Quantum Optimization and Its Impact on Supply Chain and Business Performance

Modern supply chains and logistics systems involve large-scale, highly combinatorial decision problems such as multi-echelon inventory positioning, container yard operations, routing, and capacity allocation under uncertainty. These problems are typically modeled as mixed-integer stochastic programs that become computationally intractable at realistic scales, despite the growing availability of rich operational data. At the same time, recent advances in quantum optimization (e.g., QUBO/Ising formulations solved via quantum annealing and variational algorithms) suggest new computational paradigms for tackling complex combinatorial structures. However, there is currently no systematic understanding of how real supply chain and logistics problems can be reformulated to exploit quantum optimization, nor when such approaches outperform advanced classical methods.

This PhD project seeks to explore the intersection of operations research, supply chain analytics, and quantum computing by investigating how logistics and supply chain optimization problems can be reformulated into quantum-amenable structures and addressed through hybrid quantum–classical solution approaches. The research will combine modeling, analytics, and computational experimentation on realistic logistics problems (the project partner is Port of Koper) to assess the potential and limitations of quantum optimization in this domain. We particularly welcome applicants from technical universities with a strong background in optimization, mathematical modeling, and analytical methods, as well as students from business economics who are interested in studying the impact of these emerging methodologies on the operational and business performance of companies.

By agreement, we can offer a paid PhD position (tuition covered and employment or student work for the duration of the project), with funding secured through an already approved university research project.

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