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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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
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Lara Zakfeld, M.A.
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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
- Works as a Research Assistant at University of Applied Sciences Worms, Germany

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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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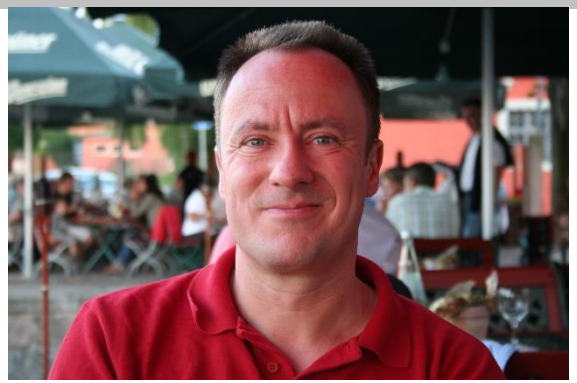
- studied computer science at the RWTH Aachen University, Germany.
- at the Fraunhofer Institute IITB in Karlsruhe, Germany: worked primarily on algorithms for production control and received in this field a PhD.
- at SAP AG: several positions (Germany, Japan and USA), at the last as director.
- as a 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

- **Business Process Simulation Focusing Supply Chain Risk Management Aspects.**
- **Can Simulation Prevent Companies from the Bullwhip Trap?**
- **Simulative Comparison of Scheduling at Krones AG with Shortest Slack.**
- **Optimisation Modelling with Excel and CMPL2.**

Summary

- Supply chains have become more interconnected and complex and they are predisposed to disruptive events
- Even a local failure can negatively affect businesses on a global scale
- Logistics managers have understood the importance of resilient supply chains
- However, the critical question arises: how should a supply chain risk management be implemented and specified to improve the resilience of the logistics structures?

➔ Need of an easy applicable approach

Summary

- Development of a novel approach based on business process simulation
  - Data-based supply chain model, which uses the data available within the company
  - Consequence-driven risk simulation to reveal the critical paths of the logistics networks; backtracking of possible triggering events instead of anticipating such events first and from scratch

Future investigations

- Specifications of the steps included within the approach, mathematical formulations etc.
- Development of use cases to illustrate and further develop the procedure and to reveal advantages and drawbacks

Can Simulation Prevent Companies from the Bullwhip Trap?– Simon/Zakfeld/Jensen/Klietsch/Montag

Summary

- This paper is about two holistic and modifiable approaches using commonly available tools like Excel and a Petri net tool to protect companies from the bullwhip trap.
- For this, a novel, web-based Petri net modeling and simulation environment called **Process-Simulation.Center (P-S.C)** has been developed to overcome limitations of existing tools.
- A custom supply chain scenario was developed as a simulation environment. A distinction was made between initial data such as market volume and modifiable data such as the nervousness factor per participant.
- Each approach can meet the user at their individual skills and supports the performance of what-if analyses and in running through different scenarios.

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Future work

- Further collaborations are planned to model and simulate additional logistics processes. Past work raised the question on how to visualize the simulation results. Especially for high-level Petri nets this is not sufficiently worked out. For the paper, the authors had to export the simulation results and used external tools for the visualization. Instead of this explorative approach a more structured one should be developed for the future.

- A prominent application of Petri nets is process mining. Obviously, there exists a certain duality between process mining which is retrospective and simulation which is forward-looking. It seems to be worthwhile considering this duality and probably to integrate process mining techniques in the P-S.C.

Simulative Comparison of Scheduling at Krones AG with Shortest Slack – Herrmann

Summary :

- Simulation of final assembly planning at Krones AG.
- Planning final assembly: simple priority rule better for planning situations with high time pressure.

Future investigations:

- Simultaneous planning of limited machine capacity and limited space.
- Literature: Two disjunctive problem classes.
- Development and simulation-based analysis of combinations of rules for meeting due dates with rules for avoiding unused space.

Summary

It is reasonable to connect spreadsheet programs with optimisation software to combine the modelling capabilities of optimisation software with the data maintained in spreadsheets.

Advantages and disadvantages of known solutions:

- Add-ins in spreadsheet programs such as the Excel solver add-in allow interactive work, although modelling with cell ranges does not seem suitable for complex models.
- Data interfaces to spreadsheets of algebraic modelling languages, which are excellent for modelling complex problems, do not allow interactive work.
- Approaches that combine modelling languages with Excel in the form of an Excel add-in and thus combine interactive work with excellent modelling possibilities. Unfortunately, these are only available for Windows and some of them seem to have been discontinued.

This facts led to the motivation to create CmplXlsData, which is CMPL's interface to Excel. It is an easy-to-use interface between this modelling language and Excel, which allows interactive work and is available for Windows and macOS.

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.