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## AgentChat: Feasibility Of Large-scale Multi-agent Based Coordination For Freight Co-loading

### Project Team:

Dr. Alexandra Brintrup, Lecturer in Digital Manufacturing, Department of Engineering, University of Cambridge



Dr. Liming Xu, Research Associate, Department of Engineering, University of Cambridge



Stephen Mak, PhD Candidate, Department of Engineering, University of Cambridge



### Industry Partners



### What does the project demonstrate?

Freight co-loading increases the utility of freight capacity by including shipments from multiple shippers onto the same freight to travel between close shipment locations. Benefits of freight co-loading may include reduced carbon, cost of shipment and congestion at receiving locations. Yet, in the UK and Europe only 63% of journeys carry useful load and average vehicle utilisation is under 60%. Although the idea of freight co-loading is not new, it never been fully implemented. Freight co-loading is a hard problem because:

- Co-located or close suppliers do not know whether they are sending items to similar locations at similar times. For them to know, someone needs to tell them.
- For the retailers, orchestrating co-loading involves transaction costs. The benefits of truck co-loading does not necessarily outweigh the costs of paying for manual orchestration.
- For logistics providers to be the orchestrator, suppliers would need to use the same logistics providers, creating a lock down effect, not suitable to sporadic journeys.
- For a third party mediator to orchestrate, multiple suppliers need to sign up and pay for it.

AgentChat will explore the feasibility of an alternative solution to address these challenges. AgentChat involves two key aspects: a distributed, multi-agent software system that automates solution search and optimisation; and a learning algorithm to reduce solution search space over time. Multi-agent systems are inherently suitable for supply chain and logistics problems as agents can be used to represent individual goal seeking entities and communicate with one another.

Whilst various previous industrial applications have been carried out to implement multi-agent system solutions in manufacturing, supply chain solutions have been lacking. Key challenges we are investigating for supply chain agent systems include appropriate agent architectural configurations, and how to keep agent learning scalable.

Our ultimate vision is an open source platform that supply chain stakeholders can install, deploy agents that represent their organization, automatically searching for and getting alerted for co-loading opportunities in a secure private manner. This project explores the feasibility of this vision. The first challenge we are investigating includes agent architectural configurations and learning while keeping the system scalable. Secondly, exploring the use of learning algorithms to reduce search space over time, by finding recurrent co-delivery patterns automatically.



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