Leveraging ABM and DTs for Resilient Transport Systems: Abstract

The globalization of supply chains and the rising frequency of large-scale disruptions such as pandemics, natural disasters, and geopolitical conflicts have made modern logistics operations increasingly difficult to manage. The COVID-19 pandemic made this particularly clear, causing simultaneous failures across suppliers, transport operators, and distribution networks on a scale that had not been seen before. Despite this, most existing simulation frameworks remain limited in their ability to capture both the behavioral complexity of individual decision-makers and the real-time dynamics of the systems they operate within. Agent-Based Modeling (ABM) has shown real potential in addressing part of this challenge, with studies in literature demonstrating its ability to capture emergent system behaviors that top-down approaches fundamentally cannot, including its practical advantages over traditional heuristic approaches in dynamic transport scheduling contexts. Digital Twin (DT) technology extends this further by enabling live, data-driven virtual replicas of physical systems that support proactive risk management before, during, and after disruptions. However, these two methodologies have largely been developed in isolation, and the question of how their integration within a unified framework might enhance operational resilience in intermodal logistics systems remains largely unaddressed. This study proposes an integrated ABM and DT framework using the AnyLogic platform, applied to weather-related disruption scenarios at a major international port. The framework models physical assets such as terminals, berths, and vessels, alongside key stakeholders including port authorities and logistics providers, as autonomous agents whose behavioral rules are continuously informed by real-time operational data. The main challenges expected relate to data availability and reliability, validating agent behavior against real observations, and capturing multimodal interdependencies within a single simulation environment. This research advances the methodological integration of ABM and DT technologies in intermodal logistics, provides a validated simulation architecture that future researchers can build upon, and delivers a decision-support tool that enables practitioners to evaluate intervention strategies and stress-test operational resilience before disruptions occur.

Soliman Abdullah

Ontologies of Failure in Construction Project Management: A Critical Exposition

Abstract Written By: Ahmad AlOmar, Year 1 PhD, Management Science and Marketing Division

Failure in construction project management is conventionally assessed as performance deviation against predefined targets of time, cost, and scope. This paper argues that such assessment is a constitutive reduction that shapes what the field can observe, explain, and ultimately reproduce. The persistence of project failure, despite sustained attention, reflects a deeper problem in how the phenomenon is specified. Dominant evaluative regimes stabilise failure in forms that are contractually expressible, while displacing the generative conditions through which projects lose viability. What is at stake is the field's capacity to develop explanatory frameworks adequate to the phenomenon it seeks to understand.

This paper engages the canonical literatures that have theorised project failure through an integrative critical review (Torraco, 2005; Alvesson and Sandberg, 2011), analysing both how failure is theorised and how it is operationalised. Three positions recur across decades of scholarship, a tripartite structure corroborated in adjacent organisational literatures (Fincham, 2002). First, failure as outcome, defined as deviation from planned performance (Atkinson, 1999). Second, failure as a process, unfolding through escalation, lock-in, and path dependence(Flyvbjerg, 2014). Third, failure as social judgement, constituted through interpretation and the alignment of interests among heterogeneous actors(Berger and Luckmann, 1966; Pinto and Slevin, 1988). These positions rest on distinct ontological assumptions, yet at the point of empirical application all collapse into the same deviation-based measurement logic.

This convergence is explained as ontological compression. Under conditions of contractual accountability, evaluation must be commensurable, auditable, and enforceable, and deviation from plan provides such a form. Three interlocking conditions produce this: the contract fixes accountability to predefined deliverables; standardised metrics must travel across organisational boundaries; and judgement is demanded before the full trajectory of a project becomes analytically legible. The contract, written prospectively under uncertainty, cannot accommodate what it did not anticipate. Between how failure develops in reality and what the contract can recognise lies a structural gap. The actor who bears residual causal responsibility for failure exists outside contractual categories, present in failing projects and absent from disputes conducted about them. Drawing on Simmel's analysis of triadic relations (Simmel, 1950), it is this actor whose invisibility sustains the persistence of failure. The regime adjudicates what it can see while the conditions that produced breakdown remain beyond its frame.

An integrative critical review is adopted because the problem is ontological, requiring scholarship to be pressed on its assumptions rather than its findings. However, research of this nature carries inherent limitations and anticipated challenges. The selection of literatures involves interpretive judgement, the boundaries of the review are not algorithmically determined, and the constructs advanced, while theoretically bounded, remain open to contestation on interpretive grounds. These are constitutive features of the method and of the problem it is designed to address.

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Carbon-Aware Cargo Storage in Port Warehouses: Machine Learning Optimization for Congestion, Scope 3 Emissions, and Supply Chain Resilience

Shina Khaki Moghadam

Port warehouses increasingly shape the operational efficiency and traffic conditions of container ports, yet cargo storage decisions are still often treated as local, static choices rather than dynamic levers for system-wide performance. Existing studies have predominantly focused on container yard optimisation and isolated warehouse planning, with limited attention to the interaction between storage decisions, gate congestion, and carbon emissions. This research develops a carbon-aware approach to cargo storage assignment and retrieval planning, using machine learning-based optimisation to improve internal traffic flow, reduce port and terminal congestion, and lower associated Scope 3 emissions from truck movements and outsourced transport operations. The study analyses how intelligent storage and retrieval decisions can smooth truck arrivals, shorten equipment travel distances, and accelerate cargo turnover under uncertainty.

A mixed-methods design is adopted. Quantitatively, machine learning models forecast cargo arrivals, dwell times, and onward transport modes, which inform a stochastic optimisation model that determines storage locations and retrieval schedules to minimise internal travel, re-handling, and peak gate flows while maintaining service levels. Qualitatively, semi-structured and group interviews and network analysis examine coordination and orchestration mechanisms among port authorities, terminal operators, trucking firms, and rail operators. These insights reveal how information sharing, truck appointment systems, and joint planning practices enable or hinder the implementation of congestion-reducing warehouse strategies, and they refine model assumptions regarding actor behaviour and feasible coordination mechanisms.

Integrating diverse operational and traffic data, identifying feedback effects between storage choices and system congestion, and coordinating optimisation results with current procedures and legacy systems are some of the main obstacles. The suggested strategy is anticipated to decrease truck queuing, internal bottlenecks, and needless equipment movements by clearly connecting cargo warehouse management to port traffic patterns and multimodal flows, resulting in quantifiable reductions in Scope 3 emissions. By connecting operational decision-making with supply chain coordination dynamics, the research suggests carbon-aware, congestion-sensitive warehouse optimisation and provides practical advice for ports looking to increase efficiency, resilience, and environmental performance.

Beyond Uniformity: A Multi-Dimensional Framework for Differentiated Return-Policy Design in Modern Retail Systems

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The rapid growth of omnichannel and online retailing has made an already difficult problem for retailers even harder: figuring out how to make return policies that are both profitable and take into account the different needs of customers, the characteristics of the products, and the operational limitations of each channel. In the past, return policies were the same for all customers and product categories, with the same refund terms, deadlines, and return channels. But recent trends in the industry and new academic research show that this kind of uniformity is not good for business or for how people behave. Retailers today have to deal with very different types of customers who have different levels of uncertainty about value, cultural norms, psychological expectations, product fit risks, and chances for opportunistic or dishonest behaviour. At the same time, products have very different return propensities, salvage values, lifecycles, and refurbishment potentials. Return costs also vary widely between channels, regions, cities, and reverse logistics infrastructures. This changing environment makes it necessary to have return policy frameworks that are not the same for everyone, but instead are different for each customer, product, and location or channel.

Existing literature offers valuable theoretical models demonstrating that refund generosity, return windows, exchange options, restocking fees, and refund formats interact with demand, pricing, and consumer behaviour. Analytical work shows how return policies should respond to valuation uncertainty, salvage value, opportunism, and channel structure, while behavioural studies highlight the role of fairness perceptions, mental accounting, and risk aversion. However, despite this rich foundation, research remains fragmented: most studies adjust only one policy lever at a time, consider only a single channel or product category, or ignore real-world heterogeneity such as region-specific logistics costs, dynamic customer histories, cultural variation, and technology-enabled personalisation. These gaps reveal substantial room to build a more holistic and practically relevant approach.

In this context, the proposed research seeks to examine the optimal design of return policies tailored to various customer segments, product categories, and geographical return cost frameworks. We will use a mixed-methods approach. First, a structured conceptual synthesis will chart existing models, pinpointing areas where differentiation has been analytically validated and where deficiencies remain. Second, an empirical analysis using retailer-level data will estimate different return behaviours based on things like customer characteristics, product categories, and regional logistics. Third, an analytical or optimisation model will be created to suggest different return policy structures that take into account customer behaviour, product characteristics, and changes in costs across different locations. This methodological triangulation is selected to guarantee both theoretical robustness and practical significance.

Geoffrey Kimani

Precipitation is a weather variable required in multiple sectors - agriculture, flood warning, insurance, humanitarian response - yet it structurally disadvantaged with recent studies showing systematic underestimation of heavy rainfall when verified against ground observations rather than reanalysis. At the same time, the most damaging events such as the medicane Storm Daniel lie at or beyond the edge of historical data records, exposing limits in how Foundation Models (FMs) learn, represent and quantify extremes. The Climate Risk Index 2026 reports that TC Daniel caused 13,200 lives and over USD 6 billion in damages in Libya, ranking it fourth in extreme events impacts between 1995-2025 alongside Dominica, Myanmar, and Honduras which had fewer events but also ranked in the top five. This PhD focuses on extreme precipitation over north-western Europe as the primary testbed with a single grey-swan medicane case as canonical stress-test.

Research has identified three problems. First precipitation is zero-inflated, heavy-tailed and largely sub-grid at FM resolutions, yet it is treated as a continuous, normal distribution and trained with symmetric loss functions leading to smoothing bias. Second, even for calibrated probabilistic or ensemble models evaluated on the same bulk metrics, might still produce miscalibrated forecasts for thresholds like for flooding. Finally, data strategies for extremes i.e. oversampling, generative augmentation are rarely analysed for their impact on tail skill and calibration.

This project aims to explore four research questions: (1) How should extreme precipitation be defined and represented at foundation-model grid scale in a way that respects zero-inflation, heavy tails and basic regime differences? (2) Under what conditions do Prithvi-WxC based precipitation forecasts fail to be reliable in the tail and how does this relate to the training objective, event rarity, and lead-time? (3) How do data composition choices – oversampling, synthetic extremes – affect skill and calibration? (4) To what extent can FM-style model generalise to grey swan precipitation events that lie outside their training set?

Methodologically, the work will focus solely on FM-style models by building on the Prithvi-WxC model as the backbone and adding decoder heads to infer precipitation from atmospheric state fields. Within this setup, I will compare output representations and training objectives for precipitation, develop and apply tail-focused diagnostic tools for failure and uncertainty analysis, run experiments on synthetic data augmentations. Key challenges will include the well-known biases of using reanalysis-based precipitation targets, the need to optimise tail performance without losing bulk forecasting skill and the number of truly extreme and grey swan events.

The expected contributions of this project are to characterize extreme precipitation by providing clearer definition of extremes, tools to expose uncertainty in FM models and when their reliability fails, and evidence-based guidance on how synthetic extremes should be used or avoided when adapting FM models for extreme precipitation.

Abstract – Yousra Mahdy

Recommender systems (RS) have become an indispensable tool for helping users navigate the vast amount of information available in the digital age. These systems are designed to provide personalized recommendations by predicting user preferences and suggesting relevant items, such as products, services, or content. recommender systems have been widely adopted across various domains, including e-commerce [30], streaming services, social media, and healthcare, due to their ability to enhance user experience, increase user engagement, and drive business growth.

User preferences play a central role in the design and evaluation of recommender systems, as these systems aim to personalize content by modeling what users like or value. Personalized recommender systems have profound effects on both users and the companies that deploy it. From the user perspective, personalization can improve relevance, reduce information overload, and enhance user satisfaction by tailoring content to individual interests. From the companies' perspective, personalized recommender systems are a key driver of engagement, retention, and revenue growth. By optimizing for metrics such as click-through rate, dwell time, or long-term user value, firms can increase the predictability of user behavior and improve monetization through advertising, subscriptions, or targeted sales.

Recent design of RS formulates the recommendation process as a Markov Decision Process (MDP), to increase long-term users' engagement. This introduced the usage of Reinforcement Learning (RL) and Deep RL techniques in the design of recommender systems as the new state-of-the-art performing models (referred to as RLRS, and DeepRLRS). These models optimize for longer user engagement, which may encourage RL recommender systems to favor strategies that shift user preferences toward more profitable or predictable states, even when such shifts conflict with users' long-term interests. This phenomenon is being studied within the recent literature and referred to as user-preference shift or user-tampering.

Studies refer to this phenomenon as one of the RS harms (user-manipulation harm), and correlates it with bias, filter bubble and polarization, especially in the news RS application. Recent studies have been concerned with means to observe, quantify and measure this harm along with some initial attempts to mitigate from the design [1,2,3,4,5,6,7]. These studies provide proof of the existence of this phenomenon through reproducible experiments, and metrics to measure the user-manipulation harm. Moreover some provide mitigation techniques to reduce it. However, the mitigation techniques used are not compatible with the state-of-the-art recommender systems algorithms (RL, and DeepRL models). Moreover, it is noted that while mitigating user-preference harm, the performance of the RS is reduced as well.

On the other hand, since the RSRL and RS DeepRL techniques are the state-of-the-art RS model, I propose that extending RL optimization techniques can be adopted to this problem, considering it as a multiple objective RL optimization problem. Hence, techniques like meta-learning, multi-objective RL(MORL) can be used to provide better mitigation approaches that can reduce user-manipulation while not affecting the RS performance. These approaches are being deployed in different RL problems but not in recommendation systems.

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AMBS DOCTORAL CONFERENCE 2026: ABSTRACT

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Title: Mechanisms, Assumptions, and Boundary Conditions in a Local Supply Chain: Empirical Evidence from an Emerging Economy

Introduction: Local supply chains (LSCs) are increasingly positioned as a strategic response to global supply risk, geopolitical uncertainty, and coordination complexity. Yet while prior research often assumes that geographical proximity improves operational performance, the mechanisms through which such benefits arise remain under-theorized. This creates a gap in understanding how and when LSCs deliver improved outcomes. This study investigates LSCs in emerging economies through a comparative multi-case study of four industrial manufacturing firms in India. This context is particularly relevant given policy initiatives such as Make in India, which promote supply chain localization and highlight the need to understand its performance implications. Emerging economy supply networks are further characterized by institutional variability, capability asymmetries, and hybrid governance structures, making them both theoretically important and underexplored. The study critically examines whether spatial proximity alone explains responsiveness or whether coordination processes and institutional conditions enable LSCs to generate operational advantages. The research may encounter challenges in accessing multiple firms, capturing cross-functional perspectives, and comparing heterogeneous networks, which the study aims to address through a multi-case, cross-functional interview design.

Key Pointers from Literature: The study draws upon literature from OSCM, encompassing both empirical and conceptual studies. Existing research on LSCs primarily focuses on food industries, with limited attention to manufacturing contexts (Roznowicz & Odou, 2021). Prior studies also under-specify the coordination mechanisms operating within geographically concentrated networks. Emerging economy manufacturing settings offer a distinctive context where formal contracts coexist with relational governance, informal information exchange, and capability asymmetries across network actors, suggesting that localization outcomes are contingent rather than universal.

Research Questions: This study will address three primary questions: how do LSCs enable or constrain coordination mechanisms that influence network performance; what boundary conditions limit the effectiveness of LSCs in delivering operational advantages; and how transferable are prevailing assumptions about LSCs from developed to emerging economy contexts?

Methodology: A qualitative, theory-building approach using a multiple case study design is adopted, suitable for examining under-theorized phenomena and uncovering mechanisms. Data will be collected from four manufacturing firms through semi-structured interviews with managers across procurement, operations, engineering, and suppliers, providing rich, multi-perspective insights. Cross-case comparison will be used to identify recurring and contrasting coordination mechanisms, while systematic analysis of interview data will support the development of explanations linking LSCs to operational outcomes.

Expected Contributions: By developing a contextually grounded understanding of LSCs in manufacturing, this study contributes to OSCM literature. By uncovering the coordination mechanisms and institutional conditions that shape performance, it extends theory on supply network design and identifies boundary conditions where localization may not be a positive strategy. For practitioners, it offers a framework for designing and managing LSCs in emerging economy manufacturing contexts, making the findings both theoretically and practically relevant.

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Why Decent Work Policies Do Not Fully Deliver: Internal Legitimacy in Downstream Operations

Ana Claudia Wierman Terra, Chris Smith, Fahian Huq

Despite growing commitments related to decent work across supply chains, cases of excessive workloads, intensified monitoring, and poor labour conditions continue to surface (LeBaron, 2021). The critical puzzle is if organisations are increasingly implementing initiatives aimed at improving working conditions, why do such conditions continue to re-emerge over time?

Prior research has advanced decent work in supply chains by emphasising private governance, auditing practices, and compliance-based labour regulation mechanisms (Marques et al., 2025). However, it has focused primarily on adoption, offering limited insight into how such initiatives unfold within the organisation and whether they lead to sustained improvements in workers' experiences.

This limitation is highlighted in downstream operations, such as warehouses, where labour-intensive processes, operational pressures, and monitoring systems shape daily work (Geng et al., 2022). Even though these contexts offer more visibility, problematic work conditions issues still rise into the spotlight. Although warehouse seems more visible for being "in-house", evidence suggest there is a need to further investigate persistent labour issues.

To address this puzzle, this study brings legitimacy theory as the lens to explain that though legitimacy in supply chains is commonly linked to external concerns such as reputation and disclosure, particularly in initiatives aimed at improving working conditions (Suchman, 1995; Liu et al., 2024; Marques et al., 2024), internal legitimacy operates as a generative mechanism shaping whether such initiatives are accepted or resisted. When internal legitimacy is low, employees may disengage and develop informal practices that undermine implementation (Loos & Spraul, 2024; Brandl et al., 2021).

Building on this argument, the research question is how are decent work initiatives interpreted and enacted in downstream operations, and how does internal legitimacy shape their acceptance or erosion over time? This study adopts an interpretivist ontology and social constructivist epistemology (Cassel et al, 2012), using narrative process research to centre worker voice in examining how a process change aimed at improving working conditions is interpreted and enacted (Grimm et al, 2024). Empirically, the study develops an embedded case in Brazil, where labour vulnerabilities persist despite institutional and organisational efforts (Tribunal Superior do Trabalho, 2026; G1, 2026). The organisation has implemented changes in working-hours management, including a new monitoring system alongside revised policies and enforcement mechanisms.

Data will be collected through semi-structured interviews with shop-floor workers, supervisors, and policy designers, adopting a retrospective approach to reconstruct how the project unfolded through participant's and document's narrative. This multi-level design enables analysis of how interpretations may vary and shape internal legitimacy in different stages.

By conceptualising internal legitimacy as a generative mechanism embedded in everyday work, this study challenges the assumption that introducing responsibility initiatives is sufficient to improve working conditions, repositioning decent work from policy design to its enactment in downstream operations.

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