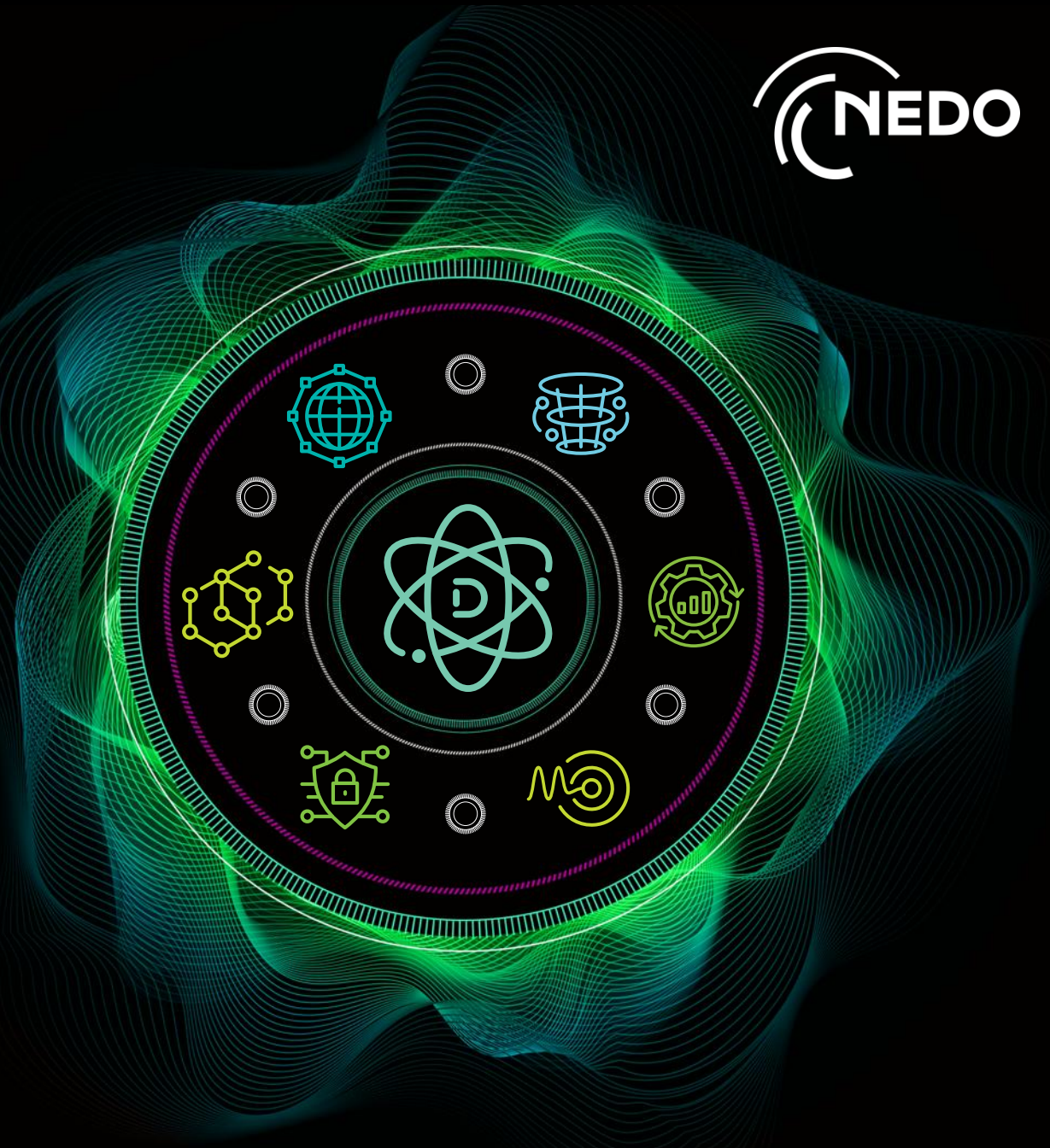
Quantum Computing Use Cases

Improving the efficiency of educational facility development plans

Takenaka Corporation



New Energy and Industrial Technology Development Organization (NEDO)

Takenaka Corporation:
Improving the efficiency of educational facility development plans [2025/2] 1/2

Validation

Industry	Other
Process	Other
Method	combinatorial optimization
Category	Ising*

Background

- In order to increase the operation rate of classrooms and other facilities in educational facilities and improve management efficiency, it is necessary to develop an optimal facility development plan for the building in accordance with the curriculum implementation plan.

Issues and motivation to be solved

- A curriculum plan for an educational institution needs to consider multiple factors, such as the structure of the institution, the number of teachers, and the number of students. **In the case of a large university, a period of several months is needed to create one plan,** where more than 500 classes are held throughout 1 semester.

Problem setting as a quantum computer

Formulate an optimal educational facility development plan according to the following procedures

1. Identify the current status of educational facilities and curricular implementation constraints
2. Obtain the following data from educational institutions
    1. Teachers' information such as available lecture times
    2. Information on class names and lesson plans of subject faculties
    3. Information about the facility, such as the number of classrooms and capacity
3. devise a plan for the structure of facilities in terms of the number of classrooms and capacity
4. Organize and convert the data obtained from educational facilities and the proposed facility structure data set in our company into a format that can be read by the program.
5. Modify and test the program to calculate the optimal facility structure to accommodate the specific constraints of educational facilities
6. Run the program to calculate the optimal facility configuration
7. Check the calculated results with the educational institution and receive feedback to revise and re-execute the program.
8. draw up a facility development plan based on the final facility structure plan

Reference: Takenaka Corp. "Development of optimization technology for educational facility development plan using quantum computer" (https://www.takenaka.co.jp/news/2025/02/04/)
*Ising: A computing approach, mainly associated with quantum annealers and simulators specialized for the Ising model, in which a problem is first formulated as an Ising model and then solved computationally. It is particularly well suited to problems that involve finding the optimal combination from a vast number of possibilities.

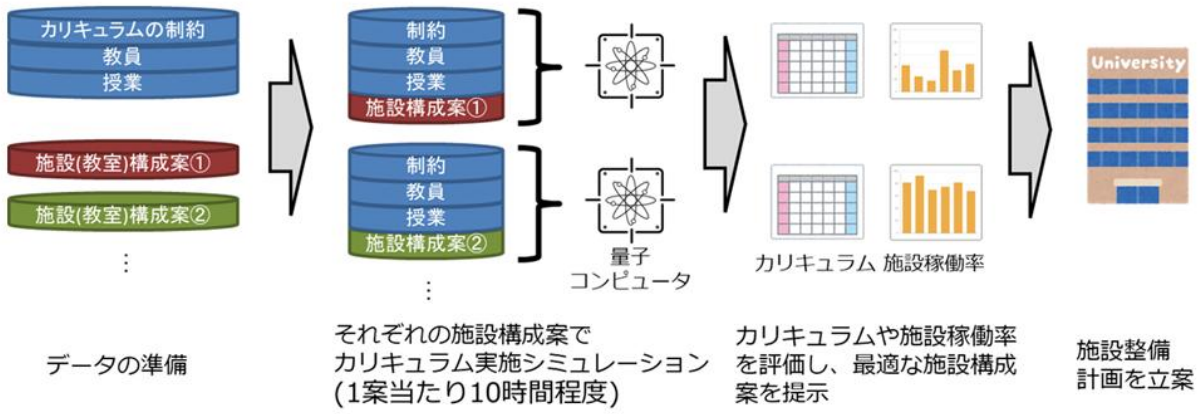
Takenaka Corporation: Improving the efficiency of educational facility development plans [2025/2] 2/2

Validation

Industry	Other
Process	Other
Method	combinatorial optimization
Category	Ising*

Expected business benefits

- Confirmation of restrictions on curriculum implementation, preparation of data necessary for simulation, and arrangement of program preparation require the same amount of time as the conventional method. However, once the preparation is complete, it becomes possible to create (simulate) 1 curriculum proposal in about 10 hours, and **it becomes possible to simulate multiple curriculum implementation proposals in a short time by changing conditions such as facility configuration.**
- It is possible to evaluate multiple curriculum implementation plans obtained through simulation and propose an optimal facility development plan based on the results.



Design image of educational facility development plan

Reference: Takenaka Corp. "Development of optimization technology for educational facility development plan using quantum computer" (https://www.takenaka.co.jp/news/2025/02/04/)
*Ising: A computing approach, mainly associated with quantum annealers and simulators specialized for the Ising model, in which a problem is first formulated as an Ising model and then solved computationally. It is particularly well suited to problems that involve finding the optimal combination from a vast number of possibilities.

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”.