„Special Topics in OM and SCM: Industry 4.0 / High Performance Manufacturing (HPM) / Physical Internet (ALICE)

Gerald Reiner[)]

Universitaet Klagenfurt (AAU), Austria
Faculty of Management and Economics
Head of Department of Operations, Energy and
Environmental Management (OEE),
Chair of Operations Management and Logistics (PLM)
https://www.aau.at/oee

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Outline

- Research Focus

- Industry 4.0 – SemI40

- High Performance Manufacturing (HPM)

- Physical Internet - ETP-Alice

Research Focus – Integrated Supply & Demand Management

➢ **Efficient processes: e.g., food industry**

⇒ Reiner, G., Trcka, M.: Customized supply chain design: Problems and alternatives for a production company in the food industry - A simulation based analysis. *International Journal of Production Economics*, Vol. 89, No. 2, 217-229, 2004

⇒ Reiner, G., Teller, C., Kotzab, H., Analyzing the Efficient Execution of In-Store Logistics Processes in Grocery Retailing - The Case of Dairy Products, *Production and Operations Management*, Vol. 22, No. 4, 924-939, 2013.

➢ **Risk Hedging processes, e.g., chemical industry**

⇒ Reiner, G., Jammernegg, W., Gold, S., Raw material procurement with fluctuating prices using speculative inventory under consideration of different contract types and transport modes, **International Journal of Production Research** Vol. 52, No. 22 6557-6575. 2014

➢ **Responsive processes: e.g., semi conductor industry and humanitarien logistics**

⇒ Reiner, G.: Customer-oriented improvement and evaluation of supply chain processes supported by simulation models. **International Journal of Production Economics**, Vol. 96, No. 3, 381-395, 2005

⇒ Jammernegg, W., Reiner, G.: Performance management of supply chain processes by coordinated inventory and capacity management. **International Journal of Production Economics**, Vol. 108, No. 1-2, 183-190, 2007

⇒ Reiner, G., Fichtinger, J., Demand forecasting for supply processes in consideration of pricing and market information. **International Journal of Production Economics**, Vol. 118, No. 1, 55-62, 2009

⇒ Kunz, N., Reiner, G., Gold, S., Investing in disaster management capabilities versus pre-positioning inventory: A new approach to disaster preparedness. **International Journal of Production Economics**, Vol. 157, No. 1, 261-272, 2014

➢ **Agile Prozesse: e.g., telecom industry**

⇒ Reiner, G., Natter, M.: An encompassing view on markdown pricing strategies: an analysis of the Austrian mobile phone market. **OR Spectrum**, Vol. 29, No. 1, 173-192, 2007

Research Focus – Rapid Modeling

➢ **Rabta, B., Schodl, R., Reiner, G., Fichtinger J.,** A hybrid analysis method for multi-class queueing networks with multi-server nodes, **Decision Support Systems**, Vol. 54, No. 4, 1541–1547, 2013.

➢ **Rabta, B., Reiner, G.,** Batch Sizes Optimization by means of Queueing Network Decomposition and Genetic Algorithm. **International Journal of Production Research**, Vol. 50, No. 10, 2720-2731, 2012

Research Focus – Sustainability & Base of the Pyramid

➢ **Fortis, Z., Maon, F., Frooman, J., Reiner, G.,** Unknown Knowns and Known Unknowns: Framing the Role of Organizational Learning in Corporate Social Responsibility Development. **International Journal of Management Reviews**, first published http://onlinelibrary.wiley.com/doi/10.1111/ijmr.12130/full, 2017

➢ **Gold, S., Kunz, N., Reiner, G.,** Sustainable Global Agrifood Supply Chains: Exploring the Barriers. **Journal of Industrial Ecology**, first published   http://onlinelibrary.wiley.com/doi/10.1111/jiec.12440/full, 2017

➢ **Reiner G., Gold S., Hahn R.,** Wealth and health at the Base of the Pyramid: Modelling trade-offs and complementarities for fast moving dairy product case. International **Journal of Production Economics**, Vol. 170, Part B, 413-421, 2015
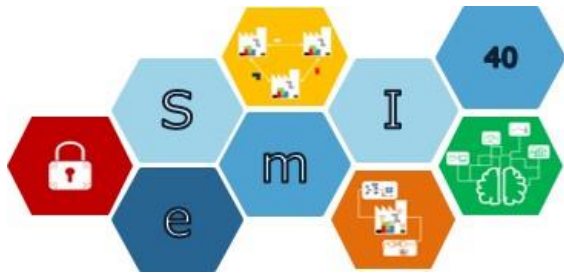
SEMI40 ECSEL JU Project

Power Semiconductor and Electronics Manufacturing 4.0

Industry 4.0

➢ Represents the „Fourth Industrial Revolution"

➢ I4.0 is defined as the digitalization and integration of the entire value chain and follows a fusion of the virtual and physical world to ensure sustainability, energy and resource efficiency, productivity improvement and innovation.

Source: Kagermann et al. 2013, Semi40 – www.semi40.eu

SemI40 Project focus

By advancing European electronic components and systems manufacturing to „Smart Sustainable and Integrated Production", SemI40 will **focus on two domains** of the key enabling technologies, „**smart production**" and „**cyber phsysical production system**" made in Europe.
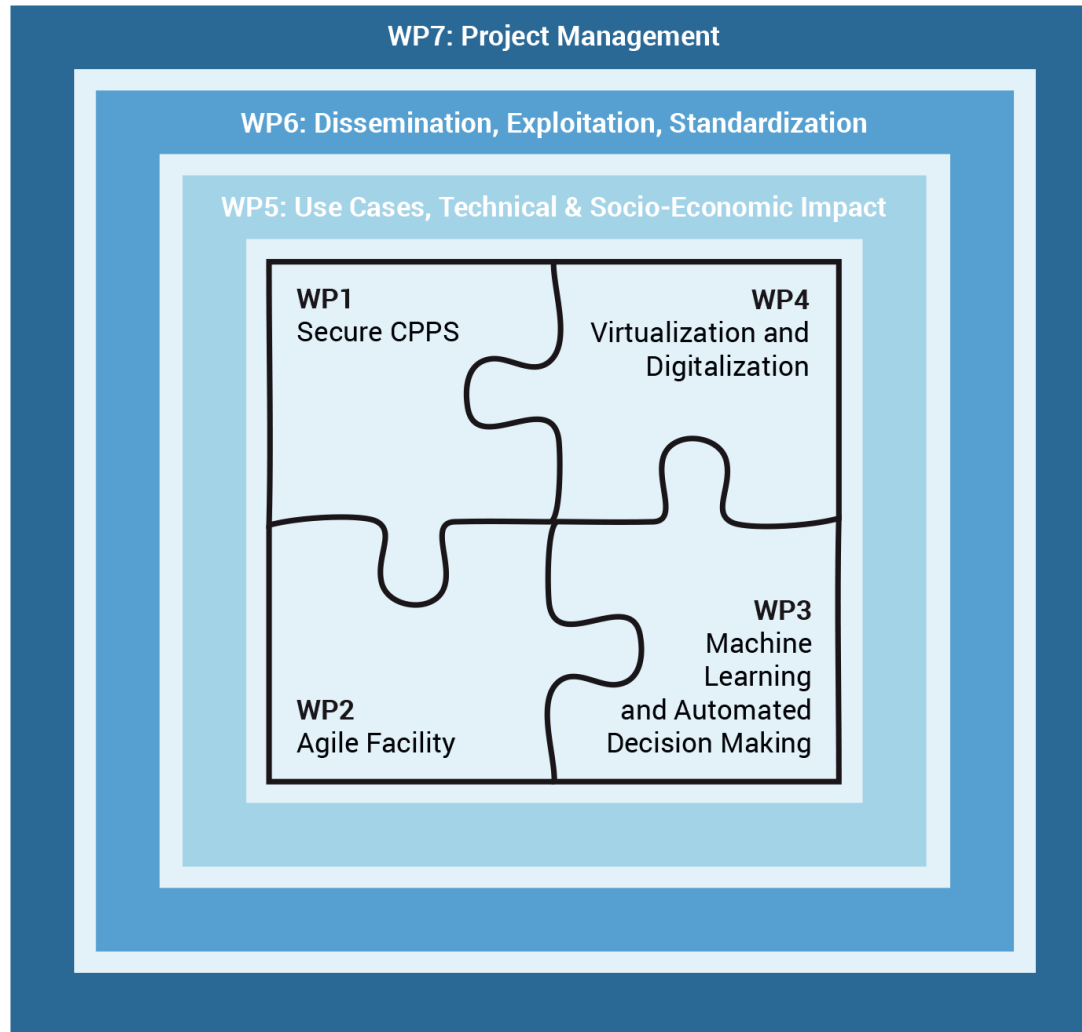
Source: www.semi40.eu

Project description

➢ 37 partners

➢ 5 European countries

➢ The implementation of Industry 4.0 technologies is the key aspect of SemI40 project, to enhance sustainable competitiveness in European electronics and semiconductor production, adopting recent innovations in electronic systems and ICT technologies.

➢ SemI40 particularly concentrates on developing essential manufacturing capabilities.

Source: www.semi40.eu

Work Plan

Source: www.semi40.eu

Our Work Areas of SemI40

➢ ## Agile Facility
  - ☞ Fast reconfiguration and controlling of logistic processes and automated experiments.
  - ☞ Enhanced logistics & material flows
  - ☞ Enhacned equipment setup & efficient traceability
  - ☞ Real time representation in virtual environment

➢ ## Machine learning & automated decision making
  - ☞ Complementary, new algorithmic approaches for predictive analytics
  - ☞ Tools and methodologies for automated decision making in manufacturing shop floor, based on big data analysis methods.

Source: www.semi40.eu

Acknowledgement

The High Performance Manufacturing survey

- Initiated in 1989 to analyse the success of manufacturing plants along many dimensions of operational performance.

- Fourth round was completed in 2016.

- Participating plants are located around the world, e.g., in Austria, Switzerland, Brazil, Germany, Spain, Israel, Sweden, Italy, Japan, China, Korea, Finland, Taiwan, United Kingdom, United States, and Vietnam.

- The questionnaires were developed by academics and practitioners based on subject specific literature.

- Independent research groups collect data on plant level from machinery, electronics and automotive supply industry.

- In total, 12 different areas at each plant are addressed.

- The survey encompasses several areas of manufacturing strategy including both perceptual and objective measures.

Research at the University of Klagenfurt based on the High Performance Manufacturing survey

Improving manufacturers' capabilities in line with the cumulative performance sand cone model (Reiner, G. and Wurzer, T.)

- The purpose is outlining the methodological framework to identify improvement practices that enhance flexibility and cost performance as well as examining whether adherence to a certain sequence of performance improvement practices is economically promising.

- Use of an alternative **Structural Equation Modeling** approach. Focus is put on **testing for moderating effects** on the relationship between Agile Manufacturing Enablers and the performance dimensions at the top of the sand cone model.

- Results show that certain **improvement practices**, e.g., Modular Product Design, can improve cost and flexibility performance simultaneously, provided that a **solid basis** in terms of delivery and quality performance exists.

- The findings make improvement processes more predictable and help managers to overcome traditional trade-off situations.

Physical Internet - ETP-AliceCE

➢ ALICE, Alliance for Logistics Innovation through Collaboration in Europe

➢ European Technology Platform for Logistics, launched on June 11, 2013, and receiving official recognition from the EC in July 2013.

➢ The European Technology Platform ALICE is Set-up to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovation in Europe.

Physical Internet - ETP-Alice

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The platform will support and assist and advise the European Commission into the implementation of the EU Program for research: Horizon 2020 in the area of Logistics.

http://www.etp-logistics.eu
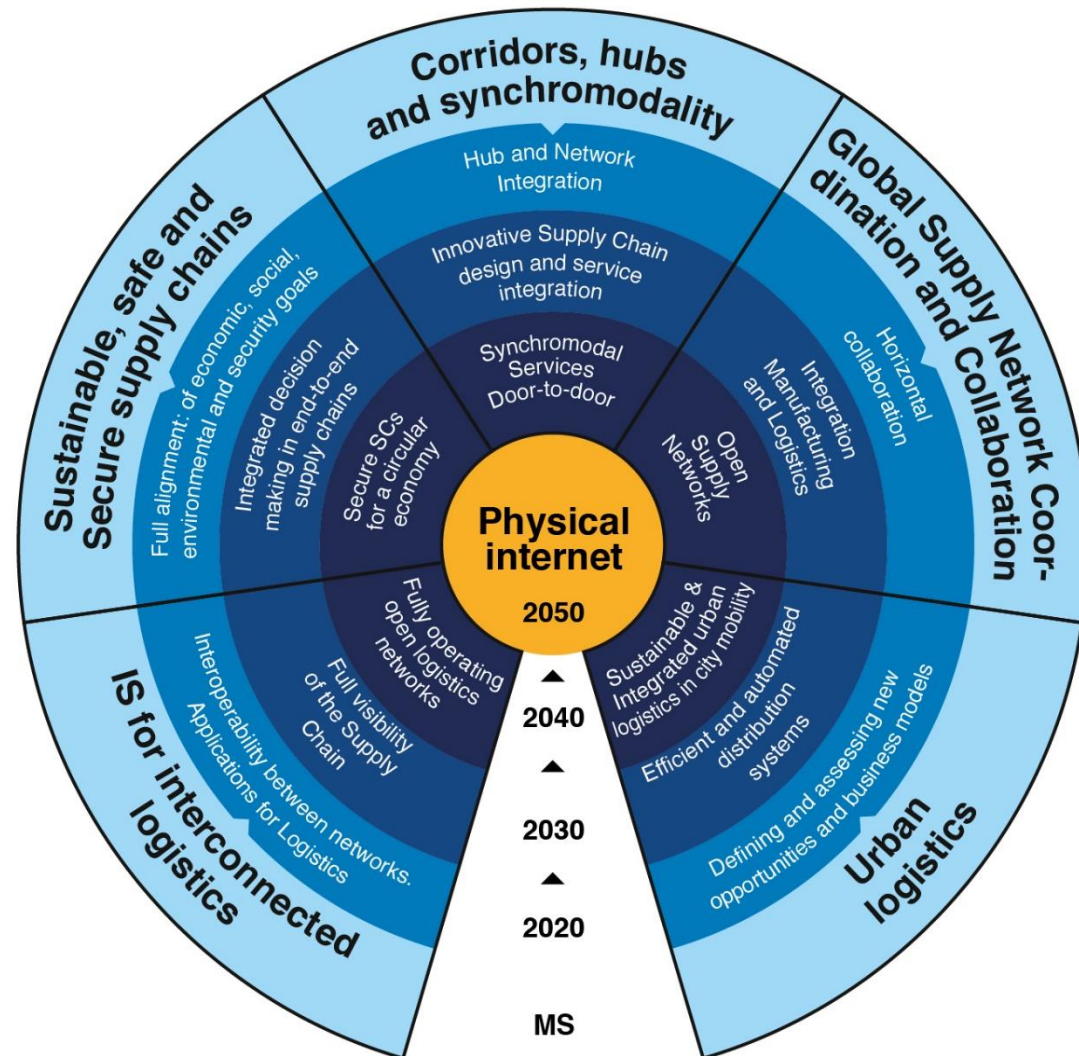
WG 1: Sustainable, Safe and Secure Supply Chain Research Roadmap

Vision, Mission, Scope

Vision

The design of sustainable, safe and secure logistics systems and supply chains should contribute to solutions for societal problems such as resource scarcity, pollution, demographic changes, and global safety and security concerns.

Mission

Identify and define research and innovation challenges that allow new and improved designs of logistics systems and supply chains that effectively address these challenges. In addition, the mission is to connect research, education and piloting solutions in executing this mission.

Main Scope

Within ALICE the focus of the supply chain pillar will be to encourage the research and development of new logistics systems and supply chains that involve all relevant players, and address societal challenges.
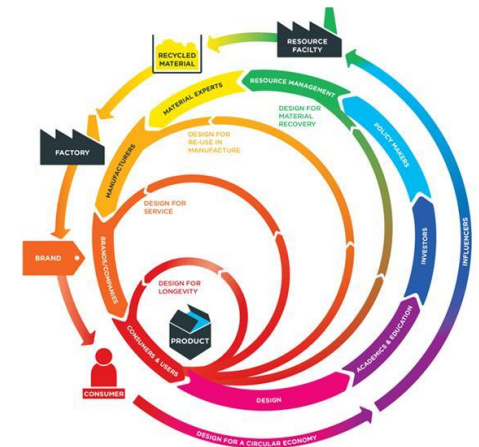
Key Milestones WG1

2020

- Full alignment of economics, environmental, social and security goals
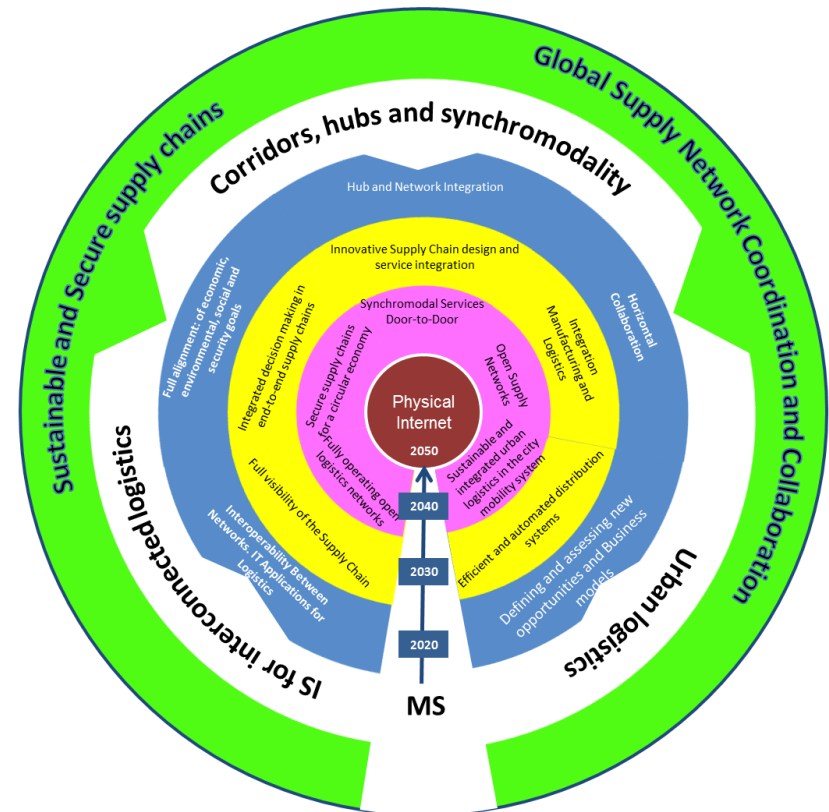
2030

- Integrated decisionmaking in end-to-end supply chain

2040

- Safe and secure supply chains for circular economy

2050

- Physical Internet

Challenges (sustainability)

The main challenge addressed in the roadmap is:

to ensure that growth, competitiveness, innovation and industrial   leadership does not take place at the cost of environmental sustainability, safety and security in supply chains.

Further challenges:

- *Reducing dependency* on non-renewable energy resources (oil dependency),
- *minimising emission* of greenhouse gasses,
- *advancing re-use* of products and materials,
- *transformation* of supply chains towards a low-carbon economy

Challenges (safety and security)

The main challenge addressed in the roadmap is:
> to better balance societal and business driven objectives in supply chain management.

Further challenges:
- Enhance the efficiency, speed and reliability of legitimate trade and logistics,
- enhance the effectiveness of supervising global trade,

Thank you very much for your attention!