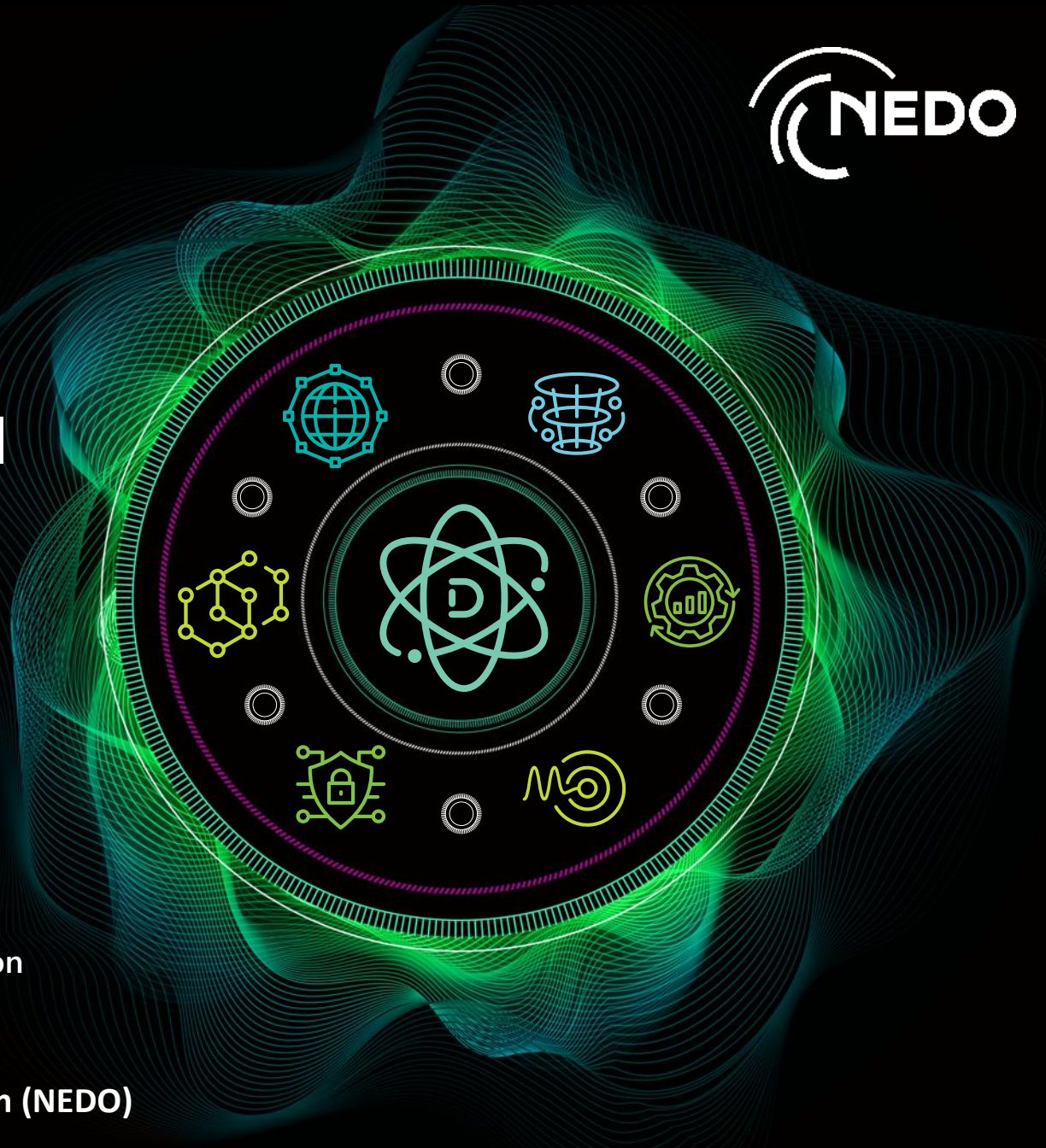
Quantum Computing Use Cases

Optimal resource allocation based on sophisticated economic forecasting



Promotion of SDGs with Quantum Technology

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New Energy and Industrial Technology Development Organization (NEDO)

精緻な経済予測による資源最適配分
Optimal resource allocation based on sophisticated economic forecasting



ユースケース概要 **Use Case Overview**	経済予測のボラティリティを減らし、先回り対策や資源最適配分の精度を向上 Reduce the volatility of economic forecasts and improve the accuracy of measures and resource allocation.
解決できる課題と効果 **Issues to be addressed and their effects**	経済的なリスクとリターンの明確化による、企業成長の確度上昇 Clarification of economic risks and returns leads to a higher certainty of corporate growth.
量子技術の貢献 **Contributions of quantum technology**	より精緻な経済予測モデルの導出およびリスク予測のシミュレーション Derivation of more sophisticated economic forecasting models and simulation of risk predictions.

実現予想時期 **Expected realization period**	(Year)2040～2050
産業分類 **Industry classification**	コンシューマ・その他 Consumer・Others
関連するQRAMI階層 **Related QRAMI layers**	機能層 Functional layer
関連する量子技術 **Related quantum technologies**	量子コンピュータ(NISQ) Quantum Computer(NISQ)

新規性 **Novelty**	軽微な改良 Minor improvements
達成難易度 **Difficulty of achievement**	どちらとも言えない Neither
社会貢献度 **Social contribution level**	幅広い業種に貢献 Contributions to a wide range of industries
市場規模 **Market size**	見積困難 Difficult to estimate

Detail

Optimal resource allocation based on sophisticated economic forecasting

- Eliminate uneasiness about the economy by making precise economic forecasts and enabling proactive measures and optimal allocation of resources.

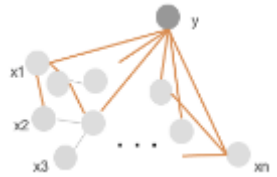
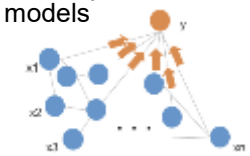


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Volatility of GDP growth rate

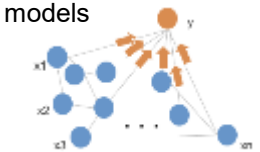
GDP growth is currently uncontrollable and volatile, but growth rate volatility can be made zero through precise economic forecasting along with proactive measures and optimal allocation of resources.

Potential contribution of computational technology	Feasible ultimate world	Supportable SDG goals
Simulation of economic growth in countries worldwide Prediction of economic risk and impact of measures Proposals for optimal policies toward economic growth in countries worldwide Proposals for optimal technology investments by countries and companies Proposals for amount and method in allocating an optimal basic income to individuals	Economy grows throughout the world and provisions for economic risk are made in advance. Risk and return of technology investment becomes clear and accuracy of corporate growth improves. A basic income is established enabling everyone to live a full life	1 貧困をなくそう 9 産業と技術革新の基盤をつくろう 10 人や国の不平等をなくそう

Optimal resource allocation based on sophisticated economic forecasting

Process (1/2)	Necessary R&D and business development	Quantum-computer scope of contribution and future development issues	
Precise economic forecasting: Current economic forecasting Test mathematical models, perform new economic forecasting, construct mathematical models	■ Verify validity of existing economic forecasting models (e.g., ABM) and extract parameters to construct more precise forecasting models (convert correlated items into precise causal relationships) → Use linear regression analysis to clarify correlation and causal relationships between more parameters (formalize links between economic indicators and production activities by company, economic activities of the entire population, etc.))		■ Expand the scope of applying quantum computers to statistical analysis including linear regression analysis (develop techniques to expand the application range beyond existing algorithms)
Select optimal model	■ Select and propose use of optimal model in real time	Solve many forward problems in causal models 	■ Within those models, identify computational tasks difficult to solve by a classical approach ■ Develop algorithms to efficiently solve those tasks ■ Verify the advantages of parallel computation in quantum algorithms, etc.
Establish methodology for correctly collecting parameters	■ Collect required parameters described above in real time (e.g., interest rates, exchange rates, transaction prices, demographics, policies by country, etc.)	-	■ None in particular
Establish computational technology	■ Perform real-time forecasting calculations on a global scale	Solve forward problems in causal models 	■ Within those models, identify computational tasks difficult to solve by a classical approach ■ Develop algorithms to efficiently solve those tasks ■ Achieve real-time, large-scale execution of established mathematical models

Optimal resource allocation based on sophisticated economic forecasting

Process (2/2)		Necessary R&D and business development	Quantum-computer scope of contribution and future development issues	
Proactive measures and optimal allocation of resources	Predict economic risk and impact of measures	■ Perform simulations to predict risk of a macroeconomic downturn based on the above models ■ Establish technology for simulating medium/long-term impact of government policies to ensure that there are no unexpected risks of executing those policies (e.g., simulation of medium/long-term impact of introducing a basic income)	Solve forward problems in causal models 	■ Within those models, identify computational tasks difficult to solve by a classical approach ■ Develop algorithms to efficiently solve those tasks
	Propose proactive measures to prevent risk	■ Propose current and short/medium/long-term optimal policies to prevent an economic downturn	-	■ None in particular
	Establish a safety net	■ Design a safety-net mechanism to guarantee minimal activity in individual lives and corporate management in the event of an economic recession, (e.g., design of a minimum wage, life protection system)	-	■ None in particular
	Set up an environment to execute measures	■ Create a social system in which the government can change policies immediately	-	■ None in particular

Roadmap

Optimal resource allocation based on sophisticated economic forecasting

Process		Necessary steps	2024	2025-2030	2030-2040	Beyond 2040
Precise economic forecasting	Current economic forecasting Test mathematical models, perform new economic forecasting, construct mathematical models	■ Collect/analyze existing economic models				
		■ Expand the scope of applying quantum computers to statistical analysis including linear regression analysis				
		■ Clarify more precise correlation and causal relationships using linear regression analysis and construct models				
	Select optimal model	■ Verify the advantages of parallel computation in quantum algorithms				
		■ Collect past forecasting data of existing models				
		■ Within those models, identify computational tasks difficult to solve by a classical approach				
		■ Develop algorithms to efficiently solve those tasks				
	Establish methodology for correctly collecting parameters	■ Check existing data collection methods (using official statistics, research papers, etc.)				
		■ Establish mechanism/technology for accurately collecting data in real time				
	Establish computational technology	■ Within those models, identify computational tasks difficult to solve by a classical approach				
		■ Develop algorithms to efficiently solve those tasks				
		■ Achieve real-time, large-scale execution of established mathematical models				
Proactive measures and optimal allocation of resources	Predict economic risk and impact of measures	■ Within those models, identify computational tasks difficult to solve by a classical approach				
		■ Develop algorithms to efficiently solve the forecasting of economic risk and impact of measures				
	Propose proactive measures to prevent risk	■ Collect patterns on past economic policies and data on measured effects				
		■ Improve and raise efficiency of classical approach to optimization of proactive measures based on the above economic models				
	Establish a safety net	■ Analyze needs of individuals and companies targeted by a safety net				
		■ Collect/analyze past data on social risks and economic downturns				
		■ Improve and raise efficiency of classical approach to proposing safety-net optimization				
	Set up an environment to execute measures	■ Create a social system in which the government can change policies immediately (money supply, taxes, interest rates, etc.)				

Items related to quantum computers

More use cases are available on our website. We invite you to explore them.
https://www.quantum-computing-use-cases.nedo.go.jp/english/

More Use Cases

New Energy and Industrial Technology Development Organization (NEDO)
AI and Robotics Department (e-mail: quantum_ai@ml.nedo.go.jp)

This collection of use cases was obtained as a result of the work commissioned by the New Energy and Industrial Technology Development Organization (NEDO) "Cyber-Physical Development Business of Quantum/Classical Hybrid Technology/Study of Use Case of Quantum Technology" and the “Post-5G Information and Communications System Infrastructure Reinforcement R & D Project (Quantum Industrialization)/Comprehensive Study for Promoting the Industrialization of Quantum Computers ”.