

Untangling Coopetitive Tensions for Sustainability: A System Dynamics Exploration

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Purpose: This study aims to explore the construction and evolution of knotted paradoxes within the context of coopetition for sustainability. By adopting a system dynamics (SD) approach, we seek to unravel the cognitive mechanisms through which organizational actors construct and navigate intertwined (knotted) paradoxical tensions. Our research addresses the gaps in understanding how knotted paradoxes are formed, maintained, and evolved over time, and how these dynamics impact organizational behavior and decision-making.

Theoretical Framework: Paradox theory serves as a theoretical lens for this study and provides a robust approach for examining contradictory yet interrelated elements within organizations that push-pull actors between competing interests/goals. Paradoxes are inherently characterized by their contradictory nature, interdependence of their opposing elements, and their persistence over time. These features create a cyclical relationship between opposing forces and makes paradoxes one of the core aspects in organizational studies. Traditionally, research has focused on individual paradoxical tensions, such as exploration vs exploitation, short run vs long run goals or flexibility vs stability. However, in reality, organizations often face multiple paradoxical tensions that interact and become interwoven, forming “knotted” paradoxes.

Coopetition for sustainability is an exemplary context for studying knotted paradoxes. This concept involves simultaneous cooperation and competition among firms to achieve environmental, economic, and social goals simultaneously. The dual engagement in coopetition and sustainability introduces inherent tensions between competitive and cooperative logics, as well as between the often conflicting goals of sustainability. Despite significant research on coopetition and sustainability as separate phenomena, their intersection as a knotted paradox has been largely overlooked. This study aims to fill this gap by exploring how these complex, intertwined tensions are constructed and managed over time.

Methodology: We employed a system dynamics (SD) approach, which facilitates the cognitive construction and understanding of complex systems based on cause–effect links and feedback loops. The empirical investigation centers on the Eldorado (ED) project, a large-scale urban development initiative in Sweden involving seven construction firms, the municipality, and three municipal infrastructure companies. Data collection methods included 63 semi-structured interviews, meeting observations, and analysis of primary and secondary project documents. The data were translated into SD terms to construct causal loop models that represent the mental models of actors navigating coopetition and sustainability tensions.

The SD approach allowed us to capture the dynamic interactions and feedback loops within these mental models and, therefore, provides a comprehensive view of how knotted paradoxes are constructed by actors and evolve over time. A paradoxical tension is represented by a causal loop mental model if competing demands are linked via at least two opposing causal loops. We employed various data analysis techniques such as identification of causality language markers, semantic analysis, linguistic counterfactual causal analysis to identify tensional poles, determine relevant nodes and pairwise relationships, and map out causal loops. The models were validated through workshops with the actors and by AI to ensure the reliability and robustness of our findings.

Findings: Our analysis revealed that actors construct knotted paradoxes through cognitive causal models, which integrate feedback loops and capture the dynamic interplay of opposing

(co-competition and sustainability) elements. These mental models reflect actors' analytical reasoning regarding the project and uncover their understanding of complex interdependencies between competition, cooperation, economic, environmental, and social demands (see the overall causality loop model in Fig.). Specific triggers, including internal factors (such as organizational changes and strategic shifts), external factors (such as market dynamics and regulatory changes), and mixed factors (such as collaborative initiatives and competitive pressures) initiate changes in the construction of knotted paradoxes.

The feedback loops within these mental models significantly influence the persistence and evolution of paradoxical tensions over time and lead to increasing complexity of the paradoxical systems over time. Causal loop diagrams, developed in the study, also provide a visual representation of how actors navigate (address) the contradictory yet interdependent elements over time.

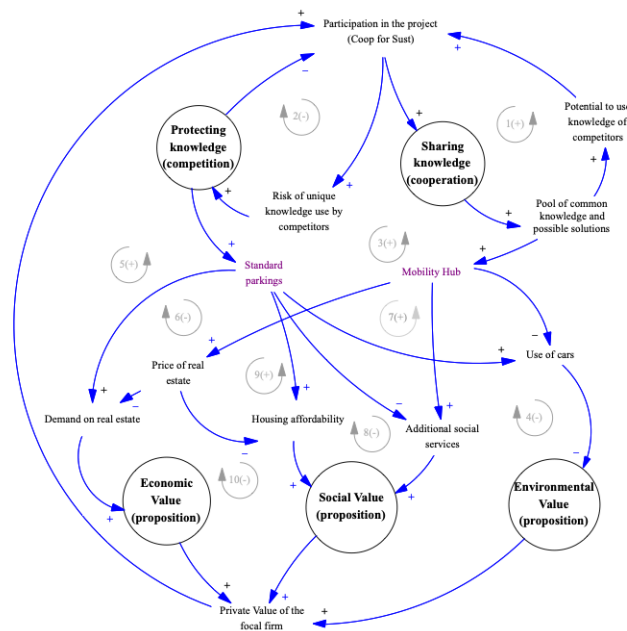


Fig. Competition for sustainable mobility: Overall causality loop model

Originality/Value: This study contributes to the emerging field of knotted paradoxes by providing a detailed exploration of their construction and evolution through a system dynamics approach. The research offers a novel conceptualization of paradoxes as causal loop systems and provides practical insights for managing complex interdependencies in organizational settings. Focusing on co-competition for sustainability the study bridges the gap between competition and sustainability research and enhance the understanding of how these paradoxical tensions interact and evolve over time.

Theoretical and Practical Implications: Theoretically, this research introduces a novel conceptualization of paradoxes as causal loop systems that elucidate the cognitive mechanisms through which actors construct and navigate knotted paradoxes. It extends paradox theory by revealing the structure and dynamics of these knots and emphasizes the role of feedback loops in the cognitive construction process. Demonstrating how feedback loops affect the construction and evolution of knotted paradoxes this study offers a deeper understanding of the cognitive underpinnings of paradoxical tensions and their impact on organizational behavior. Practically, the findings offer valuable insights for managers dealing with knotted paradoxes. A deep understanding of the structure and dynamics of these knots can inform more effective management strategies and enable managers to leverage feedback loops to better navigate the complex interplay of competing demands in co-competition for sustainability. For instance, recognizing the triggers that initiate changes in knotted paradoxes can help managers implement relevant managerial interventions that could correct cognitive processing of tensions.