berlin, Springer, 1999.
- [11] Scheuchl, Michael (2006): Einflussfaktoren und Planungsmethodik für supra-adaptive Logistiksysteme. Diss, TU München, 2006.
- [12] Feldhahn, Karl-Andreas (1991): Logistikmanagement in kleinen und mittleren Unternehmen. Diss, TU Braunschweig, 1992.
- [13] Schneider, Markus und Otto, Andreas (2006): Taktische Logistikplanung vor Start-of-Production (SOP). In: Logistik Management, 8. Jahrgang 2006, Ausgabe 2, S. 58 – 69.
- [14] Dürrschmidt, Stephan (2001): Planung und Betrieb wandlungsfähiger Logistiksysteme in der variantenreichen Serienproduktion. München, Techn. Univ., Diss, 2001.