

Building Sustainable Engineering Education through Research Laboratory Infrastructure: Policy and Institutional Challenges in Mongolia

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In resource-rich developing countries, sustainable industrial growth depends not only on natural resources but also on the availability of highly skilled engineers trained through research-based education in geoscience and related fields. As of 2014, Mongolia was classified as a lower-middle-income country, with economic growth largely driven by mining. While public spending on education reached approximately 4.7% of GDP, national investment in research and development remained low at around 0.2%, leading to limited laboratory infrastructure and weak integration of research into engineering and geoscience education.

This structural imbalance contributed to a shortage of engineers with internationally competitive technical and research skills, constraining technological development and innovation. Addressing this challenge required strengthening research and education capacity at leading universities—particularly the National University of Mongolia and the Mongolian University of Science and Technology. Within this context, the Japan–Mongolia strategic partnership launched the Higher Engineering Education Development Project (MJEED, 2014–2026) to modernize laboratories, enhance faculty capacity, and promote research-based education through international collaboration.

The project established multiple advanced research laboratories that support interdisciplinary learning centered on geoscience, engineering, and related fields. The META research laboratory provides a representative example of this transdisciplinary capacity, conducting measurements and experimental analyses spanning geology and mineralogy, mineral processing, mining machinery components, biology, botany, and pharmaceutical studies. This broad operational scope demonstrates the potential of research laboratories to function as shared infrastructure supporting cross-sectoral research and education aligned with national development priorities. However, ensuring the long-term sustainability of such laboratories remains a critical challenge.

University laboratories in Mongolia do not receive dedicated operational funding from the state budget, and institutional laboratory governance systems remain underdeveloped. Consequently, laboratory operation and personnel costs are often managed by individual researchers through short-term, project-based funding, limiting research continuity and the effective use of national research capacity. Based on the operational experience of the META research laboratory, this presentation discusses the role of research laboratories as core infrastructure for geoscience-oriented engineering education and identifies key policy and institutional challenges affecting their sustainability. We argue that policy-level interventions are essential to secure stable operational funding, institutionalize professional laboratory management, and align laboratory governance with national research and innovation strategies.

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