39.Techno-Ökonomie Kolloquium on 24.November in 2026

Technical University Leoben

Zukunftsdialog, Impulszentrum für Werkstoffe (IZW), Roseggerstraße 12, 8700 Leoben

ABSTRACT

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TITEL: ACTIVITY-BASED STANDARD-COST & GHG ACCOUNTING: DESIGN AND DEVELOPMENT OF AN ACCOUNTING INFORMATION SYSTEM FOR THE MANUFACTURING DOMAIN

SHORT BIOGRAPHY:

Lalla Hasnae Alaoui is a PhD candidate at the Institute of Management Science at TU Wien. She holds a background in computer science and project management and has experience in digital marketing. Her research focuses on the design and development of an activity-based standard-cost and GHG accounting information system for Manufacturing. Her research interests lie at the intersection of accounting, information systems engineering, manufacturing, and sustainability.

ABSTRACT:

Recent sustainability regulations increase the need for companies to integrate greenhouse gas (GHG) information alongside financial information, not only for reporting but also for management and control. This requires reliable and traceable quantification of GHG emissions arising from operational activities and their employment of resources. Manufacturing provides a particularly relevant application domain, as production information systems capture structured data about these underlying activities the corresponding resource inputs and outputs. However, existing Accounting Information Systems (AIS) provide limited integration between economic and environmental accounting information and the underlying activities and resources from which they originate. The primary research objective of this dissertation is to address this gap by designing and developing a Manufacturing Accounting

Information System that connects operational production data with activity-based standard-cost and GHG accounting in multi-level structures.

Following a Design Science Research process, ontology-based domain engineering provides a methodological approach to the design and development of the system. The resulting add-on application provides an interactive digital representation of multi-level manufacturing structures, integrating production activities, resources, and their dependencies with their economic and environmental impacts. It enables performance to be planned, measured, compared, and traced across these structures to support management and control. Production transactions and related inventory changes further connect production execution with accounting information. Hence, the artefact contributes a computable and traceable accounting implementation of multi-level manufacturing and provides a digital-twin-ready accounting and management-control layer that can be coupled with real-time shop-floor data toward a manufacturing accounting digital twin.

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ABSTRACT

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TITEL: Engineering Agentic AI for Industrial Process Redesign: A Method and Reference Architecture for Governed Deployment in Semiconductor Manufacturing

SHORT BIOGRAPHY:

Philipp Besinger holds a Dipl.-Ing. degree from TU Wien. Since 2021, he has worked at Fraunhofer Austria Research GmbH in Vienna as a Senior Project Manager. He manages applied AI projects with industrial partners, including Infineon Technologies Austria AG and Bosch Rexroth. His work includes multi-agent systems, domain-specific foundation models, AI-supported knowledge capture, and engineering recommendation systems. He is a doctoral candidate at the Institute of Management Science, TU Wien, Research Unit of Production and Maintenance Management, supervised by Univ.-Prof. Dr.-Ing. habil. Fazel Ansari. His publications address responsible AI in manufacturing, large-language-model-based maintenance assistance, and knowledge management. His dissertation is embedded in the industrial research project TRANSFORM with Infineon Technologies Austria AG.

ABSTRACT:

Agentic artificial intelligence (AI) can plan, use tools, and carry out multi-step tasks with limited human input. In manufacturing, however, adding agents to existing workflows can transfer work to engineers, who must supervise and correct their output. It remains unclear whether agent-produced engineering artefacts match or improve on those produced by current human processes. These problems are particularly important in semiconductor fabrication, where process changes require approval, work spans several systems, and critical knowledge is often held by individual experts. Existing research addresses parts of this problem, but not process redesign, agent governance, and evaluation as an integrated whole. This dissertation asks how governed agentic AI can be engineered into regulated industrial processes, and whether redesigning a process around human-agent collaboration reduces human work time and improves artefact quality. Using Design Science Research, it develops a traceable method for process redesign and a reference architecture that specifies agent responsibilities, permissions, escalation paths, and system interfaces. Requirements are derived from expert interviews, personas, journey maps, process models, and system landscapes. Prototypes for maintenance of ion implantation equipment and unit process engineering will be evaluated against documented human baselines using time-on-task and predefined quality criteria.

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TITEL: DEVELOPMENT OF AN END-OF-LIFE DECISION SUPPORT MODEL FOR SELECTING ENVIRONMENTALLY AND ECONOMICALLY OPTIMAL END-OF-LIFE STRATEGIES IN THE WIND INDUSTRY

SHORT BIOGRAPHY:

Stefanie Eisl is a doctoral student in the “Human–Machine Interaction” research group at the Institute of Management Science at Technical University Vienna. From 2015 onward, she studied mechanical engineering at TU Wien and economics at the University of Vienna. Her interest in sustainability began during her master’s studies and grew through research projects in her former role as a researcher at Fraunhofer Austria. At TU Wien, her research focuses on the development of circular economy strategies, mainly in the renewable energy sector, with the aim of taking one step closer to slowing and closing the resource loop. In addition to her work at TU Wien, she teaches Data Science as an external lecturer at FHWien WKW since 2024.

ABSTRACT:

Wind energy represents a key pillar of the global sustainable energy transition, yet its environmental benefits are compromised by inadequate End-of-Life (EoL) management of wind turbines. Slowing and closing the material loop is crucial to address the increasing resource demand and mitigate the otherwise unavoidable growth of waste volumes in the sector [1], [2]. The resulting challenge arises not only from the mass and complexity of wind turbines but also from missing or non-transparent information on their design, use, and condition [3]. The dissertation addresses these limitations by developing an End-of-Life decision support model that provides a robust, data-driven basis for selecting environmentally and/or economically

optimal EoL strategies. The overarching goal is to contribute to the transition towards circular value creation systems in the renewable energy sector.

Using the Design Science Research Methodology (DSRM) and a mixed-method approach, the research connects four key research areas: (1) reference object, (2) End-of-Life management, (3) impact assessment, and (4) optimisation modelling.

Area (1): As there exist insufficient data on the composition of different turbine types, a regression-based approach is developed to estimate the component and material composition from basic turbine specifications, such as the rotor diameter. The resulting scaling functions form the basis of a novel generic wind turbine model capable of estimating the composition of different turbine types from limited input data. Area (2) identifies state-of-the-art EoL strategies in the wind industry. The systematic literature review revealed a strong focus on low-value strategies, such as recycling, a limited number of components accounting only for a small mass share, such as blades, and a lack of common understanding of feasible EoL strategies. The identified strategies are not only defined and described in but also synthesized into novel EoL scenario maps showing strategy-specific process sequences. Building on these inputs, in Area (3) the economic and environmental impact is assessed. While Life Cycle Assessment (LCA) provides a scientifically established basis for comparing the environmental impacts of EoL strategies, its industrial application is limited by high data requirements, methodological complexity, and considerable time and labour effort. Therefore, a simplified LCA approach was developed, using the scenario maps to enable a semi-automated assessment of multiple EoL strategies, thereby addressing these limitations. Unlike the environmental impact assessment, which considers the full EoL process chain, the economic impact assessment is limited to the product owner's perspective and ends with the transfer of ownership. Based on González & Adenso-Díaz [4] & Feng et al. [5] the resulting EoL profit can be defined as the revenue from selling the product, components, or materials minus strategy- and disassembly-related costs.

The results of area (1)-(3) all serve as input for Area (4), which focus on the development of an optimisation model for selecting feasible circular economy strategies using mathematical modelling. Analogous to a classical assignment problem, each component can either be assigned an EoL strategy or further disassembled into subcomponents. This enables strategy selection across multiple product levels rather than at a single predefined level, as commonly applied in existing research. Costs are modelled as described in Area (3), while determining environmental impacts through the simplified LCA approach allows the optimisation model itself to remain concise.

The resulting EoL decision-support model makes an important contribution to streamlining the complex EoL decision-making process in the wind energy sector. By combining circular economy thinking with data-driven decision support, a first step towards achieving a closed-loop energy future can be made.

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ABSTRACT

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Titel: Integrated Planning for Logistics and General Assembly in the Automotive Industry

Short Biography:

I completed both my Bachelor's and Master's degrees in Industrial Engineering and Mechanical Engineering at Graz University of Technology, specializing in Production and Logistics as well as Economics during my Master's studies. After graduating, I joined the Institute of Engineering and Business Informatics as a Research Assistant, where my teaching activities focus on Production Theory and Analytics as well as Operations Research.

Abstract:

Automotive manufacturers increasingly rely on mixed-model assembly lines to accommodate growing product variety and fluctuating demand. In particular, the parallel production of conventional, hybrid, and battery-electric vehicles increases the complexity of coordinating assembly operations and material supply. Two closely related tactical planning problems are assembly line balancing, which assigns assembly tasks to workstations under precedence and cycle-time constraints, and assembly line feeding, which determines how the required materials are supplied. Although these decisions strongly influence one another, they are frequently addressed sequentially. Moreover, existing optimization approaches often represent the border of line, or provisioning area, through simplified space constraints and approximated walking distances. Consequently, the influence of detailed material arrangement on worker movements, production feasibility, and logistics operations is insufficiently captured.

This doctoral thesis addresses this research gap by developing an integrated optimization approach for tactical assembly and logistics planning, with particular emphasis on the physical interface between both planning problems. The research follows a stepwise approach, progressing from detailed material allocation to the joint optimization of assembly line balancing, line feeding, and material arrangement at the border of line.

The initial research focuses on the optimization of material and container placement within the provisioning area. A genetic algorithm is employed to optimize material arrangements while considering spatial restrictions, existing infrastructure, worker accessibility, and logistics replenishment requirements. Building on this foundation, a simulation-optimization approach is developed to incorporate more detailed worker processes and paced assembly lines. The approach combines metaheuristic optimization with simulation to evaluate the effects of material placement on worker walking distances and task execution times. Furthermore, changing product mixes are considered through scenario-based robust optimization, aiming to identify material arrangements that maintain good performance under varying production conditions without requiring frequent rearrangement. Computational experiments using industrial data demonstrate average reductions in worker walking distances of 15.1% for product-mix-specific layouts and 11.7% for robust layouts compared with manually planned arrangements.

Based on these developments, the research further investigates the integration of material arrangement and line feeding decisions. Different material supply strategies, including line staging and the utilization of the full provisioning area, are evaluated under varying takt-time conditions. Particular attention is given to the trade-off between assembly-worker walking effort and internal logistics costs, with the aim of identifying cost-efficient planning strategies depending on production conditions.

The final research objective is to integrate these aspects into a joint optimization model for assembly line balancing and line feeding. By simultaneously considering task assignments, material supply strategies, and the detailed arrangement of materials at the border of line, the proposed approach aims to capture interdependencies that are neglected in sequential planning. Its performance will be evaluated against conventional planning approaches with respect to takt-dependent production and logistics costs per vehicle.

The central scientific contribution lies in incorporating detailed spatial material arrangement into the integrated assembly line balancing and feeding problem. By explicitly modeling the border of line as the interface between production and logistics, the thesis aims to provide a

more realistic and comprehensive basis for tactical planning decisions in automotive assembly systems.

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ABSTRACT

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TITEL: **STRATEGIC THINKING AND ORGANIZATIONAL SENSING: AN EMPIRICAL STUDY**

SHORT BIOGRAPHY:

Rudolf Grünbichler (https://orcid.org/0000-0002-5872-5771) is project assistant at the Institute for Business Economics and Industrial Sociology. Before joining Graz University of Technology, he gained several years of experience in tax and management consulting. His research and teaching in management accounting focus on strategic thinking (ST) and its role in supporting managers to recognize emerging opportunities at an early stage.

ABSTRACT:

Dynamic Capabilities (DC) enable organizations to respond to changing environments by identifying emerging opportunities and threats. While previous research has linked managerial cognition and ST to DC, the influence of specific types of ST on organizational Sensing activities remains insufficiently understood. This study examines which types of ST best support managers in identifying and evaluating emerging opportunities and threats. Focusing on creative, synthetic, visionary, and divergent thinking, it draws on DC Theory and Upper Echelons Theory to explore how individual cognitive approaches contribute to organizational Sensing capabilities. A quantitative survey using validated measurement scales will be conducted among individuals involved in strategic activities in industrial companies, with Structural Equation Modeling used to test the relationships between the four types of ST and organizational Sensing capabilities. The study contributes to DC Theory by examining ST as a cognitive foundation of the Upper Echelons perspective and identifying the thinking types most relevant to organizational Sensing. The findings may contribute to leadership development, talent selection, and educational initiatives aimed at strengthening managers' opportunity recognition capabilities.

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ABSTRACT

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TITEL: **DECISION SUPPORT IN INDUSTRIAL PRODUCTION NETWORK PLANNING**

SHORT BIOGRAPHY:

Daniel Gutmann is a university assistant at the Institute of Innovation and Industrial Management at Graz University of Technology. His work focuses on industrial production and factory planning, particularly production networks, capacity planning, and simulation-based decision support. He has gained practical experience through various industrial research and projects.

ABSTRACT:

Planning in industrial production networks often relies on aggregated capacity figures, such as the total production hours available at a site. However, these figures may not fully reflect the capabilities and constraints of individual machines or production lines. A site may therefore appear to have sufficient capacity, even though the equipment required for certain orders has insufficient available capacity. This can affect decisions about production capacities and the allocation of orders across manufacturing sites. The research focuses on how production characteristics at different levels of the production system, ranging from individual resources and production sites to entire networks, affect the assessment of capacity planning and order allocation alternatives. Building on previous simulation-based investigations, the research examines how planning assumptions and production constraints influence plan feasibility and delivery performance. The objective is to identify which production characteristics are relevant for different planning decisions and how their consideration can contribute to decision support in industrial production network planning.

ABSTRACT

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TITEL DER ARBEIT: „I'VE GOT NOTHING TO HIDE“: OPERATIONALIZING VALUE SENSITIVE DESIGN FOR PRIVACY-AWARE AI AND ROBOTIC TECHNOLOGIES IN ELDERLY CARE

KURZBIOGRAFIE:

Reinhard Kletter is a member of the Research Unit for Labor Science and Organization at the Institute of Management Science, TU Wien. With a foundation in engineering and a current focus on human-centered research, he embodies a transdisciplinary approach, dedicated to advancing technology for people.

ABSTRACT:

By adopting a value sensitive design (VSD) approach, privacy was identified as a central concern in the deployment of robotic technologies and AI within care contexts. A systematic review of robotic technologies in care conceptualized privacy as a multidimensional phenomenon extending beyond mere data protection. Building on this, a framework was developed to align mitigation strategies with the different dimensions of privacy. Co-design workshops with care workers and residents in residential nursing homes highlighted a strong need for documentation support. In response, an LLM-based documentation support system (LDSS) was designed, implemented, and evaluated. Preliminary findings indicate that the LDSS can effectively extract care-relevant information from nurse-resident interactions. However, using ethnographic methods during a longitudinal deployment of the LDSS, misalignments with care workers' documentation practices were revealed. To mitigate privacy concerns within the LDSS, this work introduces a Privacy-by-Design framework grounded in Nissenbaum's theory of contextual integrity, aiming to filter sensitive information from transcripts by identifying information flows and evaluating them against contextual privacy norms to detect potential violations. The operationalized LLM-based automated privacy detection (LAPD) pipeline represents an initial step toward systematically identifying privacy-sensitive segments in care documentation. Grounded in the VSD framework and informed by co-creation methods, this research actively involves stakeholders throughout the development process. It contributes novel, privacy-aware technological solutions while critically examining their integration into—and impact on—broader sociotechnical work practices.

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TITEL:

Implicit Interaction in Technology-Assisted Assembly: Adapting to Bodily Context and Human Action Recognition

SHORT BIOGRAPHY:

David is a researcher and PhD candidate at the department of Human-Machine Interaction at TU Wien. His primary research interests involve intelligent and AI-based user interfaces, affective computing, and embodied interaction between workers and machines in industrial settings.

ABSTRACT:

Technology-assisted assembly supports workers through systems such as projected work instructions, adaptive workstations, and collaborative robots. Most such systems rely on explicit interaction, requiring workers to repeatedly shift focus from the workpiece to the system. Implicit interaction, in which systems sense behaviour and act proactively, promises a smoother workflow but also raises concerns about workers' autonomy, and both design knowledge and empirical evidence on its use in assembly remain limited.

This thesis investigates how implicit interaction can be realised by sensing cues from workers' bodies and actions during assembly. Drawing on embodied interaction and activity theory, we distinguish bodily context, such as posture or reaching motion, which is continuous and describes how the worker works, from actions, such as screwing or sawing, which are episodic and describe what the worker does. We argue that these cues, rather than process steps, are the transferable basis for implicit interaction. While prior works suggest process steps that are specific to a product and sequence, bodily states and actions recur across tasks and products.

In two studies on bodily context, workers accepted and preferred posture-based AI adjustment of table height over manual control, formed mental models that made the system's behaviour predictable, and reported high trust. When correcting robot errors, implicitly detected reaching led to higher perceived fluency and teaming than explicit or haptic override, showing that implicit channels can also return control to the worker.

For realising implicit interaction via action recognition, we present a multimodal recognition approach encompassing video, acoustic, and wearable sensing. We further present a therblig-grounded, hierarchically annotated assembly dataset that captures diversity in motion rather than in product-specific goals, together with a benchmark. Applying action recognition to implicit interaction, in a pilot study, action-triggered AR instructions improved workflow compared to speech-based and gesture control. In the final part of the evaluation, we plan to carry out a study examining how action recognition can trigger proactive robot behaviour, evaluating acceptance, productivity as well as how recognition errors and the ability to override shape perceived control.

Following a research-through-design approach, we distil the empirical and engineering insights from these artifacts into a framework for implicit interaction in intelligent assembly workspaces. The framework describes how sensed cues can be interpreted in relation to the ongoing work, and how such systems can remain intelligible and correctable when recognition fails.

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TITEL: **INTEGRATING VALUE ANALYSIS INTO ECO-EFFICIENCY ASSESSMENT**

SHORT BIOGRAPHY:

He is a researcher in the field of Value Analysis at the Institute of Innovation and Industrial Management. He studied Mechanical Engineering and Business Economics at Graz University of Technology, where he completed his Master's degree with a focus on Computational Engineering. During his time at the institute, he gained experience in several industrial projects, focusing on production planning, product development, and Value Analysis.

ABSTRACT:

European manufacturing companies are increasingly facing the challenge of maintaining their competitiveness as manufacturing costs continue to rise. At the same time, industrial production accounts for a substantial share of greenhouse gas (GHG) emissions, highlighting the need to reduce the environmental impact of manufactured products. Addressing both challenges requires approaches that consider economic and environmental objectives simultaneously.

Eco-efficiency (EE) provides a framework for combining economic value creation with environmental performance. Value Analysis (VA), standardized in EN 12973, offers a systematic, function-oriented methodology for analysing product value and identifying improvement opportunities. While VA traditionally focuses on the relationship between product functions and the resources required to fulfil them, its integration into an EE framework could extend this perspective by explicitly considering the environmental impact associated with product functions and their fulfilment.

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TITEL: OVERALL SUSTAINABLE EQUIPMENT EFFECTIVENESS (OSEE): A DYNAMIC BAYESIAN NETWORK FRAMEWORK FOR SUSTAINABILITY-INTEGRATED DECISION SUPPORT IN MANUFACTURING

SHORT BIOGRAPHY:

Theresa Madreiter is a doctoral researcher at the Research Unit Production and Maintenance Management, TU Wien, working on sustainability-integrated performance measurement in manufacturing. She also works at Fraunhofer Austria in the group Smart Maintenance and Product Engineering, leading research and industry projects on AI for production and maintenance. Her work has been published at IFAC (2024) and in IJPHM (2025). She studied Industrial Engineering and Mechanical Engineering at TU Wien, where she also teaches.

ABSTRACT:

Manufacturing is a major driver of global resource use and emissions. The most effective levers for change lie in daily operational decisions at the equipment level. However, the production, environmental, and work-related consequences of these actions are typically assessed in isolation, which obscures critical trade-offs. Overall Sustainable Equipment Effectiveness (OSEE) addresses this by linking these perspectives directly at the equipment level, extending the established Overall Equipment Effectiveness framework. A Dynamic Bayesian Network then models the effects of operational actions over time and revises them as measurements arrive. This makes trade-offs and synergies actively assessable rather than merely assumed, enabling better operational decision-making under uncertainty.

39th Techno-Economics Colloquium on 24 November 2026

Montanuniversität Leoben

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ABSTRACT

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TITLE: Automating the Double Materiality Assessment in Sustainability Reporting under the CSRD

SHORT BIOGRAPHY:

Maximilian Nowak is a doctoral candidate at the Institute of Management Science (E330) at TU Wien. His dissertation is supervised by Univ.-Prof. Dr.-Ing. Sebastian Schlund. He works as a project manager at Fraunhofer Austria Research GmbH in Vienna. There he leads projects with industrial clients at the interface of production, sustainability and digitalisation. His research focuses on automated support for sustainability reporting under the CSRD. He presented the concept of his dissertation at the Techno-Economics Colloquium 2025 and today presents the results.

ABSTRACT:

The Double Materiality Assessment (DMA) is the first step of every sustainability report under the CSRD and the ESRS. It remains mandatory after the Omnibus reform of 2026. In practice, it is carried out in workshops. This is time-consuming and the derivation of the results is often not documented. In the case company examined in the dissertation, the assessment took 113 person-hours. 44 of 92 topics were dropped without a written justification.

The dissertation develops a model that supports steps 1 and 2 of the DMA in an automated way. The model consists of three phases and 14 steps. A rule-based core derives candidate

impacts, risks and opportunities (IROs) from publicly available data. Each candidate receives an audit trail with indicator, raw value, threshold and source. A language model formulates the IRO candidates in text. Assessment and approval remain with the human.

The research follows the Design Science Research approach of Peffers et al. (2007). It builds on a systematic literature review of 48 publications. The evaluation was defined before the first model run and measured against the manual process of a manufacturing company. The model identifies the material topics precisely (trigger precision 0.91) but not completely (coverage 0.33). The structured evidence base nearly doubles the hit rate of the language model. The results are more stable under repetition than the agreement between human raters (AC1 0.95 versus 0.60). Transferability was tested at a second company.

The contribution is an end-to-end, modular and evaluated procedure in which the audit trail is part of the result. For suppliers without a sustainability department of their own, the model offers a traceable entry point into the DMA.

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TITEL: ENGINEERS' DIGITAL, INNOVATION AND SUSTAINABILITY COMPETENCES: INTERRELATIONSHIPS AND ASSOCIATIONS WITH ORGANISATIONAL PERFORMANCE

SHORT BIOGRAPHY:

Amila Omazić was a research and teaching assistant at the Institute of Business Economics and Industrial Sociology at Graz University of Technology (TU Graz). Her research focuses on human resource management practices that can further enhance organisational performance in the context of fostering the development of engineers' sustainability, digital, and innovation competences.

ABSTRACT:

Engineers' digital, innovation and sustainability competences are relevant to organisational challenges associated with the circular economy and circular engineering. From a human capital theory (HCT) perspective, these competences represent components of engineers' human capital and as such may be relevant organisational performance. Although digital, innovation and sustainability competences are increasingly discussed in engineering research, their interrelationships and their individual and collective relationships with perceived organisational performance need further examination within an integrated empirical framework. A sequential research design combined semi-systematic literature reviews to conceptualise constructs and derive initial measurement items, with a cross-sectional survey of European engineers. The empirical analysis was based on a final sample of 400 submissions, after data examination and preparation. Descriptive analyses examined sample characteristics. Inferential analysis was conducted by the means of Partial Least Squares

Structural Equation Modeling using SmartPLS and enabled empirical assessment of the hypothesised relationships among the constructs. The study applied a disjoint two-stage approach. In the first stage, interrelationships among the competences and their individual relationships with perceived organisational performance were examined within one model. In the second stage, the latent variable scores of digital, innovation and sustainability competences were used to form the higher-order digital-innovation-sustainability (DIS) competence construct, and its relationship with perceived organisational performance was examined within the second model. Significant positive relationships were identified among the three competences, including a small positive indirect relationship between digital and innovation competences through sustainability competence. Digital and sustainability competences yielded significant positive relationships with perceived organisational performance, while the relationship between innovation competence and perceived organisational performance was positive but not statistically significant. The higher-order DIS competence construct yielded positive significant relationship with perceived organisational performance, although the model's explanatory power was relatively limited (R^2 = 0.131). Digital and sustainability competences made significant relative contributions to DIS. Innovation competence's relative contribution was not significant, but its outer loading showed significant absolute importance; it was retained because of theoretical relevance and the absence of problematic collinearity. All three competences were significant in terms of absolute importance for the DIS construct. The study contributes to an integrated understanding of engineers' digital, innovation and sustainability competences by providing differentiated empirical evidence on their interrelationships and individual and collective relationships with perceived organisational performance. The study provides an empirically assessed framework for analysing engineers' digital, innovation and sustainability competences and offers research-based implications for competence development and human resource management (HRM), while highlighting the need for future replication, longitudinal research and further validation.

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ABSTRACT

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TITEL: **DIPL.-ING.**

SHORT BIOGRAPHY:

After studying Mechanical Engineering and Business Economics with a specialization in computational engineering at Graz University of Technology, I joined the institute of Enginnering and Business Informatics in 2023 as a project assistant. My field of work includes requirements engineering, service design, process modeling and modeling languages. Recent and current research projects focus on the creation of a digital platform for the reuse of assembly line components and additive manufacturing of cranial implants.

ABSTRACT:

In recent years, firms have increasingly adopted innovation- and platform ecosystem-oriented strategies to create greater value for end customers. Well known examples include Google's Android, BlaBlarCar or Uber. Rather than delivering value through isolated products or services, these strategies rely on the combination of complementary offerings and technologies contributed by multiple ecosystem actors. To support the analysis and communication of such ecosystems, several modeling languages have been developed. A literature review revealed that these existing modeling approaches do not fully incorporate the rich variety of complementarities and technical dependencies, which can arise among actors' individual contributions to the ecosystem. Furthermore, existing approaches also do not always explicitly capture how these contributions are combined and coordinated to

produce an ecosystem-level outcome. To address these limitations, this dissertation project aims to develop a new modeling language which supports the structured representation of ecosystem actors, their contributions, their dependencies, and the mechanism of how they jointly create the system-level value for end users. The concept presentation will give a detailed discussion of the gap in existing work and then focus on outlining the planned methodology for the development of the artefact - the new modeling language.

39.Techno-Ökonomie Kolloquium on 24.November in 2026

Technical University Leoben

Zukunftsdialog, Impulszentrum für Werkstoffe (IZW), Roseggerstraße 12, 8700 Leoben

ABSTRACT

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TITEL

EN: Leveraging Industrial Energy Flexibility in Production Planning for Redispatch in Electrical Grids

DE: Einsatzoptimierung industrieller Energieflexibilität durch Produktionsplanung für Stromnetzstabilität

SHORT BIOGRAPHY:

Julian Perwitz is a research associate at Fraunhofer Austria Research GmbH in Vienna. His work focuses on modeling and simulation of complex industrial production and energy systems, with a particular emphasis on production planning, optimization, and industrial energy flexibility. He studied mechanical and industrial engineering at TU Wien, where he is currently pursuing a doctoral degree.

Publication list:

- Simulation-based evaluation of performance benefits from flexibility in assembly systems and matrix production (2022)
- Simulation-based evaluation of optimized reconfigurable cellular manufacturing deploying a diversified workforce (2025)
- Cross-Factory Production and Energy Optimization (2025)
- Activating Industrial Energy Flexibility in Production Planning: A Systematic Pre-Evaluation for Digital Twin-Based Optimization (2026)

ABSTRACT:

This dissertation develops a digital planning method for integrated production and energy optimization that enables manufacturing companies to exploit industrial energy flexibility in support of electrical grid stability.

European electricity grids face growing strain as the share of variable renewable generation continues to rise. Grid expansion, while indispensable, is costly and slow to implement. The resulting bottlenecks raise redispatch costs for congestion management and force renewable curtailment, while the build-out of renewable capacity slows down. Industrial energy flexibility – the active shifting of production loads in time – is increasingly promoted as a complementary instrument that can reduce the need for costly grid expansion rather than substitute for it. It thus offers a largely untapped potential for cost-efficient grid stabilization.

Realizing this potential in complex factories, however, requires planning methods that can translate flexibility potential into actionable, dynamic demand-side management. Practical approaches for coordinated energy optimization remain scarce, as existing research predominantly targets short-term market synchronization, peak shaving, and balancing-energy provision, leaving contributions to grid stability via redispatch underexplored and unquantified. Against this background, the dissertation addresses the following research question: How can a digital planning method for integrated production and energy optimization be designed to support both economic efficiency and grid-supportive behavior of companies in discrete manufacturing?

The dissertation follows the Design Science Research Methodology (DSRM), complemented by a systematic literature review based on the SALSA framework. The resulting artefact is a digital planning method built around a production scheduler with metaheuristic optimization that exploits load-shifting potential to optimize energy procurement, grid-fee reduction, and ancillary-service provision. A proof-of-concept demonstrator with three partners from the metal-processing industry is used for evaluation, making transparent both the economic potential – through savings in electricity costs and grid charges as well as redispatch revenues – and the contribution to grid stability. In doing so, the dissertation aims to be among the first to quantify how industrial energy flexibility from production planning can support redispatch-based grid stability, closing a gap left open by approaches to date.

This talk at TOEK 2024 presents the identified research gap and the concept of the digital planning method that forms the core of this scientific contribution.

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SHORT BIOGRAPHY:

Daniel Valtiner leads the Analytics and Artificial Intelligence Team at Infineon Villach's production facility. He started his career in 2002 at RHI AG Radenthein, where he did an apprenticeship in electrical engineering. While completing head foreman school and HTL he worked at RHIs production and changed to Infineon Villach's maintenance department for ion implantation in 2010. Besides working at Infineon, Daniel completed studies in Systems Engineering at FH Kärnten, Information Technology and an MBA at University of Klagenfurt. At Infineon he held further positions as R&D engineer, assistant to the board Austria and department manager maintenance.

ABSTRACT:

Towards Measuring the Economic Value Contribution of Generative AI in Semiconductor Manufacturing

This talk reviews the state of the art in industrial generative artificial intelligence (GenAI) and targes the current debate: under which conditions does technical performance translate into measurable economic benefit?

Following a Design Science Research approach, the doctoral research aims to link task-specific tests, user feedback and development and operating costs with concrete equipment maintenance outcomes. The empirical basis is an enterprise-grade GenAI stack developed through multi-year research cooperation and scaled to 2,000 users across four Infineon sites. Real-world data from Infineon Villach's semiconductor fab provide a basis for evaluating repair time and downtime. The talk discusses the developing method, attribution of improvements to AI assistance and transferability between use cases.

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SHORT BIOGRAPHY:

Julian Widhalm completed his Master's degree in "Management in Chemical Technologies" (Dipl.-Ing.) and his Bachelor's degree in "Chemistry and Chemical Technology" at Johannes Kepler University (JKU). His expertise lies in combining a solid scientific foundation in chemistry, materials science, and biochemistry with essential business and management skills.

ABSTRACT:

Academic and research-based ventures represent an important mechanism through which scientific knowledge and technological advances can be translated into economic and societal applications. At the same time, these ventures have **particular characteristics** and develop within distinct environments, often including strong scientific and technological knowledge bases, relationships with universities and research organizations, access to specialized resources and infrastructure, intellectual-property arrangements, academic norms and often limited commercial experience (Vohora et al., 2004; Mustar et al., 2006; Rasmussen et al., 2011; Mathisen & Rasmussen, 2019; Hossinger et al., 2020). For these ventures, translating their scientific or technological potential into a viable commercial offering is often not a predetermined process, as the underlying knowledge or technology may allow for several plausible paths toward **commercialization.** This leaves open questions about possible applications and markets, customers, partners, routes to market, and revenue generation. Ventures therefore need to develop a viable commercial configuration among multiple possible options while navigating **opportunities, constraints, and uncertainties** associated with their particular setting. This raises the question of how ventures arrive at certain commercial configurations among these multiple possibilities and within their distinct academic and research-based contexts.

Business models provide a way of examining such commercial configurations by describing how ventures organize the **creation, delivery, and capture of value** (Teece, 2010; Zott & Amit, 2010). Research on academic and research-based ventures has accordingly used the business-model concept to examine different commercialization approaches and provides evidence that ventures may

pursue different business models and adapt them as they develop. A smaller stream also more directly examines how these business models emerge and develop during commercialization and, with varying degrees of explanatory depth, provides insights into aspects such as learning and experimentation, technology co-development, adaptation, and evolution (Bower, 2003; Sanz-Velasco & Saemundsson, 2008; Lehoux et al., 2014; Ziaee Bigdeli et al., 2016; Lubik & Garnsey, 2016; De Marco & Piccaluga, 2016; Moktar et al., 2026).

Despite these contributions, research on business-model development in academic and research-based ventures remains limited and fragmented. While existing studies provide valuable insights into how business models emerge and develop, they often focus on specific aspects, are dispersed across specific cases, development stages or conceptual perspectives and provide only limited explanations of why particular development paths emerge.

Consequently, there is still limited integrated and in-depth understanding of *why and how business models develop* as they do in academic and research-based ventures and *how different factors become relevant* within this development. This dissertation addresses this gap by systematically synthesizing possible factors relevant to business-model development from existing research and by empirically examining how selected factors become relevant within particular venture contexts.