Conference Abstract Booklet

"New Trends and Challenges in Engineering Management – Management of Global Industrial Processes"

2026

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Foreword

The conference "New Trends and Challenges in Engineering Management – Management of Global Industrial Processes" is one of the most important forums for domestic and international engineering management research and industrial applications at the Faculty of Engineering of the University of Debrecen.

At this conference, we aim to create an annual opportunity for domestic and international lecturers, researchers, students, and practitioners to present their new results and experiences in the field of engineering management, as well as to build and nurture relationships.

The program focuses on the following topics:

- Product and Process Innovation
- Industry 4.0 / 5.0 and Digital Manufacturing
- Process Management
- Innovation and Engineering Management
- Sustainability in Engineering Processes
- Circular Economy and Life Cycle Assessment
- Lean 5.0
- Logistics and Supply Chain Management, Procurement
- Capacity Planning and Production Scheduling
- Computer Science, Cloud Computing, Operations Research
- Engineering Project Management
- Education 5.0 for Industrial and Engineering Competence Development
- Quality Management
- Sports Technologies
- Challenges of Artificial Intelligence, Robotics, and Digitalisation
- Construction Management and Building Information Modelling
- Industrial and Engineering Leadership and Organisational Science

The organisers would like to thank all speakers and participants who contributed to this conference, continuing the tradition that has made engineering management and other management fields a major pillar of professional practice.

On behalf of the Organising Committee

Dr. Judit T. Kiss, PhD
head of department, associate professor
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Content

Abstracts of the Plenary Lectures Session

Sustainable Optimization in the Age of AI: Decision Intelligence for Global Supply Chains and Industrial Systems

Prof. Dr. Atidel Aboubaker Hadj-Alouane, professor, chair of Industrial Engineering & Engineering Management Department, College of Engineering, University of Sharjah, UAE

Operations Research (OR) and optimisation have long supported engineering management decisions, but today's global industrial processes face new challenges, including decarbonization, circular-economy requirements, disruptions, volatile demand and energy prices, and rapid digital transformation. These forces redefine "optimality" beyond cost and efficiency toward sustainability, resilience, and societal impact.

A new form of decision intelligence is emerging at the intersection of OR, optimisation, and artificial intelligence. Sustainability pressures are pushing models beyond deterministic, single-objective thinking toward formulations that are policy-aware and uncertainty-informed, explicitly embedding carbon constraints, green investments, and circular flows. In parallel, AI is redefining the speed and responsiveness of decision-making by improving prediction (demand, disruptions, emissions), accelerating decision cycles, and enabling adaptive control. Insights from recent work on sustainable closed-loop supply chains and AI-enabled operational decision-making illustrate how hybrid AI–OR methods can connect strategy, planning, and execution, supporting strategic design, tactical planning, and real-time scheduling in the presence of disturbances. The closing message is an agenda for engineering management: prioritise interpretability and scalability, validate through digital twins, and translate methods into practical deployment for global industrial impact.

Sustainable Manufacturing, Ethnics & Challenges for a True Circular Economy

Prof. Dr. Andre D. L. Batako, reader in Sustainable Advanced Manufacturing Technologies; university professor, General Engineering Research Institute (GERI), Faculty of Engineering and Technology, Liverpool John Moores University (LJMU), United Kingdom

The transition to a circular economy represents one of the most transformative ambitions of the 21st century, demanding not only technological innovation but also deep ethical reflection from the inception throughout the life of the innovation. Sustainable manufacturing lies at the heart of this transition, where material cycles are closed, waste becomes a resource, and value creation aligns with ecological and social well-being. Yet, realising a true circular economy remains fraught with ethical dilemmas and systemic challenges. Here, we explore the moral, technological, and policy dimensions of sustainable manufacturing within a circular economy framework.

We interrogate questions of equity, transparency, and responsibility across global value chains, asking who benefits, who bears the costs, and how circularity can avoid reproducing existing inequalities, e.g. child labour, unfair prices and wages. Equally, we examine the challenges of implementing circular principles at scale, from lifecycle design and supply chain traceability to materials, energy use, data ethics, and regulatory coherence.

Drawing on contemporary research, industry practices, and international policy frameworks such as the SDGs and the EU Green Deal, the presentation emphasises the need for ethical governance, interdisciplinary collaboration, and innovation ecosystems that promote long-term sustainability over short-term gains. Ultimately, this is a call for a rethinking of manufacturing ethics, where circularity is not merely a technical fix, but a moral commitment to justice, stewardship, and resilience in the current geo-political era, in which human activity has the most detrimental influence on climate and natural habitat. Anthropocene. Greg Ramm, Country Director for Save the Children, said: "We're seeing a huge need for green energy solutions globally, which heavily relies on cobalt – but it is imperative that what fuels our smartphones, computers, and electric cars doesn't also fuel child rights violations."

Improved Alteration and Refurbishment of Heritage Buildings – A Conceptual Digital Twin/ Industry 5.0 Model

Prof. Dr. David Oloke, professor and head of School of Engineering and the Built Environment, Anglia Ruskin University, United Kingdom

The adaptive reuse of historic listed buildings frequently requires sensitive internal alterations to improve accessibility, accommodate new functions, and enhance user capacity, while preserving the structural integrity and architectural significance of the original fabric.

Recent advances in digital technologies have enabled innovative approaches to managing these competing demands. In particular, the application of digital twins—virtual representations of physical assets continuously updated through sensor data—has shown growing potential in heritage contexts, with emerging examples in cathedral monitoring, bridge retrofitting, and museum conservation where structural performance is tracked in real time without intrusive interventions.

This paper presents a case study of a Grade-listed church originally constructed circa 1861, where internal reconfiguration included new access routes, redefined functional spaces, and the installation of a gallery seating area.

The gallery was designed as a fully self-supporting steel frame with composite metal decking, deliberately isolated from the historic masonry and timber elements to avoid load transfer to the original structure.

A digital twin framework aligned with Industry 5.0 principles was adopted, integrating IoT-enabled displacement sensors strategically installed on the new steel frame and at selected non-invasive reference points within the existing building.

The methodology combined laser scanning/3D Modelling, BIM-based structural modelling, and real-time sensor data integration to create a living digital twin capable of reflecting the as-built condition and in-service behaviour of the intervention, demonstrating how digital twins can reconcile modern functional requirements with the stewardship of historic buildings.

From Managing Results to Developing People. A Shift in Leadership Thinking Inspired by Masao Nemoto

Dr. Joanna Czerska, assistant professor, dean's representative for Learning Outcomes Assurance; Department of Management and Quality Engineering, Faculty of Management and Economics, Gdańsk University of Technology, Poland

Contemporary organizations operate under intense performance pressure, often equating management with target achievement and performance control. Yet does a strong focus on measurable results truly build long-term adaptability and systemic capability? Or does it reinforce short-term efficiency at the expense of organizational maturity?

Masao Nemoto, a senior Toyota executive and contributor to the concept of Kanri, proposed a different understanding of leadership. In his view, management is primarily about developing people — their ability to think independently, make responsible decisions, and act in alignment with organizational direction.

Results are not the ultimate purpose of leadership; they are a consequence of the quality of managerial thinking and the conditions leaders create for others to grow.

This presentation reflects on the shift from "managing results" to "developing people" as a fundamental change in the leadership paradigm. It invites participants to explore key questions: Where does my responsibility as a leader truly end? Do I cultivate dependence or capability? And does the organization I help shape become stronger because of the way I lead?

Predict, Improve and Sustain: Lean Six Sigma Powered by Machine Learning

Prof. Dr. Katarzyna Antosz, associate professor; Department of Manufacturing Processes and Production Engineering, Rzeszów University of Technology, Poland

As global industrial processes become increasingly complex and variable, integrating machine learning (ML) with Lean Six Sigma allows for faster, more reliable, evidence-based improvements.

This presentation will demonstrate how ML can accelerate Lean Six Sigma projects by streamlining the 'Measure' and 'Analyse' phases through structured data preparation, feature engineering and predictive modelling. It will also show how Lean goals, such as improved flow and waste reduction, can be achieved in the 'Improve' phase.

Furthermore, it will demonstrate how gains can be sustained in the Control phase by operationalising models with MLOps practices, including model validation, deployment governance, and continuous monitoring of data and model drift. The DMAIC cycle will form the basis of the integration, with ML monitoring being linked to Statistical Process Control (SPC) to close the loop.

Selected industrial case studies will be discussed to illustrate scalable implementation paths and typical pitfalls in high-variability production environments.

The key message is that ML strengthens decision-making in Six Sigma projects and increases the probability of achieving a sustainable, repeatable impact at a large scale.

Abstracts of the Section Meetings

The Role of Standards in the ESG Framework

Dr. Piroska Harazin, assistant professor; Dr. Judit Edit Futó, assistant professor and Dr. Orsolya Szendrey, assistant professor
Institute of Economics, Faculty of Economics and Business, University of Debrecen

The presentation shows how international standards published before the introduction of ESG (Environmental, Social, Governance) requirements in the European Union and Hungary can be used to support corporate governance within the ESG framework and facilitate reporting.

We emphasise standards and frameworks published or updated in the recent period that can clearly facilitate and support compliance with ESG requirements. The study examines the practice based on public data: the frequency of application of the standards and their supporting function in ESG reporting are in focus.

Based on these two criteria, we analyse companies that are required to comply with the Hungarian ESG law (Act CVIII of 2023) and organisations listed in the EMAS (Eco-Management and Audit Scheme) register.

The Place and Role of Fire Protection and EHS in the ESG Framework

Norbert Kerekes, PhD student; Dr. Piroska Harazin, assistant professor; Dr. Mihály Soós, associate professor and Dr. Orsolya Szendrey, assistant professor
Institute of Economics, Faculty of Economics and Business, University of Debrecen

As ESG gains global prominence, growing attention is being directed toward companies' non-financial risk exposures. At the same time, the role of environmental, health and safety protection (EHS), especially fire safety, within the ESG framework is not uniformly regulated.

The aim of this study is to demonstrate how EHS, as a management system, can be integrated into the ESG framework, with a particular focus on the social and governance pillars.

The research is based on a review of the literature, analysis of international and domestic statistical data, and content analysis of sustainability reports from large companies in Hungary.

The results highlight the shortcomings of EHS and fire safety disclosures and the need to develop standardised ESG indicators.

The Role of Digital Substations in Sustainable Energy Systems: Energy-Efficient Architectures and System-Level Decarbonization in the Context of Technical Processes

Máté Mórocz, PhD student
Doctoral School on Safety and Security Sciences, Óbuda University, Hungary

The accelerating digitalisation of power systems is fundamentally transforming substation technologies, particularly with the emergence of digital substations based on the IEC 61850 standard. While a significant portion of the literature focuses on communication interoperability, cybersecurity, and protection automation, increasing attention is being paid to a critical question: what role do digital substations play in the development of sustainable energy systems, and how do they contribute to the decarbonization of technical processes?

The aim of this research is to examine, from a system-level perspective, the energy efficiency and sustainability potential of digital substations, with particular emphasis on the architecture of digital protection and control systems, data communication infrastructures, and the enhancement of grid reliability and resilience. Compared to conventional substations, one of the most significant innovations of digital substations is the implementation of process and station buses, which replace copper-based wiring with optical communication. This transition offers not only technical and operational advantages but also potentially significant environmental benefits. Reduced cabling, modularised intelligent electronic devices (IEDs), and remote diagnostic and maintenance capabilities may help lower overall system energy consumption and carbon intensity. However, the increasing energy demand of IT-related digital infrastructure and the rapid obsolescence of hardware components pose new sustainability challenges. A fundamental question of the research, therefore, is whether digital substations truly represent a greener alternative or merely reshape the structure of emissions.

The study approaches sustainability not exclusively from a life-cycle assessment (LCA) perspective, but also through the optimisation of technical processes. Digital substations enable real-time data acquisition, predictive maintenance, and adaptive network configuration, all of which can enhance supply reliability and reduce outages. Since power interruptions may result in significant indirect emissions, increasing system resilience can be directly linked to decarbonization objectives. The research places particular emphasis on self-healing substation concepts, where fast GOOSE-based communication and automated control logic enable dynamic network reconfiguration in the event of faults or cyberattacks. Methodologically, the research integrates multiple levels of analysis. First, a system architecture assessment compares the energy efficiency characteristics of conventional and digital substation structures. Second, communication traffic and network topologies are modelled, with special attention to the energy demand of redundant Ethernet-based architectures. Third, sustainability key performance indicators are defined, such as energy consumption per bay, specific power demand of digital devices, and emission reductions resulting from optimised maintenance cycles. The study combines qualitative and quantitative elements, including literature review, system-level modelling, and simulation-based scenario analysis to evaluate the impacts of different architectural configurations. Particular attention is given to the trade-offs between digitalisation and sustainability. Although virtualised protection functions and cloud-based infrastructures may reduce the number of physical devices, increased computational capacity and data traffic may generate new energy demands. The study therefore proposes an optimisation approach that balances reliability, security, and environmental impact. One of the central hypotheses of the research is that properly designed digital substation architectures not only result in direct energy savings but also support the integration of renewable energy sources through enhanced grid flexibility, thereby reducing the overall carbon intensity of the power system. The expected findings may contribute to integrating sustainability considerations into substation design and operational practices. The research offers a novel perspective for energy sector stakeholders, in which the digital substation is positioned not merely as a technological innovation but as an active instrument of decarbonization strategy. The system-level analysis may demonstrate that optimised communication topologies, modular IED architectures, and predictive operational models can jointly reduce energy consumption and enhance the overall sustainability of power networks.

Analysis of the Hungarian Value Chain and Economic Growth

Dr. Pál Belyó, PhD, professor emeritus
Department of Business Administration, Edutus University, Hungary

In recent decades, Hungary has integrated into global value chains (GVCs) across several sectors. While this has generated growth, long-term development remains limited without moving up these value chains.

The length and depth of these chains are crucial characteristics of an economy; they illustrate the share of value creation across the entire spectrum—from research and development (R&D) through material and component procurement and assembly, to sales and after-sales services.

The Hungarian economy contracted by -0.9% in 2023 and by approximately -2.2% in 2024, with growth slowing significantly to 0.3% in 2025. The primary engine of the economy is its export orientation, with an export-to-GDP ratio of around 75%. Although this exceeds both the EU and global averages, the ratio of gross value added to output in the industrial sector has fallen to 21% over the last two years.

The proportion of domestic value added to GDP remains low, constraining internal development and hindering the achievement of higher wage levels.

To ensure stable growth and move up the value chain, Hungary requires: increased domestic R&D and innovation, stronger Hungarian medium and large-sized enterprises, tighter integration between multinational corporations and domestic suppliers, and significantly improved education and skills development.

A substantial expansion is needed in the value added of manufacturing, as well as in design, software development, and the scope and quality of services within regional hubs. The question remains: how much expansion in value-chain positioning is required in the industrial and service sectors to ensure stable, long-term growth?

Characteristics of Circular Economy in Open System

Nóra Harangi-Ökrös[1], PhD student; Dr. Hajnalka Madai[1], associate professor and Dániel Péter Kovács[2], PhD student
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The aim of the study is to examine the specificities of implementing the circular economy in open production systems. According to the open system interpretation, economic processes are not closed mechanisms, but structures in continuous interaction with their environment, where the determination of system boundaries and the mapping of input–output relationships are key factors.

Our basic assumption is that, by their nature, by-products and organic outputs generated in the agricultural sector can be fed back into the production cycle, thereby reducing the environmental load.

The study contributes to the interpretation of the circular economy in open systems and serves as an example for the resource-efficient transformation of production systems.

The results have a management and decision-support approach for the sustainable transformation of biologically based production systems.

The implementation of the circular economy thus does not mean the artificial closure of the system, but rather the conscious and sustainable flow and life cycle of materials from input to output.

Co-production and Public Participation in Nature-based Solutions for Liveable Healthy Innovative Cities

Dr. Herta Mária Czédli, associate professor; Dr. Zsolt Ferenc Varga, associate professor
Department of Civil Engineering, Faculty of Engineering, University of Debrecen

The water is the lifeblood of our planet, a precious resource that faces different threats due to climate change and rapid urbanisation. Its responsible management and conservation are crucial not only for human survival but also for the health and vitality of urban ecosystems worldwide.

In this study, we take a journey through innovation and practical blue-green infrastructure applications that underline the significance of water conservation in the built environment. Community planning is a collaborative process involving residents, organisations, and local government to design, shape, and manage the future development of neighbourhoods and cities.

It integrates social, economic, and environmental,, factors to improve quality of life and create sustainable, places. Innovative nature-based urban management involves the local protection, conservation, restoration, and sustainable management of ecosystems to address global challenges such as climate change, anthropogenic pollution, and biodiversity loss. It integrates green infrastructure – such as parks, green roofs and wetlands – into urban design to increase resilience, improve human health and reduce urban heat islands, ultimately contributing to sustainable, liveable and healthy cities.

Public participation in Nature-based Solutions (NbS) is essential for creating sustainable, effective, and socially equitable environmental interventions, particularly in urban and community-based projects. Meaningful engagement involves stakeholders from planning to implementation, fostering stewardship, social learning, and a sense of belonging.

By empowering people and integrating their knowledge and experiences into the planning process, we can create cities that are more liveable, healthy, resilient, and innovative—offering pathways toward a more sustainable and equitable urban future.

Financial Literacy: Motivations and Opportunities for Lifelong Learning in Adult Education and Training

Prof. Dr. Brigitta Zsótér[1], head of institute, associate professor; Mónika Erdei[2], PhD student
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Nowadays, the development of financial awareness and financial culture is of paramount importance, as it fundamentally contributes to the well-being and financial security of the population. Financial awareness in a formal sense involves careful consideration of financial decisions. Lack of financial literacy can lead to financial insecurity, which also creates the conditions for increasing social inequalities.

The development of financial culture is therefore not only essential for personal well-being, but also essential for maintaining economic stability and social cohesion. In the context of adult education and higher education, financial awareness can also be understood as a lifelong learning process.

The research focuses on the psychological and attitudinal factors behind financial success and vulnerability, thereby contributing to increased economic competitiveness. It is important for education and training, whether inside or outside the school system (e.g. internal training, other training, etc.), to adapt to the constantly changing economic and social environment, which may directly or indirectly result in the development of the financial culture of the participant as an employee, as well as in increasing, encouraging and retaining the satisfaction of the employee.

The research aims to conduct a systematic literature review in the fields of financial awareness, lifelong learning, adult education (including workplace settings), and/or higher education.

Examining the Effects of Price Margin Cap from an Economic and Consumer Perspective

Dr. Tamás Marczin, assistant professor and Prof. Dr. István Szűcs, institute director, university professor
Institute of Economics, Faculty of Economics and Business, University of Debrecen

Over the past decade, economic trends have affected the agricultural and food industry product chains. Market shocks were caused by several factors.

These shocks also had a significant impact on consumers. Compared with relatively stable prices in the past, price volatility and food price inflation have become increasingly apparent.

In 2022-2023, there was a significant price increase of up to 50% across the European Union. This trend is currently less pronounced, but still present.

In Hungary, this effect was more pronounced. In addressing the problem, Hungarian policymakers opted for a less commonly used method: applying market regulation tools, which took the form of price caps in 2021-2022. In the current situation, the previous measure has been reintroduced to the market as a margin cap.

The aim of our research was to examine the impact of rising food inflation, particularly in light of the introduction of previous and current market regulation tools in Hungary. To this end, we collected data on 30 designated products from four domestic retail chains and supplemented our findings with secondary research.

Based on the results, it can be concluded that food inflation in Hungary rose sharply in December 2024, which was also reflected in consumers' living costs.

With the introduction of the regulation, most of the affected products responded with an immediate price decrease or stagnation, except for poultry meat products, mainly chicken breast.

In the case of products not covered by the regulation, it can be said that in most cases the market compensated for the loss of profit, as the prices of most of them increased.

In the longer term, the analysis shows that the use of market regulation tools has a negative impact on the market.

The Role and Potential of the ESG Framework in the Venture Capital and Investment Fund Segments

Dr. Orsolya Szendrey, assistant professor; Dr. Judit Edit Futó, assistant professor and Dr. Piroska Harazin, assistant professor
Institute of Economics, Faculty of Economics and Business, University of Debrecen

In recent years, the ESG framework has become increasingly prominent in the daily activities of economic actors, including investment and venture capital fund managers.

Although the arrival of the Omnibus package has brought about several simplifications in the regulations surrounding the ESG framework, financial market players are facing tighter regulations and increasing investor pressure to integrate ESG considerations into their day-to-day operations and investment decisions.

In line with this, one of the objectives of this study is to examine the ESG preparedness of domestic fund managers based on their publicly available reports and disclosures.

In addition, in the second step of the analysis, the study examines the differences between current practices and ESG expectations (GAP analysis) for three selected entities. It identifies and addresses potential material issues involving the organisation's stakeholders.

What Does the Scale Parameter Measure? The Relationship Between Scale Heterogeneity and Latent Attitudes in Best–Worst Scaling Data

Dr. Péter Czine, assistant professor; Prof. Dr. Péter Balogh, university professor; Prof. Dr. Péter József, Lengyel, university professor and Dr. János Szenderák, assistant professor
Faculty of Economics and Business, University of Debrecen, Hungary

This study presents a methodological application in the field of discrete choice modelling using representative data from a cross-country best–worst scaling (BWS) survey.

The survey was conducted in eight European countries, with approximately 800 respondents per country, and focused on consumers' preferences for cultured pork meat. An object-case BWS design was implemented using a balanced incomplete block design (BIBD) experimental framework: respondents made choices across seven hypothetical decision situations, each containing three of the seven evaluated attributes.

The empirical analysis follows a stepwise modelling framework. First, a conditional logit (CL) model is estimated. Second, a random parameter logit (RPL) specification is employed to capture unobserved preference heterogeneity across individuals. Third, a generalised multinomial logit (GMNL) model is applied to explicitly account for scale heterogeneity, thereby allowing differences in choice consistency to be separated from taste heterogeneity.

Finally, the specification is further extended within a hybrid choice modelling (HCM) framework by integrating an attitudinal latent construct that enters the model through its interaction with the scale parameter.

The empirical results indicate that the random parameter logit model captures substantial preference heterogeneity, while the GMNL specification on its own provides only limited additional gains in model fit.

However, results from the hybrid model suggest that scale heterogeneity cannot be interpreted as purely random noise: the significant relationship between the latent attitude and the scale parameter implies that decision consistency is structured and can be systematically linked to psychological factors.

From a methodological perspective, the findings highlight that explicitly modelling scale heterogeneity does not necessarily lead to marked improvements in model fit, but linking scale heterogeneity to latent variables opens up new avenues for interpreting individual decision-making behaviour in stated preference data.

Information and Cybersecurity Regulation (Principles and Options)

Prof. Dr. Pál Michelberger, full professor
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Information security regulation has undergone major changes in the past two decades. The standards and methodological materials applicable to the subject have also evolved in line with the challenges.

Today, a corporate organisation must take into account many factors to develop an appropriate information security regulation.

This can be the creation and operation of an information security management system in accordance with standards and/or recommendations, or simply the writing and enforcement of a constantly updated cybersecurity policy.

Examination of Revenue during the First-time Application of IFRS

Dr. Alexandra Szekeres, assistant professor
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The research topic is the impact assessment of the transition to IFRS for companies operating in the Hungarian accounting environment. The subject of the research is the companies among the first adopters that already prepare their individual reports in accordance with IFRS. The objective of the research is to examine the factors affecting companies' transition to IFRS, with particular attention to sales revenue, in two different accounting environments.

Based on the results of the Wilcoxon rank sum test, I established that, among the factors affecting the results examined, a significant difference was observed in sales revenue as a result of the transition. The differences in sales revenue are specifically due to the effect of one standard, the special requirements of IFRS 15. I consider it important to highlight that the average reported revenue is significantly higher in the Hungarian accounting environment.

The primary reason for this may be that, according to the provisions of the IFRS 15 standard, it is possible to recognise revenue in proportion to the costs incurred, i.e. the amount of revenue that can be recognised is independent of the invoiced amount.

As a result, the principle of comparison is more strongly enforced in IFRSs, as it shifts the revenue values between the years of the underlying period.

The Percentage Of Completion method (POC) represented a significant difference between Hungarian accounting regulations and IFRSs until January 1, 2020, as from that date, Act C of 2000, due to the impact of IFRSs, mandates this new method for revenue recognition, primarily in relation to project recognition.

Given that my investigations into the transition to IFRSs predate this date, the difference in revenue recognition is clear.

Forecasting the state of innovation and trends in the European Union

Dr. habil. László Török, associate professor
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The future of the European Union (EU) will be fundamentally determined by innovation-based competitiveness.

The study examines what characterised the innovation situation of the EU as a whole and its Member States between 2017 and 2024. For the situation analysis, the study examines the development of the Summary Innovation Index (SII) values, which describe the innovation situation of the Member States, using the ARIMA model and K-means clustering.

The study estimates the expected innovation situation of the EU and its Member States in the medium term using the linear trend model.

The results show that innovation is the least coordinated area of the EU cohesion policy, as there is a significant variation in the innovation situation across Member States. In the case of the two extreme innovation values, the difference is four times.

With this ratio, the average innovation development of the Scandinavian states is higher than that of some Eastern European Member States.

The extrapolation results indicate that the innovation gap is likely to persist in the medium term across the Member States despite ongoing modernisation.

Strategy-Driven Process Management in the Energy Sector: A Case Study of an SME

Anita Dr. Auksziné Erdélyi, PhD student and Dr. Beáta Bittner, associate professor
Faculty of Economics and Business, University of Debrecen, Hungary

The central question in SME strategic management is whether formal strategic planning can trigger genuine organisational transformation and sustainable performance improvement, particularly in sectors characterised by rapid regulatory and technological change.

This study examines how the 2026–2030 strategic planning process of a Hungarian SME operating in the energy sector—based on David's comprehensive strategic management model—contributed to the emergence of process management and to the generation of structural and operational outcomes.

The research applies a qualitative case study methodology, drawing on document analysis, executive interviews, and a structured reconstruction of the strategic planning process. Two research questions are addressed: (1) how did the application of the David model contribute to the development of process management in the SME, and (2) what methodological and substantive limitations can be identified in the model's application?

The external analysis yielded an External Factor Evaluation (EFE) score of 3.102, indicating above-average strategic alignment with environmental opportunities despite regulatory uncertainty and competitive pressures.

The Internal Factor Evaluation (IFE) score of 2.671 reflected strong professional competencies and financial stability, but also structural immaturity, including the absence of formalised processes, ERP systems, and controlling mechanisms. The QSPM analysis ranked organisational restructuring as the highest strategic priority, signalling that internal formalisation was a prerequisite for leveraging external growth opportunities.

Implementation led to the introduction of an integrated ERP system, formal organisational structures, financial and project controlling systems, and documented operational procedures. Process management emerged not as an explicit initial objective but as an emergent and necessary consequence of strategic execution.

The primary limitation of the study is its single-case design, which limits statistical generalisation. Moreover, the perception-based internal analysis underscores the need for more objective organisational maturity assessment tools in future research.

Smart Contracts and their Practical Application

Márk Vass, PhD student
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The digitalisation of global supply chains necessitates the adoption of new technological solutions to achieve more efficient and transparent operations.

Blockchain technology and smart contracts offer innovative tools that enable the automation of contractual processes, the secure recording of transactions, and the decentralised establishment of trust among economic actors.

This research presents the role of smart contracts in supply chain management. It reviews the operation of the technology, its potential applications, and the legal, technological, and organisational challenges that may arise during its implementation.

Although smart contracts undoubtedly have significant potential, their application requires complex strategic decision-making by organisations.

The Relationship between Lean Transformation and Quality in Real Life

Zoltán Dorogi, VPS Manager (Lean manager) and guest presenter
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This case study is based on the implementation of a development project carried out in a real industrial environment, in which the installation of a fibre laser cutting machine (BySmart Fiber 6000) was not treated as a standalone investment, but as an integral part of a comprehensive lean transformation. The central research question examines whether a technological investment can extend beyond mere capacity expansion and contribute to the overall improvement of the manufacturing system, while simultaneously enhancing quality and efficiency.

During the project, it became evident that the placement of the equipment could not be addressed as a conventional layout design task. The required reorganisations—relocation of multiple machines, infrastructure upgrades, and the redesign of material flow—introduced a level of complexity that necessitated a system-level application of lean principles. In this context, the concept of "hoshin layout planning" emerged as a physical manifestation of strategic objectives such as lead time reduction, quality improvement, and efficiency enhancement.

The study demonstrates how layout design in practice is closely interconnected with material flow planning, cycle-time-based capacity thinking, as well as ergonomic and safety considerations.

Numerous layout alternatives were developed during the project, and the final solution accounted not only for spatial constraints but also for the operation of the entire production system. Lean tools applied during the implementation—including 5S, waste reduction, PDCA cycles, and structured material flow design—supported system-level optimisation. Practical experience revealed that the project evolved in a non-linear manner, driven by continuous feedback and iterative adjustments.

The results indicate that the integration of technological development and lean principles led to measurable improvements in manufacturing performance: rework was reduced, product quality improved, cycle times decreased, and material flow became more transparent. The main conclusion of the case study is that a machine installation project becomes a true transformational tool only when it is designed and executed as part of a strategically aligned, system-level approach rather than as an isolated investment.

Crisis Communication and Leadership: Potential Key Factors in Crisis Management

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The aim of this presentation is to examine the role and organisational impact of leadership crisis communication in the crisis management process.

In today's business and societal environment, rapidly changing circumstances, increased information pressure, and the rise of digital channels have made leaders' communication decisions a critical factor in ensuring organisational stability and long-term effectiveness.

The study situates the importance of transparent and authentic communication within a theoretical framework and analyses the specific role of social media in crisis communication. Particular attention is given to emerging challenges—such as the rapid spread of misinformation—which influence both leadership decision-making and reputation management in the digital space.

This research contributes to a deeper understanding of the interconnections among leadership identity, personal brand development, and crisis communication, while highlighting how stakeholder trust and organisational credibility can be maintained during critical situations.

A Gap-Based Quality Management Analysis of Academic Staff Perceptions in Higher Education

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Higher education institutions increasingly rely on stakeholder feedback to inform decision-making and enhance quality management. Internal stakeholders — academic and non-academic staff — are key players in how institutional processes, policies and routines work in practice. Relatively little attention has been given to comparing staff expectations with their perceptions of actual institutional performance.

This paper reports on an exploratory gap analysis study of engineering faculty at a European university.

Using data gained from an anonymous questionnaire survey (N = 70), staff expectations of, and perceived performance in, aspects of our key quality-related areas, namely strategy and vision, leadership, communication, working conditions, staff development, and general culture of the organisation, were examined.

The survey determined expectations and perceived performance across the same six broad areas within the institution, but also broke down responses by academic and non-academic staff.

Across most dimensions, there are gaps between expectations and perceived performance.

It highlights the greatest weaknesses in areas such as leadership, communication, transparency, workload, reward, and recognition management. Several aspects of organisational culture also stand out as relative strengths.

The expectation–performance gap analysis revealed in this study can assist in driving evidence-based quality management and targeted improvement efforts within the higher education institutions, as per ISO 21001.

Emotions in Digital Entrepreneurship Education: A Pre–Post Study

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Within the Education 5.0 paradigm, entrepreneurship education is increasingly seen as a flexible, human-centred, and technologically enabled learning experience.

Accordingly, digital and personalised learning environments shift the focus from knowledge transmission toward entrepreneurial mindset development, understood as a combination of cognitive appraisals, affective responses, and action-oriented tendencies.

This presentation provides a theoretical account of how digital entrepreneurship training may influence these mindset components, with particular emphasis on emotions as a core mechanism of entrepreneurial learning under uncertainty.

We outline a pre–post survey study of university students enrolled in a digital entrepreneurship course to capture multiple dimensions of entrepreneurial emotions (e.g., passion, positive/negative affect and anticipated emotions).

By connecting Education 5.0 design principles to affective change, we discuss how digital entrepreneurship education may shape students' emotional foundations for entrepreneurial thinking and action.

Women's Leadership in Higher Education: Trends, Challenges, and Opportunities

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This study examines women's leadership in higher education by synthesising research on leadership trends, organisational challenges, and institutional opportunities influencing progression into senior academic and administrative roles.

A PRISMA-based systematic review was conducted using peer-reviewed studies identified through academic databases with search terms related to academic leadership and higher education management. After screening and applying the inclusion criteria, the selected studies were analysed using thematic synthesis.

The findings show increasing scholarly attention to women's leadership in higher education alongside persistent management-related challenges, including constrained leadership pipelines, promotion systems focused on academic output, centralised governance structures, workload imbalance, and limited leadership development opportunities.

The review also identifies institutional practices that support leadership progression, such as mentorship, succession planning, leadership training programs, and transparent evaluation systems.

This study contributes to higher education management literature by integrating leadership trends, organisational challenges, and leadership development practices within a single analytical perspective.

Technology Supported Autonomous Learning in English for Business Purposes Courses

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All levels of the educational system face the challenge of aligning the content and methods of their programs with the demands and forecasts of the labour market. ESP instructors in higher education are expected to expand their teaching goals beyond simply developing classic language skills and also equip students with the highly sought-after employability and digital skills.

The spread of digital technology further underscored the need for intentional, organised and goal-oriented autonomous learning to replace spontaneous learning.

This paper presents a way to integrate learner autonomy and innovative digital technologies into ESP programs. Learner autonomy is particularly important in language learning, where not only the content but also several language and non-language skills must be developed.

It is crucial in Language for Business Purposes courses, as its perspective and methods overlap with those of the business world. An autonomous language learner is the initiator and director of language learning, taking active responsibility for the learning strategy and process.

By applying the principles of metacognition, autonomous learners become aware of and regulate their own cognitive processes and activities.

The paper presents AI tools that best support the development of autonomous business language learning and put students in the driver's seat of their own career preparation.

These tools can offer comprehensive preparation for job interviews or specific training in logical reasoning for debates, opposing arguments effectively, or improving pronunciation.

A Bibliometric Analysis of Sustainable Supply Chain Management: Drivers, Barriers, and Research Trends

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This study conducts a comprehensive bibliometric analysis of the literature on Sustainable Supply Chain Management (SSCM) implementation, with a particular focus on identifying key drivers, enablers, barriers, and challenges at the firm and organisational levels.

Following the PRISMA guidelines, a systematic literature search was conducted in the Web of Science and Scopus databases, covering peer-reviewed, English-language, open-access articles published through the end of 2025. After applying inclusion and exclusion criteria and removing duplicates, a final dataset of 288 articles was retained for analysis.

The bibliometric analysis was performed using R Studio and VOS viewer and comprised two main components: (i) performance analysis, examining publication trends, influential authors, journals, and citation patterns; and (ii) science mapping techniques, including citation, co-citation, co-word, and co-authorship analyses supported by clustering methods.

The findings offer a structured overview of the evolution, intellectual structure, and thematic development of SSCM implementation research, revealing dominant research streams, emerging themes, and underexplored areas. These insights contribute to a clearer understanding of the current state of the field and provide directions for future research and managerial practice.

Challenges to Performance Measurement Systems (PMSs): Evidence from Jordanian Industrial States Companies

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Performance Measurement Systems (PMSs) are widely regarded as essential tools for supporting strategic alignment and improving organisational performance. However, their successful implementation remains challenging, particularly for industrial firms operating in developing-economy contexts.

This study examines the most influential barriers affecting the implementation and effective use of PMSs in Jordanian industrial firms, based on empirical evidence collected from companies operating in Jordanian industrial estates.

The findings reveal that resource-related constraints represent the most significant challenge, indicating persistent difficulties in securing adequate financial resources, skilled personnel, and appropriate technological infrastructure to support PMS implementation.

In addition, the results highlight the challenge of operating static PMSs within dynamic organisational and environmental conditions, which limits system relevance and responsiveness over time.

Poor implementation practices and insufficient managerial commitment further emerge as critical obstacles, emphasising the importance of leadership support and structured implementation processes. Together, these barriers contribute to a gap between PMS design and actual managerial use, reducing the potential performance benefits of these systems.

By focusing on the most prominent implementation challenges, this study contributes context-specific empirical insights to the PMS literature and offers practical implications for managers seeking to enhance PMS effectiveness in industrial firms operating in similar emerging economy environments.

Is Bathymetry Technology Worth Adopting for Sustainable Mine Water Management? An Assessment in the Indonesian Coal Sector

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Effective water management is increasingly critical for ensuring environmental compliance and supporting broader sustainability goals in coal mining regions.

Conventional monitoring practices, such as manual depth measurement, grab sampling, and periodic laboratory testing, remain widely used but are constrained by low frequency, limited spatial coverage, safety risks, and slow reporting.

These limitations hinder alignment with global sustainability frameworks, including SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), SDG 15 (Life on Land), and the ICMM Water Stewardship Principle. As mining operations face growing pressure to improve transparency, protect ecosystems, and maintain their social license to operate, digital and automated monitoring technologies are gaining prominence. Bathymetry, traditionally applied in marine environments, has emerged as a promising tool for assessing inland water bodies such as settling ponds in coal mines.

This study examines the potential value of adopting bathymetric technology, particularly USV-bathymetry, for sustainable mine water management, with a particular focus on the Indonesian coal-mining context. It explores the technical principles, applications, and advantages of bathymetry, especially its ability to provide high-resolution depth data, support sedimentation analysis, estimate pond capacity, and enhance hydrological modelling.

The study also evaluates the technical specifications of USV-bathymetry systems from different regions and assesses their suitability for local mining conditions.

Key barriers to adoption are identified across technical, economic, organisational, and market dimensions. A simple feasibility assessment is conducted to compare USV-bathymetry with conventional methods in terms of capital and operating costs, maintenance, after-sales support, spare availability, and productivity.

The findings indicate that while USV-bathymetry requires higher upfront investment, it offers significant benefits in accuracy, safety, data richness, and sustainability compliance.

The study concludes that bathymetry is a viable and increasingly necessary technology for modern mine water management, particularly for operations seeking to strengthen ESG reporting and long-term environmental performance.

Sub-sized Specimens in Nuclear Safety: Small Scale, Big Impact

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The nuclear industry demands the highest levels of structural integrity with a particular focus on predicting fracture behaviour in service.

Traditionally, standard specimens—Compact Tension (CT) and Single Edge Notch Tension (SENT)—are used to extract fracture toughness parameters and to calibrate micromechanical models such as the Gurson-Tvergaard-Needleman (GTN) model.

These techniques, however, are limited by specimen size, cost, irradiation exposure risks, and the availability of material from in-service components.

Digitalisation in the Context of Industry 4.0

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This study examines the role of digitalisation in industrial transformation, with a particular focus on the rise of data-driven operations and smart manufacturing systems. Digitalisation represents a comprehensive transformation of economic processes, increasing efficiency and competitiveness by integrating information collection, processing, and utilisation.

In an industrial setting, this manifests itself through real-time data flow, process automation, and the optimised use of resources. Drawing on a review of the literature and empirical research, this study analyses the macroeconomic effects of digitalisation, particularly on economic growth, productivity, and the labour market.

The results show that digitalisation contributes to improved economic performance through both direct and indirect channels. The quality of human capital, innovation capacity, and the sophistication of the institutional environment play a key role.

The study highlights that the impact of digitalisation is not uniform but depends on countries' levels of development and structural characteristics. Accordingly, the targeted design of economic policy interventions is essential to realise the positive effects of digitalisation.

Numerical and Experimental Investigation of Welding-Induced Residual Stresses in Steel Joints

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Residual stresses generated during welding arise from severe thermal gradients, localised plastic deformation, and metallurgical transformations.

These stresses can significantly affect fatigue resistance and service life of structural components. In this work, a three-dimensional coupled thermo-mechanical finite element model was developed to simulate the welding process and predict the evolution of residual stresses in steel plates.

Line Production Optimization through Operation Balancing Simulation

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The paper explores methods to increase production output without incurring additional operational costs, focusing primarily on line balancing in manufacturing environments. By redistributing tasks across workstations and optimising cycle times, line balancing enables a more efficient use of existing resources, reducing idle time and enhancing overall flow.

The study also examines alternative line configurations, including one-piece flow layouts, highlighting their impact on throughput, process stability, and waste reduction. Additionally, a simulation-based analysis evaluates the effects of batch-size optimisation on productivity and responsiveness. The results demonstrate that significant performance improvements can be achieved solely through organisational and methodological changes, without requiring new investments in equipment or labour. These findings reinforce the value of intelligent process design—"smart balance"—as a cost-neutral strategy for operational enhancement.

The Role of Leadership in Developing ESG Awareness

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The ESG (Environmental, Social, Governance) approach forms the foundation of corporate sustainability, social responsibility, and transparency. Global challenges and EU regulations, such as the CSRD, are increasing ESG requirements. This systematic literature review examines how leaders contribute to the development of ESG awareness. The results indicate that ESG integration is a leadership-driven process: strategic decisions, ethical role modelling, organisational culture, and leadership values play a key role. Organisational maturity, structure, innovation, and HR practices—such as training and employee engagement—further strengthen ESG awareness. Overall, the successful implementation of ESG enhances corporate sustainability and competitiveness through the combined effects of leadership exemplarism and coordinated organisational mechanisms.

Women Leaders and ESG: Strategic Advantage or Social Expectation?

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During the presentation, we will show why it is worth following and adhering to the criteria set out by the ESG framework, especially for companies aiming to increase the proportion of female managers. If companies view female leaders as a strategic opportunity rather than merely complying with legal requirements, they can create real value within certain frameworks. Numerous studies confirm that a more balanced gender composition in management improves a company's ESG performance in several ways. When examining trends in the proportion of female executives, we found that international and Hungarian databases from previous periods often contained only partial data on this topic. Today, this must be treated as a mandatory element in ESG reports. We will therefore examine what indicators were available to demonstrate this before ESG regulation and in what reports the situation of women could be presented. In light of this, we will analyse the companies primarily subject to the domestic ESG law and the organisations listed in the EMAS register.

The Role of Management Consulting in Managerial Decision-Making within Production Organizations

Barbara Zsófia Stefán, PhD student ; University of Debrecen, Hungary

Production organisations operate in increasingly complex technological and organisational environments, where management consultants play a growing role in supporting managerial decision-making. The aim of this study is to explore how the academic literature conceptualises the contribution of consulting knowledge to managerial decisions and to identify the factors that influence the effective utilisation of consulting recommendations in production-oriented firms. The study is based on a structured literature review integrating theoretical models of management consulting, the knowledge-intensive business services (KIBS) perspective, and research on trust and interpretive frameworks in organisations. The analysis suggests that the value of consulting in production settings does not primarily reside in methodological tools or technological solutions, but rather in the process of joint sensemaking between consultants and managers. As digitalisation and algorithmic decision-support systems become more prevalent, consulting roles are being redefined: alongside data-driven approaches, interpretation, contextualisation, and organisational alignment are gaining increasing importance. The study contributes to the fields of management and organisation studies, as well as innovation and technical management, by framing consulting value as an interpretive rather than purely technological dimension within managerial decision-making in production organisations.

Economic Rent Theory and Practice – A Pragmatic Approach to Estimating Entrepreneurial Rent

Dr. Ferenc Ede Buzás, research associate; Anita Dr. Auksziné Erdélyi, PhD student; Dr. Viktória Vida, associate professor and Prof. Dr. Adrián Szilárd Nagy, full professor
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The concept of economic rent was established by representatives of classical economics, who interpreted it narrowly as arising from the ownership of natural resources (primarily land).

The notion was defined more broadly by representatives of the neoclassical stream; they defined economic rent as the income surplus realised by an owner of a factor of production (e.g., a limited natural resource) that exceeds the minimum amount required to keep that factor in its current use.

According to their view, rent is an income surplus that exceeds the minimum amount necessary to bring a factor of production (labour, capital, or land) into production.

The separation of different rent components from the income amount is generally carried out in practice according to the residual principle, but the calculation methodology used is diverse, mainly regarding opportunity costs. In certain economic sectors, it also poses a separate problem to determine the rent of natural resources (e.g., land or a mine).

In the paper, the authors intend to present a practical method that, from a pragmatic perspective, enables the separation of rent components at the level of individual agricultural enterprises.

The procedure may provide practical guidance in economic or business situations, as well as in legal or compensation cases where the specific quantification of economic rent or lost profit is required.

The Economic Role of Tourism in International Comparison

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The aim of the research is to present, using statistical data, the development of key indicators for accommodation and hospitality across European countries for the years 2019-2023, highlighting the performance of Hungary, Romania, and Croatia.

All three countries experienced a significant decline during the Covid-19 crisis, but in several areas they approached or significantly exceeded pre-crisis levels by 2023.

For example, Croatia leads the ranking in terms of contribution to GDP, with the sector's share increasing from 25.2% to 25.8%, while in Hungary it decreased from 8.3% to 7.4% and in Romania from 6% to 5.6%.

The data show that eurozone countries performed well on the most important indicators. The introduction of the euro had a positive impact on Croatia's economy, particularly on tourism.

In Hungary, the continuous weakening of the forint is also contributing to the economy's slower growth.

The Romanian leu is more stable against the euro, and the economy as a whole is performing in a balanced manner.

Accession to the EU opens up new prospects for the country's economy, especially for the tourism sector.

The implementation of sustainable tourism is now a priority for all stakeholders in European countries. This requires an appropriate economic environment and social and environmental sustainability.

After the pandemic – although there were signs of it even before – European tourism faced a new challenge.

Empirical Analysis of Working Capital Management Efficiency and Its Impact on Profitability in Food Industry Firms

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The increasing uncertainty of the economic environment, inflationary pressures, supply chain disruptions, and rising financing costs have made maintaining corporate liquidity and operational efficiency a critical priority for firms.

In this context, working capital management has become a key component of corporate financial management, as it directly affects liquidity, operational stability, and profitability.

The specific characteristics of the food industry - particularly high inventory levels, perishable products, and short operating cycles - further emphasise the importance of efficient working capital management.

The aim of this research is to empirically examine the efficiency of working capital management in food industry firms and to identify its impact on corporate profitability.

The analysis is based on firm-level financial data and evaluates working capital efficiency using indicators such as the cash conversion cycle, inventory turnover, receivables turnover, payables turnover, and net working capital measures.

Profitability is assessed using return on assets (ROA), return on equity (ROE), and return on sales (ROS).

The study also investigates differences in working capital efficiency across firm size, industry subsectors, and regional characteristics.

The objective is to identify the key working capital components that contribute most significantly to improved corporate performance.

The findings are expected to support financial decision-making and provide practical implications for improving the planning and control of working capital management.

Relative Corporate Efficiency Analysis in the Hungarian Food Industry Using the DEA Method

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The objective measurement of corporate efficiency is fundamental to assessing competitiveness and the quality of resource utilisation.

The aim of this study is to examine the relative efficiency of Hungarian food industry firms using the Data Envelopment Analysis (DEA) method.

The empirical basis of the analysis comprises accounting data from 762 domestic enterprises spanning 2020-2024, enabling a multi-year, panel-based evaluation of efficiency differences.

Using the DEA method, efficient and inefficient firms were identified, and the input–output combinations under which firms can achieve an optimal operational level were determined.

The results revealed significant heterogeneity in the efficiency of the examined firms, highlighting the decisive role of resource management and operational structure.

The study contributes to a deeper understanding of the performance of Hungarian food industry firms and provides valuable insights for managerial decision-making and industry benchmarking.

Attitude Clusters and Integration Challenges: Perceptions of Third-Country Nationals in the Hungarian Labour Market

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Due to domestic labour shortages and the intensification of international migration, the employment of third-country nationals has become an increasingly significant factor in the Hungarian labour market. The phenomenon is relevant not only from an economic perspective but also from social and organisational viewpoints, particularly with regard to attitudes that influence the success of integration processes.

The aim of the present study is to examine the patterns of attitudes among actors in the Hungarian labour market towards third-country national workers and to explore how these attitudes may shape the conditions of organisational integration. The analysis focuses on identifying groups characterised by different attitudinal orientations and on examining differences emerging along levels of xenophobia. The empirical investigation is based on a questionnaire survey (n = 152) conducted among active participants in the Hungarian labour market. The data were analysed using descriptive and inferential statistical methods in order to identify distinct attitudinal groups. The results reveal clearly distinguishable attitude clusters characterised by varying degrees of acceptance and rejection towards third-country national workers. One group demonstrates a predominantly inclusive attitude, viewing their employment as an economic necessity, while another cluster expresses stronger cultural and labour-market-related reservations. These attitudinal differences may have direct implications for organisational integration processes, particularly for the development of inclusive organisational cultures and the quality of workplace cooperation.

Thought-provoking Observations based on Experiences from a Soft Skills Development Programme

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Recent digital technologies are increasingly used in industrial tasks and advanced research. Yet reliable and responsible engineering still depends on understanding and realistically perceiving physical-world phenomena. Engineering science and practice are grounded in natural processes and laws, and this grounding requires a clear understanding of fundamental concepts and relationships. As mathematical and engineering software, and increasingly AI-based tools, take over time-consuming and less creative parts of engineering work, the engineer's role may shift from executing routine steps to analysing, evaluating, and controlling them. This shift is beneficial only if the human-in-the-loop has sufficient knowledge to judge whether software-provided solutions or decisions are correct. Efficient engineering, therefore, requires (i) understanding the problem to be solved, (ii) knowing adequate problem-solving tools, and (iii) being able to assess whether an answer is complete – i.e., what counts as a complete solution and when a problem can be considered solved. The first relies on adequate conceptual images and real-life experience (including hands-on interaction with physical objects), while the third depends primarily on critical thinking. Consequently, engineering students' success is strongly influenced by competencies gained through public education and everyday experience. While weaknesses in students' preparedness for engineering education are well known, our experience points to an additional, often hidden deficiency: lack of real-world experience that can hinder understanding of technical concepts, laws, and explanations. Modern information technology offers young people an engaging virtual alternative to physical reality, even as human control over software-generated solutions becomes increasingly important. A simple educational example illustrates the risk: some students believed a wheelbarrow load would be easier to hold if placed closer to the person than to the wheel axle. These observations motivate assessing freshers' real-world experience and developing suitable methods to identify the fundamental concepts and experiences required for engineering understanding.

Assessment of Engineering Students' Spatial Abilities Using Digital Tools

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Spatial abilities play a decisive role in the development of engineering competencies, as they fundamentally influence the effectiveness of problem-solving, the accuracy of design, and the quality of decision-making. Therefore, in engineering education, the reliable assessment and targeted development of spatial thinking, mental rotation, spatial cutting, visualisation, and distance perception are of particular importance.

Internationally recognised standardised instruments are available for the assessment of spatial abilities, such as the Mental Rotation Test (MRT), the Mental Cutting Test (MCT), the Purdue Spatial Visualisation Test (PSVT), and the Heinrich Spatial Visualisation Test (HSVT), which measure various aspects of spatial manipulation and perception. These tests have traditionally been administered in paper-based formats. The aim of our research was to develop proprietary digital assessment tools based on the above task types, while leveraging the opportunities afforded by online environments, 3D visualisation, and interactive problem-solving. Particular attention is paid to the examination of distance perception, which underpins precise engineering work, component fitting, spatial design, and 3D modelling. The presentation introduces the task types of the developed digital assessment tools, the measurement procedures used, and the empirical results obtained to date. Our experience indicates that the deliberate and systematic assessment and development of spatial abilities strengthen engineering students' professional competencies, improve academic performance, and foster independent, creative, and precise engineering thinking.

Shenzhen Waste-to-Energy Facilities - A Case Study of Environmental Projects for a Megacity

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This contribution presents a comprehensive analysis of the waste-to-energy (WTE) infrastructure in Shenzhen, China, focusing on the Shenzhen East Waste-to-Energy Plant and the Shenzhen Energy Ring. As a megacity with 20 million inhabitants that produces 15,000 tons of municipal solid waste (MSW) per day, Shenzhen has adopted advanced incineration technologies to address its land scarcity and energy demands. The study presents the technical details of these plants that contribute significantly to local waste management and to the city's energy mix. In addition, the paper presents an environmental impact assessment of these plants, with particular reference to how they adhere to stringent environmental standards (SZDB/Z233-2017) by using advanced flue gas cleaning technologies, including semi-dry absorption, activated carbon injection, and Selective Catalytic Reduction (SCR). Moreover, it shows that there is considerable potential to mitigate greenhouse gases by avoiding methane emissions, given that landfills contribute 19% of global methane emissions, along with fossil fuels. Finally, it examines the economic landscape of these plants, including government incentives and the increasing international competitiveness of Chinese WTE technology. However, the study also highlights challenges that remain to be addressed, including high capital costs, process complexity, and public concerns about air quality and property values.

The study indicates that the integrated model of the city of Shenzhen, which combines architectural excellence, transparent emission monitoring, and synergy in the use of renewable energy sources, is the world standard for sustainable waste management in cities.

The study concludes that the way forward for WTE lies in hybrid technologies and optimisation within the context of the circular economy.

Opinions on the Use of Generative AI Among Faculty Members of the Faculty of Engineering, University of Debrecen

Dr. Adrienn Vámosiné Varga, associate professor and Dr. Boglárka Burján-Mosoni, assistant professor
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The rapid and widespread adoption of generative artificial intelligence has created new challenges for pedagogical practices in higher education. Beyond offering technological innovation, GenAI encourages a rethinking of traditional approaches to teaching, learning, and assessment. Its use increasingly extends beyond a simple technical support function, as it can assist instructors with administrative tasks, contribute to educational content development, and support more reflective pedagogical practices. One of the main advantages of generative AI is its potential to reduce instructors' workloads. Automated text processing, summarisation, outlining, and the preparation of assessment-related materials may enable educators to dedicate more time to higher-level pedagogical activities and to supporting student learning. When applied within an appropriate pedagogical framework, GenAI tools may also foster professional reflection and experimentation with innovative teaching methods. Despite these opportunities, the integration of generative AI into higher education is limited by instructors' insufficient AI literacy.

Previous research highlights that educators' self-efficacy, technological confidence, and pedagogical awareness strongly influence how and to what extent AI is used in teaching practice. In many cases, AI use remains ad hoc rather than strategically aligned with pedagogical objectives, particularly in institutional environments lacking clear guidelines and targeted professional development. Hungarian studies indicate that instructors primarily use AI for routine tasks such as translation, information retrieval, and language checking. While these practices improve efficiency, more complex and pedagogically meaningful applications are less common. Ethical concerns related to academic integrity, assessment validity, copyright, and data protection further contribute to cautious adoption.

This study examines the attitudes, experiences, and usage patterns of generative AI among instructors at the Faculty of Engineering of the University of Debrecen using an anonymous online questionnaire. The findings emphasise the key role of instructors in effective AI integration and the importance of institutional support and professional development.

Circular Revolution: Open-loop vs. Closed-loop in packaging production based on the Life Cycle Assessment

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This presentation examines the environmental benefits of implementing a closed-loop system using the looping method in the production of corrugated board packaging for blueberries, compared with conventional open-loop production.

Using Life Cycle Assessment (LCA) and the EF 3.1 impact assessment method in Sphera LCA for Experts, the study evaluates the environmental impacts of both systems, with a focus on recycling rates (30%-84.5%) and material flows.

Results show that the looped system, with 84.5% recycled content, significantly reduces environmental impacts across all major categories, including climate change (–22%), freshwater ecotoxicity (–22%), terrestrial eutrophication (–45%), and fossil resource use (–17%).

A Pareto analysis shows that more than 80% of the total environmental impact originates from five impact categories. The findings support the integration of circular economy principles and eco-design into packaging development, highlighting the potential of the looping system for sustainable packaging strategies.

Debrecen Projects to Improve Natural, Social and Economic Environment

Dr. János Szendrei[1], associate professor; Dr. Dénes László Kocsis[1], head of department, associate professor and Dr. Judit T. Kiss[2], head of department, associate professor
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Debrecen, Hungary's second-largest city, has embarked on a significant green transition, which has earned it a place among the top three finalists for the European Green Capital Award in 2025. The cornerstone of the city's environmental strategy is the Green Code (2023–2026), which contains 50 specific measures covering all areas of life, from renewable energy to tree planting. The program focuses on the coordinated development of green and blue infrastructure.

A key element of the blue infrastructure is the Civaqua project, which, after decades of waiting, will divert water from the Tisza River from the Eastern Main Canal to the Tócó Stream on the western side of the city. This development not only stabilises the water supply but also enables the creation of lakes and reservoirs, and improves water management in the Nagyerdő and Erdőspuszta forests.

In the field of green infrastructure development, the "10,000 Trees for Debrecen" program stands out. After its launch in 2019, another 10,000 trees were planted in 2024. These afforestation projects are critical for filtering dust pollution and mitigating the urban heat island effect.

The city administration has also set up a modern environmental monitoring system that makes air-quality and noise-measurement data available to the public via an online interface. The greening measures also bring significant economic benefits: according to calculations, the CO_2-absorbing capacity of 10,000 trees could save the city millions of euros, depending on the trees' lifespan and the level of the carbon dioxide tax.

In addition, increased green space has been shown to improve residents' mental and physical health, reduce noise pollution, and increase property values. Debrecen's complex program thus combines sustainable economic development with improving the quality of life for residents.

Analysis and Evaluation of Oil Industry Wastewater Treatment Systems

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This contribution presents a comprehensive evaluation framework to compare various polishing methods for petroleum wastewater, with a focus on nature-based solutions, such as treatment wetlands, and engineered polishing techniques.

Petroleum refineries produce large volumes of wastewater, posing a major environmental management challenge, particularly in arid regions. Research indicates that petroleum processing plants and petrochemical processes generate significant wastewater compared to the volume of crude input. Commonly, these effluents contain high concentrations of COD/TOC, salinity/TDS, trace metals, oil and grease, and require treatment in multiple steps, including "Polishing," to comply with reuse and discharge requirements. Simultaneously, recent literature shows that concerns persist about the inadequate management of industrial wastewater discharges, underscoring the need for robust and transparent treatment and monitoring strategies. The assessment aligns with various technology features, including scale, process arrangement, operational needs, anticipated effluent quality, and the capability to handle unexpected modifications.

Additionally, evaluating and comparing benchmark systems through using (i) performance and reliability in technical aspects, (ii) environmental indicators such as energy efficiencies and potential benefits, and (iii) economic and management aspects, including cost, maintenance, and operations complexity.

The evaluation process is conducted through multiple stages, including Franklin analysis (Pros-Cons) and SWOT analysis, aligning with Sustainable Development Goals 6 and 12 to enhance and support circular-economy decision-making. The evaluation yields a practical decision matrix that guides the selection of appropriate technologies for the arid petroleum regions of Oman and the GCC.

Functional Extension of Microsoft Dynamics Business Central with Software Development Integrating Customer Evaluation

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Customer rating is of utmost importance from a controlling perspective. Enterprise Resource Planning Systems often do not contain a rating system that is sufficiently detailed and adapted to the specifics of the partner relationship system. Customer qualification is not a common element of customer cards in ERP systems. This activity poses a great IT challenge, especially if data must be imported from multiple tables during the qualification process, and we also want to associate a computational operation.

With my software development, I would like to extend the capabilities of the sales business process management of the Microsoft Dynamics Business Central ERP with a customer qualification function. My software extension numerically and collectively evaluates the components of certain customer qualification criteria, in such a way that the data tables and display websites, which need to be filled with data in the background, are automatically loaded when the basic software is started. It is therefore not particularly noticeable to the average user that these functions and their visual implementation are not part of Microsoft's basic software. Technically, customer rating is implemented using list pages and forms that can be activated from the customer card menu system. Tables must be created to store the data of the criteria and criterion components used for rating. "Pages" are created for their display, and "forms" for their upload. The development does not aim to research the creation of rating criteria, but only to manage the data entered.

The study presents the software development results used to process the verbal categories, subcategories and their quantified values of the customer rating. In doing so, I will partly discuss the specifics of the code I wrote in the "AL" language. I will also present the specific locations of the developed visual elements, inserted into the ERP's basic webpages.

Data to Decisions – Digitization Trends in Low Volume High Mix Production

Wickramanayake Pathirannahalage Sajith Dilshan, MSc student and Dr. Andrea Emese Matkó, associate professor; Faculty of Engineering, University of Debrecen

As explained recently, LVHM production settings are extremely difficult due to their unique characteristics, including highly tailored products, small batch sizes, limited data, frequent changeovers, longer lead times, and a highly specialised workforce. Therefore, decision-making based on operational performance metrics is particularly challenging. Conventional performance metrics and improvement techniques designed for mass production are often not ideal for these contexts. Thus, this research focuses on reviewing the most widely used KPIs and technological trends towards the LVHM production environments, aiming to promote best practices.

The findings demonstrate increasing adoption of emerging technologies, including digital twins, composite AI algorithms, reinforcement learning, and discrete-event simulations. Moreover, when firms focus on clearly defined KPIs, even rudimentary digital solutions express significant operational benefits. Yet Key performance indicators such as lead time, throughput, scheduling efficiency, and cost-effectiveness have all improved measurably due to these tactics. This analysis indicates that significant focus has been directed to the two KPI categories of financial expenditure and production planning. In these environments, these operational metrics also demonstrate that they add value to daily manufacturing processes and serve as strategic drivers for long-term performance improvement. Furthermore, the outcomes that demonstrate the maturity level of these organisations, which served as the basis for the research, are unclear. This indicates a comprehensible gap in “understanding these suggested digital solutions appropriate for each stage of the organisational development?” under the resource constraints. However, this research and the research direction provide researchers and industry experts with the opportunity to create new KPIs and integrate them with technology.

Digitalization and Electronic Word-of-Mouth as Drivers of Energy-Efficient and Low-Carbon Tourism Destination Selection

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This study examines how digital marketing and electronic word-of-mouth (e-WOM) influence tourists' selection of eco-friendly destinations, which represent energy-efficient and low-carbon tourism options.

As tourism-related energy consumption and carbon emissions pose growing global challenges, tourists' destination choices have become a key determinant of sustainable travel behaviour.

Drawing on the literature on destination branding and sustainability, the proposed research model investigates the mediating role of e-WOM in the relationship between digital marketing and destination selection.

Destination brand equity is conceptualised through destination image satisfaction and destination image trust, reflecting tourists' overall experiences, perceived energy efficiency, and the authenticity of sustainability practices.

Using empirical data collected from tourists and analysed through SEM, the results indicate that digital marketing positively influences e-WOM, which in turn significantly enhances destination image satisfaction and trust.

The findings highlight the critical role of digitalisation in shaping environmentally responsible tourism behaviour.

This study offers practical implications for policymakers and destination managers by demonstrating how the strategic use of digital marketing and e-WOM can shape destination selection and promote energy-efficient, low-carbon tourism consumption patterns.

Life Cycle Assessment Life Cycle Assessment for Injection Moulding Scenarios in Open- and Closed-Loop Manufacturing Systems

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The environmental performance of polymer-based manufacturing technologies is increasingly important in the transition toward sustainable development and a circular economy, particularly for resource- and energy-intensive processes such as injection moulding.

This study evaluates how closed-loop manufacturing strategies influence the environmental impacts of polyethene injection moulding using Life Cycle Assessment. Three production scenarios are compared: an open-loop system without recirculation, a semi-closed-loop system with cooling-water recirculation, and a fully closed-loop system incorporating both water and material looping.

The assessment focuses on the manufacturing stage, using a cradle-to-gate approach, and examines key environmental indicators of resource use, emissions, and climate change.

The results demonstrate that increasing the degree of looping consistently improves environmental performance. Compared to the open-loop baseline, the fully closed-loop scenario reduces global warming potential by approximately 10%, material consumption by about 3%, and freshwater emissions by nearly 3%. Water recirculation primarily reduces toxicity-related impacts, whereas material looping provides additional benefits for mitigating climate change and resource depletion.

Furthermore, the evaluation of end-of-life options for manufacturing scrap underscores the importance of energy recovery in mitigating climate impacts. Overall, the findings provide quantitative evidence that closed-loop injection moulding represents an effective strategy for advancing sustainable manufacturing solutions in the built environment.

Integrating Green Lean Six Sigma (GLSS) and Circular Economy (CE) in Construction and Industry

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The world is undergoing a "Twin Transition", the simultaneous shift toward sustainability and digitisation. However, a significant divide remains between macro-level Circular Economy (CE) concepts and their micro-level implementation on the shop floor. This research addresses this gap by exploring the synergy between Green Lean Six Sigma (GLSS) and Circular Economy principles.

Employing an Action Research paradigm, this study establishes the "Smart Green Value Stream Map" (GVSM), a novel method for illustrating a Triple Waste Stream that encompasses temporal (Lean), resource (Circular), and environmental waste. The GVSM was validated through a pilot study at a leading automotive manufacturer's high-tech battery module production line. The primary theoretical contribution of this work is the conceptualisation of the mapping construct, which enables the simultaneous visualisation of delays, resource losses, and environmental hotspots.

The results uncover a significant "Nomenclature Awareness Gap": while 92% of the industrial community utilises circular actions, only 40% are aware of the formal GLSS model. Pareto analysis identified that 82% of sustainability losses are concentrated within specific foaming and energy-intensive processes. By applying the DMAIC framework, this study identifies improvement opportunities in solvent restoration and residue reduction, projected to decrease energy intensity by 10–15% and hazardous waste by 20–25%. This thesis offers a standardised roadmap for managers preparing for impending Digital Product Passport (DPP) requirements and the ISO 59020 standards.

The findings demonstrate that GLSS serves as a crucial operative engine with high transferability toward modular construction and other complex industrial sectors.

Organization Level Learning in the Space Industry

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The commercial space industry has become one of the most dynamic fields of contemporary technological and economic development, making it an increasingly relevant context for studying organisational learning.

This paper investigates the presence and characteristics of learning curves in the launch activity of SpaceX, a leading private space company. Building on earlier exploratory studies (presented in this conference series twice in 2019 and 2025), the analysis extends the available dataset by one additional year (reaching 609 launches) and introduces controls for launch-site and rocket-type concentrations.

The study applies learning-curve theory to rocket launches, using the time elapsed between consecutive launches as a quasi-operational time indicator and the annual number of launches as a volume-based measure. Data were collected from SpaceX's official website and Next Spaceflight, and were analysed through graphical trend fitting and log-transformed linear regression models.

The results indicate a statistically significant learning curve in SpaceX's launch activity. As cumulative launch experience increases, the time required between launches decreases substantially. The estimated progress ratios are around 50% or below, suggesting an exceptionally rapid rate of organisational learning compared with the commonly cited 80% benchmark. The multivariate regression analysis confirms the strong explanatory power of cumulative experience, while launch-site and rocket-type concentration do not show significant moderating effects. However, the change in launch site between two consecutive launches was moderated significantly. The findings highlight SpaceX's remarkable operational learning capacity, while also pointing to the limitations of single-company analysis and the need for broader industry-level comparisons.

The Impact of Transformational Leadership Behaviour on the Satisfaction of Generation Z

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Transformational leadership is a leadership approach that motivates employees through inspiration, vision, and role modelling. The leader not only directs but also encourages individual development, supports creative thinking, and takes employees' individual needs into consideration.

This leadership style contributes to higher performance, satisfaction, and organisational commitment. However, despite these advantages, it may not affect individuals' satisfaction equally.

Sustainable Leadership - The Impacts of National Culture and Legal Origin on Female Directory Positions

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Fifty percent of the global social potential is female. However, their representation on corporate boards is disproportionately low and is estimated to increase slightly in the future due to cultural barriers.

The aim of this research was to examine social and legal connections quantitatively with the WiDP (Women in Directory Positions - data source: MSCI) ratio to understand the trends and patterns in 46 countries worldwide. HAC regression was performed in Gretl using WiDP as the dependent variable. The independent variables were Hofstede 4+2 cultural dimensions, and the Human Development Index was a control variable. Cross-sectional data were examined throughout the years 2022 and 2023.

The results show that board diversity was significantly and positively impacted by the growing quality of employment (HDI) in the considered countries. A positive tendency of Individualism was also perceptible. On the other hand, we found negative correlations between WiDP and Power Distance and Masculinity. Uncertainty Avoidance, Long-term Orientation and Indulgence were those of the Hofstede dimensions that did not impact board diversity.

We focused more closely on the significant cultural dimensions, and illustrated each country on regression lines to see if there are any patterns according to their legal origin. Interestingly, Professional Law countries (e.g. USA, New Zealand, Germany) showed convergence to low Power Distance and had high Individualism values, therefore had great ratios of WiDP. Feminine states, like the Scandinavian countries also had high amounts of females in company directorships (~42% average).

At the same time, countries with the Rule of Tradition predominantly had higher Power Distance, lower Individualism and lower ratios of WiDP (e.g. Saudi Arabia, China, Indonesia). Hungary remained an outlier on the regression graphs of Power Distance and Individualism, but the 11.8% of WiDP ratio turned elucidated when Hungary was affirmed to be the second most Masculine country after Japan. The majority of Political Law countries, based on their historical transformation, represented a lower-middle segment of the regression graphs. International and national initiatives had already taken place, besides establishing foundations like WILL or the Spotlight Initiative to achieve results in increasing the number of women in directorships.

Hungary almost doubled its WiDP value from 2020 to 2024 (6.7% to 12.5%). Yet, there is potential in catching up with the EU members of the sample. In order to carry out future research, we consider that the expansion of our database would be beneficial: utilising the data from the 5th SDG database would allow the sample size to be expanded. We would indeed use dummy variables to reveal the effects of the legal origins on WiDP in the future. Lastly, running a Granger causality test with the assistance of more complex software would allow us to infer if there are causal relationships between the variables used in our models.

Soft Skills - Hard Results: How Engineering Managers' Soft Skills Grounded in FranklinCovey's 7 Habits of Highly Effective People Can Drive Hard Business Results at a Service Provider Specialized in Industrial Packaging, Supply Chain Solutions, and Logistics?

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The research explored the practical, hard business results realised first-hand through improved theoretical knowledge and improved soft skills of Engineering Managers.

The research used a case study research method and a pragmatic research approach, and combined semi-structured interviews with a blended/hybrid development journey, including synchronous and asynchronous training, individual and team coaching, mentoring, learning buddies, and on-the-job assignments.

The case study collected qualitative and quantitative evidence of improved business performance generated by thoughtful application of the timeless principles described in FranklinCovey's 7 Habits of Highly Effective People (Covey, 1989) and 4 Disciplines of Execution (McChesney et. al., 2012) at the Hungarian subsidiary of a global provider of industrial packaging, logistics, and supply chain services.

The qualitative and quantitative business results included improved synergy between shifts and teams, reduced conflicts between organization levels and teams, aligned work cloths policy, predictable annual holiday planning, improved overtime management, advanced priority order management process, extended application of the Design for Manufacturing (DfM) approach for new packaging solutions, extended workload capacity planning, improved shift change handover process, and reduced capital equipment investment needs.

Overall, the company demonstrated double-digit improvement in output and efficiency, and great single-digit improvement in profitability.

The Impact of Changes in the Physical Work Environment on Organizational Citizen Behavior in a Small Business

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Organizational citizenship behaviour (OCB) is a key factor in the effective operation of small and medium-sized enterprises (SMEs), particularly during periods of transformation that directly impact employees' daily work environment.

This case study examined how changes in the physical work environment affect specific dimensions of OCB at a small business operating in Hajdú-Bihar County, which relocated its operations from less favourable conditions to a modern, new facility.

The results show that improvements in the work environment were accompanied by a strengthening of certain elements of OCB.

The research highlights that changes in the physical environment can have a noticeable impact on employees' attitudes even in the short term, as well as on the emergence of voluntary behaviours that go beyond expectations, even in smaller organizations.