

Structured Abstracts of 'Supply Chain Challenges in the Turbulent World I.' session

Application of statistical process control in the 8D methodology for manufacturing quality improvement

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Background and introduction: The originality lies in its novel application of the 8D methodology, integrating statistical analysis to uncover and address an unrecognized root cause. The research contributes substantial value by eliminating defects and fostering long-term process improvements through updated P-FMEA and automated controls. These interventions have led to reduced operational variability, increased efficiency, offering enduring competitive advantages in the automotive sector.

Objective: Paper aims: To address and resolve a pin warping defect in an aluminum component supplied to the automotive industry by identifying its root cause and implementing robust corrective actions. The study aims to enhance process reliability, minimize variability, and improve customer satisfaction.

Methodology: This research adopts the structured 8D problem-solving methodology, which includes a cross-functional team, defining the problem, implementing immediate containment actions, conducting root cause analysis with statistical and quality tools, devising and applying corrective measures, updating processes to prevent recurrence, and recognizing team contributions.

Results: The investigation revealed that manual handling of hot sprues, performed without adequate operator training or standardized work instructions, was the primary cause of pin warping. Statistical analysis highlighted significant variability in manually operated processes. Corrective actions, including process standardization and automation resulted in enhanced product reliability and reduced defect rates.

Conclusions: This research stands out due to its innovative integration of quality management tools and advanced statistical methods, offering a replicable and robust framework for diagnosing and resolving manufacturing defects. The approach demonstrated here extends beyond the immediate case, highlighting its applicability and transferability to other industrial contexts, particularly where process variability is influenced by manual operations.

Limitations and future research directions: The study encountered limitations, including challenges in historical data collection and restrictions on sample size due to production constraints and limited machine and labor availability. Despite these constraints, the findings remain robust and offer actionable insights for industry practitioners. Future work should focus on ongoing process monitoring and regular updates to the P-FMEA document to incorporate new risks.

Keywords: Quality, Statistical Analysis, 8D Methodology, Ishikawa Diagram, Automotive Industry



Managing Inventory with an RFID-Based Modified Two-Bin System to Reduce the Excess Inventory

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Background and introduction: Excess inventory in Fast-moving Consumer Goods (FMCG) manufacturing operations increases costs and disrupts planning. A barcode-based two-bin systems offer limited traceability due to manual scanning, hence more responsive system is needed to align inventory with real-time demand. The purpose of this study is to provide a data-driven model including an AI-based algorithm for enhancing the efficiency of inventory management.

Objective: The main objective of the research is to develop a mathematical model for minimizing the excess finished goods inventory and enhance service efficiency using a data-driven, RFID-based modified two-bin system tailored for FMCG supply chain optimization.

Methodology: This research proposes a modified RFID-based two-bin mathematical model within a two-stage FMCG supply chain, where one bin tracks real-time demand and the other holds safety stock. The model utilizes RFID technology for improved inventory visibility, and applies the Artificial Bee Colony (ABC) algorithm to minimizing rework activities localized on the shopfloor. The model was tested through a Python-based simulation using historical sales and inventory data from a leading FMCG manufacturer.

Results: As a result of our model it demonstrates reduction up to 74% in excess inventory levels compared to the traditional approach. Furthermore, by applying the ABC algorithm, the cost reduction can be increased from an initial 32% to 44%.

Conclusions: The proposed model outperforms traditional approaches by minimizing excess inventory and maintaining operational continuity. It offers a practical, scalable solution for perishable items of FMCG industries facing demand variability and limited storage capacity.

Limitations and future research directions: Although the model was validated through simulation using real-world data, it has not been implemented yet in a live production environment. Future research studies can address to investigate how the proposed model can be utilized in making the supply chain driver for responsiveness and efficiency.

Keywords: FMCG, RFID, Two-bin Inventory, ABC algorithm

Social Drivers of Sustainable Transport Behavior: Evidence from a Survey-Based Regression Model

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Background and introduction: As cities work toward decarbonizing transport, understanding the human dimension of mobility becomes essential. Mobility choices are shaped by complex sociological and contextual factors.

Objective: The main objective is to examine how social and behavioral factors influence mobility choices. It aims to assess their impact on individual transport-related CO₂ emissions. The goal is to support socially informed sustainable mobility policies.

Methodology: A structured survey will collect data on sociodemographics, environmental values, and travel behavior. Participants from Hungary and Colombia will be selected for cross-national comparison and individual CO₂ emissions will be estimated based on reported mobility patterns. Multiple linear regression will identify predictors of low- or high-emission behaviors.

Results: The study will reveal key sociological variables linked to emission levels. Patterns in mobility behavior will differ across national and social contexts. These findings will inform targeted policy interventions for emission reduction.

Conclusions: Mobility choices are deeply influenced by social values and context-specific factors. Policies that account for these dimensions are more likely to be effective and inclusive. The comparative approach enhances understanding of how culture shapes sustainability behavior.

Limitations and future research directions: Findings may not be generalizable beyond Hungary and Colombia due to contextual differences. Future research should include longitudinal methods, broader geographic scope, and mixed-method approaches for deeper analysis.

Keywords: Mobility behavior, Carbon emissions, Sustainable transport



Modelling Attitude as a Delighter in Supply Chains: A Kano-Based Perspective

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Background and introduction: Understanding the dynamics of relationships within supply chains is essential in today's global economy, where speed, flexibility, and information flow are key to competitiveness. These relationships shape not only transactional mechanisms but also affect production efficiency, inventory management, and customer responsiveness. Improving supply chain performance and managing its inherent risks are critical for both business competitiveness and sustainability goals.

Objective: Agile and trust-based supply chain relationships support innovation and long-term collaboration. Attitudes toward these relationships—particularly those of decision-makers—play a significant role in how networks respond to change. Digital transformation, customer integration, and problem-solving engagement are all linked to organizational attitudes that affect adaptability.

Methodology: To capture the behavioral dimension of supply chain performance, our paper integrates the Kano model into the conceptual framework. The Kano model distinguishes between basic needs, performance needs, and delighters—the latter being attributes that exceed expectations and generate strong satisfaction. In our interpretation, attitude functions as a delighter, acting as a high-impact but often underestimated driver of performance.

Results: This conceptual integration allows us to model attitude not only as a cultural or psychological trait but as a strategic lever that drives flexibility, satisfaction, and long-term supply chain competitiveness.

Conclusions: Our findings highlight the need for further research into attitudinal dynamics within logistics and supply networks, especially in contexts where digital technologies and AI are reshaping traditional decision-making structures.

Limitations and future research directions: The study underscores the importance of deeper exploration into attitudinal patterns and their operational influence, particularly as digital technologies and AI increasingly transform conventional decision-making processes in logistics and supply networks.

Keywords: supply chain, attitude, Kano model,

Digital Integration Opportunities of Production Logistics Processes

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Background and introduction: Production systems form a complex system within which logistics processes play a key role alongside manufacturing and technological processes. Nowadays, the aim is to digitalise processes, allowing for various analysis options and even real-time intervention. In the future (and already today), digital transformation of processes will be key for value-creating companies, as it will enable a more flexible and controlled system operation. This requires the integration of different technologies.

Objective: The research explores the possibilities of digitising logistics processes that support production. The boundaries between production and logistics are not clearly defined.

Methodology: The focus of this paper is on investigating digital twin technologies for production systems with an exploration of the literature. The aim is to identify the main difficulties in the field and analyse the causes and effects.

Results: In many cases, support and servicing processes are not explicitly represented in twin models, despite having a significant impact on the efficiency of value creation. There is a lack of research that can actually help companies in their digitalisation efforts. The digital twin of different production systems and processes presents companies with several challenges.

Conclusions: In this study, we present two main problem categories. Finally, we demonstrate a practical approach to getting started with digitally transparent process modelling.

Limitations and future research directions: The research focused on production-supporting logistics processes, but this will need to be supplemented with other processes at a later stage. A crucial task is to outline further steps to support digitisation and define indicators for measuring its progress.

Keywords: digital twin, digitalisation, production logistics



Structural transformations in the parcel logistics sector: theoretical model and methodological framework in a grounded theory-based approach

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Background and introduction: Before 2021, the Hungarian CEP (courier, express, parcel) and broader logistics sector displayed a fragmented, oligopolistic market structure with largely independent actors. The COVID-19 pandemic triggered a marked transformation: cooperation intensified and market concentration accelerated. This research aims to explain the structural shift through a theoretical model comparing pre- and post-pandemic, applying multiple methods: grounded theory, game theory, fuzzy logic, and narrative analysis.

Objective: The aim of the research is to develop a theoretical framework that can describe and interpret the two market states of the last-mile logistics sector under study and the structural and behavioral factors strongly influencing the transition between them. Our primary objective is to analyze market participants' strategic choices based on their cooperative and competitive attitudes.

Methodology: This research employs grounded theory, allowing theory development from qualitative data. Behavioral patterns identified via semi-structured interviews and narrative analysis are incorporated into a complex systems model. Game theory simulations and fuzzy logic explore shifts in cooperative behavior, while statistical and secondary data (e.g., e-commerce, labor markets) provide structural context. The methodology reveals how and why zero-sum logic evolved into cooperative strategies.

Results: Based on our preliminary results, the increase in market concentration can be interpreted not only as a consequence of external pressure, but also as a consequence of an internal transformation, where resource-constrained actors recognize the potential for cooperation. The narratives of cooperation and their spread can be particularly well traced through the attitude towards parcel lockers' application.

Conclusions: Researching the structural transformation of the last-mile logistics sector - interpreted as a complex system - requires a methodological combination that can simultaneously take into account the perceptions and narratives of the actors, as well as objective market trends and resource relations. Grounded theory provides the opportunity to continuously adapt the theoretical model to the experiences explored.

Limitations and future research directions: The research is currently based primarily on qualitative data, therefore the future goals include integrating it with quantitative data and validating the model through simulation. Additional research directions include incorporating counterfactual hypotheses and tracking the dynamics between actors over longer term.

Keywords: Last-mile logistics, grounded theory, game theory, fuzzy logic, narrative analysis, system model



Lean production beyond manufacturing with Andon-log application

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Background and introduction: Andon is usually a traffic light colored light stack that provides visual signal of the situation on the production line. This is made difficult by the fact that in many places, such as agriculture, processes take place over a much larger area than in a factory.

The developed "Andon-log" app allows for the immediate transmission of various error signals, and makes the solution process and its timing permanently visible to all participants in the process, from operators to mechanics to managers.

Objective: During the past 20 years Innostall has faced several typical circumstances and practices that are very typical of agricultural farms, and the difficulties arising from them, which hinder efficient operation and thus also result in significant losses.

These were the circumstances that prompted Innostall's experts to develop a user-friendly solution, the "Andon-log" application, which not only allows for the immediate transmission of various error signals predefined in Andon-log.

Methodology: The starting point for the research was a real problem observed in agricultural enterprises. We conducted in-depth interviews to investigate the root causes of the problem in detail, based on which we formulated our hypotheses and theories. The development of the new application offering a solution was preceded by extensive literature research, followed by the creation of the concept and the development of the application. The developed app was tested in a real environment.

Results: The real-world testing and application of the Andon-log application confirmed that problems were solved in every case and in significantly less time than before. The application also ensured traceability and led to the introduction of new and useful, easy-to-use performance indicators at the company. In addition to all this, employee motivation also increased dramatically. The results are currently being quantified.

Conclusions: Our research in the first phase confirmed that there is currently no Andon solution that can be applied in a so-called plant environment.

The hypotheses and concept proved to be correct, which of course required the appropriate development and continuous testing of the Andon-log application.

Limitations and future research directions: Given that we were in constant contact with an agricultural farm (test farm) during our research and development, the application provides the right solution. The solution, i.e. the limits of the research results and developments and the possibilities for further development, are expected to become known at a later stage, when Andon-log becomes more widely used.

Keywords: Andon-log for immediate transmission of various error signals and to make the solution process visible.



Navigating Disruption: A Systematic Review of Managerial Decision-Making for Resilience in Dairy Supply Chains during COVID-19

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Background and introduction: The COVID-19 pandemic caused unprecedented disruptions to global dairy supply chains, challenging stakeholders from farmers to retailers. Dairy Supply Chains (DSCs) are particularly vulnerable due to the perishable nature of their products. This study addresses a gap in the literature by providing a focused, systematic review of the specific managerial decisions that enabled resilience within the dairy sector during the pandemic, guided by the PRISMA framework to analyze relevant literature from

Objective: This study aims to systematically review and synthesize managerial decision-making and adaptation strategies employed by global dairy supply chain stakeholders to mitigate COVID-19 disruptions. The objective is to identify key resilience patterns, inform strategic planning, and provide a framework for enhancing long-term sustainability and preparedness for future crises.

Methodology: This study employed a Systematic Literature Review (SLR) following the PRISMA framework to gather and analyze data from the Scopus database. The search strategy used Boolean queries to identify relevant English-language, Open Access articles published between 2019-2025. After screening 49 records against discipline and topic-specific criteria, 8 key studies were selected for in-depth analysis, covering evidence from 13 countries across Asia, Africa, Europe, and North America.

Results: The review identified six key adaptation strategies: workforce cross-training; market diversification; policy interventions for supply-demand balance; shelf-life extension tech; risk diversification via multi-sourcing; and local sales channels. Their success was highly dependent on specific regional contexts and stakeholder capacity.

Conclusions: The findings highlight that resilience in dairy supply chains is significantly influenced by proactive, context-sensitive managerial decision-making. Key to success were organizational flexibility, rapid process adaptation, and collaborative networks. Investing in these adaptive capacities is crucial not only for immediate crisis response but also for advancing the long-term sustainability and robustness of the global dairy supply chain against future disruptions.

Limitations and future research directions: A primary limitation is the reliance on a limited number of available studies (n=8) that met the strict inclusion criteria, which may affect the generalizability of findings. Future research should conduct longitudinal studies to assess the long-term efficacy of these adaptation strategies and gather primary data to explore the role of digital technologies and policy frameworks in building systemic resilience for the dairy industry.

Keywords: Adaptation Strategies, COVID-19 Pandemic, Dairy Supply Chain, Managerial Decision-Making, Resilience and Sustainability



The Reliability of the Transport Process as the Main Factor of Effective Management of the Unified Logistics Supply Chain

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Background and introduction: The research was conducted at the Departments of Transport and Logistics of Akaki Tsereteli State University and Georgian Technical University. Master's and doctoral students are involved in the research.

Objective: The goal of the research is to improve methods for increasing the reliability of the transportation process in a unified logistics chain.

Methodology: The research is being conducted in parallel with the development of the "traceca" transport corridor, and involves, together with university professors, groups of interested master's and doctoral students, representatives of the practical organization and management of transport and logistics processes. The research uses mathematical analysis, electronic simulation, random process management and other methods.

Results: The process of moving (transporting) material, service, financial or other types of flows is the basis of any logistics activity, therefore the reliability of the transportation process determines the efficiency of the logistics chain.

Conclusions: The reliability of a unified logistics chain is determined by the reliable functioning of all subsystems and elements participating in the transportation (movement) process, which is the main indicator of the overall efficiency of the supply chain.

Limitations and future research directions: It will be possible to identify further development directions of research in the processes of development and implementation of transport and energy infrastructure projects moving through Georgian territories and seaports.

Keywords: transportation; logistics chain; reliability; effective management