# NEDO Challenge: Building an ecosystem that continuously creates use cases for quantum computers that solve social issues

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Abstract:

NEDO (New Energy and Industrial Technology Development Organization) has launched a prize-driven program to accelerate the development of practical use cases for quantum computers and to cultivate human resources in the quantum domain. In this program, we define open challenge issues to collect proposals from both industry and academia. We provide structured educational activities for newcomers to quantum computing, and offer access to advanced quantum computing environments based on multiple hardware platforms in coordination with high-performance computing resources. Through this program, numerous quantum computing use cases have been proposed and developed. These use cases cover a broad range of industrial domains, including logistics, manufacturing, energy, and materials and chemical industries. They employ a variety of quantum algorithmic approaches such as the Variational Quantum Eigensolver (VQE), the Quantum Approximate Optimization Algorithm (QAOA), quantum machine learning, Grover's algorithm, and related methods. We are conducting a quantitative evaluation of these use cases in terms of required quantum and classical computational resources, the applicability and performance of existing quantum algorithms, and their potential industrial and societal impact. Our methodology combines algorithmic complexity estimates with resource and performance simulations on near-term and future quantum architectures. Based on survey data and project outcomes, we analyze how such a national-scale program can influence the trajectory of quantum computing research and its industrial deployment. In particular, we examine how program design factors, such as the structure of prize challenges, access to heterogeneous quantum hardware, and the degree of integration with high-performance classical computing, shape the types and characteristics of use cases that emerge. We also analyze how these factors contribute to aligning academic research agendas with industrial needs. This presentation highlights representative use cases from the program and reports preliminary quantitative results on their resource requirements and expected industrial impact. We also outline a conceptual model for the social implementation of quantum computing derived from these results, and argue that this model can inform resource allocation across quantum hardware platforms, the design of incentive schemes for use-case development, and the coordination of future research directions between academia, industry, and government.