Simulation and Modelling in Supply Chains SIM-SC – Special track

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- studied Business Engineering at the Karlsruhe Institute of Technology, Germany
- received his PhD in field of Supply Chain Risk Management and Decision Support Systems at the Institute for Industrial Production at the Karlsruhe Institute of Technology
- worked as a senior consultant at Siemens Digital Logistics GmbH and as project manager at the Fraunhofer Institute of Systems and Innovations Research

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- is Professor of Purchasing and Procurement Management and leads the bachelor's degree program Purchasing and Logistics at Pforzheim University
- has over 15 years of practical experience in several management positions within logistics at Robert Bosch GmbH
- earned his doctoral degree at the University of Münster on the application of Data Envelopment Analysis to evaluate electronic procurement processes

Prof. Dr. Frank Morelli
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- is Professor of Information Management at Pforzheim University of Applied Sciences with the focus on business process management, process mining, business intelligence, SAP S/4HANA, project management, and IT organization
- acts as contact partner for the Celonis Academic Center of Excellence at Pforzheim University
- is the main point of contact for SAP University Alliance activities at Pforzheim University

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- Studied Informatics and Information Systems at the University of Koblenz-Landau, Germany.
- Applied process thinking to automation technology in the chemical industry for his PhD-Thesis.
- Considered electronic negotiations from a process perspective for his state doctorate.
- Between 2007 and 2015 Professor for Information Systems at the Provadis School of Technology and Management Frankfurt/Main.
- Since 2015 Professor for Information Systems at the University of Applied Sciences Worms, Germany.

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- Studied Business Administration and Engineering at Karlsruhe University of Applied Sciences as well as Business Administration and Economics at FernUniversität Hagen.
- Research Assistent at Fraunhofer ISI, Karlsruhe, Germany.
- Since 2017 Research Fellow at the University of Applied Sciences Worms, Germany.
- Main research interest is how to derive process models from speech.

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- She completed an apprenticeship as a management assistant in freight forwarding and logistics services.
- Studied International Logistics Management (B.A.) and currently pursuing a Master's degree in Entrepreneurship at University of Applied Sciences Worms, Germany
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- studied computer science at the RWTH Aachen University, Germany.
- at the Fraunhofer Institute IITB in Karlsruhe, Germany: worked primarily on algorithms for production control and received in this field a PhD.
- at SAP AG: several positions (Germany, Japan and USA), at the last as director.
- as a Professor for Production Logistics at the University of Applied Sciences in Regensburg, Germany: work mainly on planning algorithms, optimisation and simulation for operative production planning and control at companies.

Prof. Dr. Mike Steglich

Vita

- Degree in Business Informatics at the Department of Economics of the Martin-Luther-University Halle-Wittenberg in 1993
- Scientific assistant at the Department of Economics at the Martin-Luther-University Halle-Wittenberg 1993-1999
- Dissertation (Dr. rer. pol.) on cost variance analysis with artificial neural networks at the Department of Economics of the Martin-Luther-University Halle-Wittenberg in 2001 (summa cum laude)
- Management Accountant at the MTU Maintenance Berlin-Brandenburg GmbH (Maintenance, Repair and Overhauls of Flight-Engines) 2000-2004
- Professor of Business Administration, Quantitative Methods and Management Accounting at the Department of Business, Computing, Law of the Technical University of Applied Sciences Wildau, since September 2004

Interests

- Mathematical Modelling, in particular Mathematical Programming Languages
- Logistical Decisions
- Intensively involved in the development of software for mathematical modelling and optimisation in several open-source projects

Simulation and Modelling in Supply Chains

- **A Case Study Concept for Supply Chain Resilience Analysis.**
- **Integrated Management System for enterprise-wide documentation and simulation of (business) processes using Petri nets - The Process-Simulation.Center.**
- **Performance of Storage Strategies in a Highbay Warehouse**

Summary

- Companies have experienced in recent crises that the resilience of their supply chain is an important success factor.
- To make matters worse, supply chains have become increasingly interconnected and complex, and thus more prone to disruption.
- That leads to the fact that logistics managers often know little about the resilience level of their own supply chain and have difficulties identifying where to pull the lever in terms of applicable measures.

➔ Need of a practical and easy-to-use approach to

1. assess the resilience status of the strategic design of the supply chain and subsequently
2. identify the necessary measures to improve the current state of resilience

A Case Study Concept for Supply Chain Resilience Analysis – Schätter, Haas & Morelli

The Two-Stage Approach

- Stage 1: Strategic resilience analysis by *data-based modeling* of material flows in the supply chain focusing on eight developed “Key Resilience Areas”
- Stage 2: Root-cause analysis using *process mining* to precisely examine elements classified as critical in stage 1, which serves then as a basis for managerial action.

Current Status & Outlook

- Step 1 was carried out by means of a case study considering a manufacturing company located in Hamburg, Germany, and the inbound material flows from tier 1 suppliers
- Step 2 is work in progress and has to be be verified with real data in the form of event logs. Therefore, a business case must be identified in the next step to gather the event logs.

HS PF Business Design Engineering

Summary

- This paper is about an applicable prototype for an Integrated Management System based on Petri nets, organigrams and process maps.
- For this purpose, the web-based **Process-Simulation.Center (P-S.C)** has been continuously developed since 2016 for use in research, teaching and practice.
- The tool, which is now also available in English and German, includes several products for the support of different target groups, such as Academics or Companies.
- Users may have different authorizations, on which an approval workflow is implemented.

Future work

- In large-scale industrial projects, environmental protection and occupational safety requirements are reconciled with efficiency and effectiveness.
- With the help of P-S.C's industry partners, the impact of bottlenecks on planning parameters in warehouse design is considered.
- Further collaborations are planned. The multi-mandator concept facilitates new forms of cooperation.
- Possibilities to include interactive dashboards are developed further.

Performance of Storage Strategies in a Highbay Warehouse – Herrmann 1/2

- Coordination of procurement, production and distribution processes
- Efficient order-related order picking

Observation:

The required handling rates (number of putaways and retrievals per unit time) for order picking are not achieved.

Target criterion: Maximize the handling performance of the entire storage system.

Possible solution: costly storage and conveying technology measures measures

Solution: Good Storage Strategies

Performance of Storage Strategies in a Highbay Warehouse – Herrmann 2/2

- No strategy can be identified as generally the best. However: combination of strategies "zones" and "channel" best.
- Simulative analysis provides significantly more concrete statements.
- To expect: different results for different enterprises - high deviation opposite the data in the standard literature.
- Performance quality dependent on ABC distribution of storage and retrieval orders as well as warehouse-technical influences such as geometry of the warehouse and kinematics of the stacker crane.

Planned:

- Generalization of the results and better analytical justifications.
- Extension to other warehouse types - earlier work on pallet warehouses in future also double-deep automated small parts warehouse.

Future challenges in SIM-SC

- Development of easy applicable and cost-efficient procedures for simulation-based decision support in supply chain risk management.
- Need of focussing on resilient supply chains as a counterpart of efficiency-driven improvements.
- What are reasonable applications in supply chain management that can be elegantly solved by a combined application of the tools developed by the various research groups?
- Need for scheduling algorithms taken advantage of highly restrictive technological constraints.
- Need for integrating easy to use programs (as spreadsheet programs) with high sophisticated optimisation software.