

Risk Analysis of the Sustainability of Energy Markets in Developing Countries Using ISM

Eunsang PARK ^{1*}, Seohyeon KIM ¹, Ajin JO ¹, Jimin KIM ², Hyounseung JANG ³

¹ Undergraduate Student, Architectural Engineering Program, School of Architecture, Seoul National University of Science and Technology, 232 Gongneung-ro, Gongneung-dong, Nowon-gu, Seoul 01811, Korea.

² Associate professor, Architectural Engineering Program, School of Architecture, Seoul National University of Science and Technology, 232 Gongneung-ro, Gongneung-dong, Nowon-gu, Seoul 01811, Korea.

³ Professor, Architectural Engineering Program, School of Architecture, Seoul National University of Science and Technology, 232 Gongneung-ro, Gongneung-dong, Nowon-gu, Seoul 01811, Korea, E-mail address: jang@seoultech.ac.kr

Abstract

Managing investments in renewable energy (RE) in developing countries is essential for reducing environmental pollution, meeting the growing energy demand, and avoiding the risk of stranded assets. Establishing Public-Private Partnerships (PPPs) is necessary to address budgetary and technical issues in developing countries. PPPs recover investments through long-term operations. Risks from external political, social, and economic environments during both the construction and operational phases of PPP projects affect the stability of investment recovery. Although various support systems are in place to mitigate investment risks for investors, these systems can pose risks to the public sector. Therefore, this study identifies common risks, including construction and operational risks, as well as political, financial, and social risks, for sustainable renewable energy PPP operations. Interpretive Structural Modeling (ISM) and MICMAC (Matrix Impact Cross-Reference Multiplication Applied to a Classification) analyses were conducted to understand the interrelationships among these risks. The ISM and MICMAC analysis results showed that construction phase risks have high dependence power and driving power. In contrast, operational phase risks exhibit low driving power but high dependence power. This indicates that managing construction phase risks is effective for the sustainable operation of renewable energy PPPs. Based on the analyzed ISM and MICMAC results, preventive measures for sustainable operations of renewable energy PPPs were proposed.

Key words: Public Private Partnerships (PPP), Renewable Energy, Interpretive Structural Modeling (ISM), developing countries