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CanConstructNZ
Balance in the sector

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Problem identified

The construction sector operates in a complex and dynamic environment, where managing multi-project portfolios introduces uncertainties such as schedule conflicts and task overdues, necessitating agile decision-making. Evaluating the capacity and capability of the construction sector, especially within national construction works and activity planning, requires strategies to align resources with projected demands, considering both top-down influences like global economic factors and bottom-up causalities impacting the sector's output. Granular resource allocation practices in each contractor company collectively influence the overall supply-demand balance, requiring evaluation of project schedules, specific resource requirements, and the formulation of resource allocation and contract distribution strategies to address resource constraints while considering each contractor's compatibility with specific tasks and their capacity to handle workloads concurrently. This research focuses on the New Zealand construction sector, which confronts significant challenges including skill and labor shortages, escalating material prices, and disruptions in the supply chain, underscoring the critical importance of evaluating capacity and capability against construction demands and implementing strategies outlined in the Construction Sector Transformation Plan to enhance sector performance.

Aims

The aim of the research is to investigate the embedded mechanism and dynamics of supply-demand parity within the construction sector, focusing on the impact of resourcing multi-type and various-sized projects on overall sector outputs.

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Objectives

(not more than five in text box below)

1- Propose a method for measuring the gap between project demands and available resources within the construction sector.

2- Achieve a realistic, optimal strategy for resource allocation, thereby helping to improve sector performance to meet diversified project demands.

Methodology

1- Utilize a systematic computational modeling and simulation technique, Agent-based Modeling (ABM), to understand embedded processes within the construction sector.

2- Integrate expert knowledge, involving human expertise and rules, with reinforcement learning (RL) as a complementary approach for ABM.

Preliminary results

1- Object-oriented programming is utilized for model implementation, defining agents and environment as instances of real-world entities. The system's expert agent establishes operational rules, while experiments explore the impact of expert parameters on system state transformation and demonstrate the model's capability to incorporate new agent types, ensuring compatibility and scalability.

2- A conceptual model has been created, demonstrating potential in harnessing expert knowledge within a combination of a hybrid agent-based model and Reinforcement Learning (RL). Accordingly, a framework is proposed to incorporate an RL agent as a coordinating expert agent within the agent-based model. This integrated approach continuously improves resource allocation through ongoing learning to adjust agent-based model parameters.