Analysis of the Impact of the K-CLOUD Open Research Program's 2017 Projects Completion

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1. Introduction

The Fukushima nuclear disaster in 2011 led to significant policy changes worldwide. In Korea, the government adopted a nuclear phase-out policy, raising concerns about losing nuclear expertise and technological competitiveness. To mitigate this risk, Korea Hydro & Nuclear Power (KHNP) launched the K-CLOUD (KHNP-Creative & Leading Open innovation for Ultimate R&D) program to support external research in nuclearrelated fields, ensuring the retention of skilled professionals and key technologies. [1]

In 2017, K-CLOUD funded 25 research projects with an approximate total budget of KRW 10.8 billion. These projects resulted in 37 SCIE-indexed publications and 14 registered patents. This study analyzes the effectiveness of K-CLOUD by evaluating research outcomes, cost efficiency per output, and human resource impact. Additionally, this study compares similar international programs to highlight best practices in sustaining nuclear research.

2. Research Outcomes of K-CLOUD 2017

2.1 Academic and Technological Contributions

The 2017 K-CLOUD project yielded significant academic and technological outcomes. A total of 37 SCIEindexed papers were published, all acknowledging the K-CLOUD project's support. Additionally, 14 patents were successfully registered as direct results of the research activities funded by the program.

After the three-year utilization period following the completion of the 2017 K-CLOUD projects, the KHNP project management team conducted a performance assessment targeting the participating research institutions. As a result, a total of 37 SCIE-indexed papers and 14 registered patents were identified. The total budget for the 25 projects under the 2017 K-CLOUD program was KRW 10.8 billion. By dividing this amount by the number of SCIE publications and registered patents, the cost per research output can be calculated.

The cost per research output is determined as follows:

$$\begin{array}{l} {\rm Cost \ per \ SCIE \ Paper} = \frac{10.8 \ {\rm billion \ KRW}}{37} \approx 292 \ {\rm million \ KRW} \\ {\rm Cost \ per \ Registered \ Patent} = \frac{10.8 \ {\rm billion \ KRW}}{14} \approx 771 \ {\rm million \ KRW} \end{array}$$

Compared to other R&D initiatives, K-CLOUD demonstrated effective allocation of resources, balancing fundamental research with applied technological innovation.

2.2 Researcher Employment and Impact

The K-CLOUD initiative played a notable role in human resource development within the nuclear sector. Three researchers who participated in K-CLOUD were later employed by KHNP's Central Research Institute, where they demonstrated rapid adaptability to research projects and actively contributed to company operations.

Furthermore, some participants of the program have pursued careers in academia, securing faculty positions in nuclear and technology-related fields. Others have joined research institutions such as the Korea Atomic Energy Research Institute (KAERI), where they contribute to nuclear technology development. Additionally, some are engaged in regulatory affairs at organizations like the Korea Institute of Nuclear Safety (KINS) and the Korea Institute of Nuclear Nonproliferation and Control (KINAC).

Internationally, it was observed that a foreign Ph.D. graduate who participated in K-CLOUD later secured a position in their home country's nuclear regulatory agency. This finding suggests that K-CLOUD has contributed not only to Korea's nuclear research ecosystem but also to the global nuclear industry by training highly skilled professionals.



Fig. 1. Cost Efficiency of K-CLOUD 2017 Projects

3. Comparative Analysis of Similar Programs

The effectiveness of K-CLOUD can be better understood by comparing it to similar international research initiatives.

The comparison highlights that while GAIN in the United States focuses on innovation in advanced reactors, and Canada's CANDU Owners Group prioritizes reactor safety, K-CLOUD played a crucial role in maintaining a sustainable workforce in the nuclear sector.

Table I: Comparison of Similar Programs				

Program	Country	Purpose	Budget	Key Outcomes
K- CLOUD	South Korea	Retaining nuclear expertise	KRW 10.8 billion	support for nuclear students, universities, and research institutions [1]
GAIN	USA	Accelerating nuclear innovation	USD 82 million	Research support for advanced reactors, funding for universities and training programs in nuclear energy [2]
CANDU Owners Group	Canada	Supporting nuclear safety research	CAD 30 million	Technical solutions for CANDU reactors, collaboration with academic institutions for nuclear engineering development [3]

4. Policy Shifts and the Role of K-CLOUD Researchers

At the time of K-CLOUD's initial implementation, Korea's national energy policy aimed to phase out nuclear power. However, as energy security concerns grew, the government gradually shifted back to a pronuclear stance.

The K-CLOUD researchers played a crucial technical role during these policy transition periods. Leveraging the specialized expertise accumulated through research support, they conducted new research projects, contributing to the revitalization of Korea's nuclear research sector. Furthermore, with funding support from K-CLOUD, researchers continued technological advancements in the nuclear field, which played a pivotal role in maintaining Korea's nuclear workforce and technological infrastructure.

5. Conclusion

The K-CLOUD program successfully maintained Korea's nuclear research capacity during a period of uncertainty. The analysis suggests that open innovation models can sustain critical technological sectors through policy transitions. The results indicate that similar initiatives may serve as effective tools for countries seeking to maintain expertise in strategically important industries, even in the face of shifting governmental priorities.

REFERENCES

[1] Korea Hydro & Nuclear Power, "2017 K-CLOUD Public Call Announcement," 2017.

[2] U.S. Department of Energy, "Gateway for Accelerated Innovation in Nuclear (GAIN)," 2022.

[3] Canadian Nuclear Laboratories, "CANDU Owners Group Research Initiatives," 2021.