Public Acceptance of Small Modular Reactors in the Artificial Intelligence Era: Interaction between Social norm and Knowledge

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1. Introduction

Small Modular Reactors (SMRs) are gaining significant attention as a next-generation energy source to achieve carbon neutrality and meet the rising electricity demand of AI-driven digital infrastructure. While SMRs offer technical advantages, public acceptance remains a prerequisite for successful deployment. Social norms, defined as perceptions of socially shared expectations and the prevailing normative climate, serve as powerful cues that guide individual attitude formation. Previous literature suggests that such normative environments significantly influence energy-related decision-making [1].

This study aims to (1) identify the relative explanatory power of AI-driven energy crisis perception and social norms in predicting SMR acceptance, and (2) examine how nuclear knowledge moderates the relationship between social norms and SMR acceptance. A logistic regression model with an interaction term is used and interpreted using marginal effect analysis.

2. Methods and Results

2.1 Data and Variables

This study utilized an online survey dataset (N = 2,000) collected through a proportional quota sampling method based on region, gender, and age to ensure representative findings. The data was gathered in October 2025 via an online research platform, targeting South Korean adults aged 20 and older. To mirror the actual national population distribution, the sample was stratified across 13 administrative regions, with a balanced gender composition (49.15% female) and a broad age range (M ± SD = 45.9 ± 13.3).

The dependent variable is binary and measured by asking respondents whether they support (coded as 1) or oppose (coded as 0) the construction and operation of SMRs in South Korea.

Key independent variables in this study included AI-driven electricity crisis perception (hereafter, *AI needs*), perceived social norms regarding nuclear energy (measured as the average of societal and media attitude items; hereafter, *Social norms*), and objective knowledge of nuclear energy (assessed using four O/X quiz items and scored on a scale from 0 to 4; hereafter, *Knowledge*). Additional socio-demographic factors (*Age*, *Income*, *Education*, *Political ideology*, and *Gender*) were included as control variables. Since the dependent variable is binary, we employed logistic regression analysis.

2.2 Results of the Logistic Regression Analysis

A four-step hierarchical logistic regression analysis (Models 1-4) confirms statistically significant improvements in model fit at each step. Notably, the inclusion of *Social norm* in Model 3 leads to a substantial increase in Pseudo R-squared and a reduction in AIC, identifying *Social norm* as a significant predictor of SMR acceptance. In Model 4, the interaction term between *Social norm* and *Knowledge* is negative and statistically significant (β = -0.258, $p < .001$), suggesting that the influence of normative cues varies by knowledge level.

Table I: Results of logistic regression analysis

Variables	Model 1	Model 2	Model 3	Model 4
Age	0.024 (1.02)	0.020 (1.02)	−0.069 (0.93)	−0.061 (0.94)
Income	0.042 (1.04)	0.037 (1.04)	0.027 (1.03)	0.025 (1.03)
Education	−0.061 (0.94)	−0.075 (0.93)	−0.034 (0.97)	−0.022 (0.98)
Political ideology	−0.346*** (0.71)	−0.326*** (0.72)	−0.355*** (0.70)	−0.351*** (0.70)
Gender	−0.495*** (0.61)	−0.491*** (0.61)	−0.518*** (0.60)	−0.519*** (0.59)
Knowledge	0.290*** (1.34)	0.267*** (1.31)	0.269*** (1.31)	0.213*** (1.24)
AI needs	–	0.211*** (1.23)	0.152* (1.16)	0.160** (1.17)
Social norm	–	–	1.553*** (4.73)	1.558*** (4.75)
Social norm × Knowledge	–	–	–	−0.258*** (0.77)
Constant	1.588*** (0.296)	0.882* (0.346)	−3.018*** (0.449)	2.076*** (0.392)

Observations	2000	2000	2000	2000
Log-likelihood	−1130.25	−1122.61	−952.50	−946.27
Nagelkerke R^2	0.095	0.105	0.313	0.320
Akaike Inf. Crit.	2274.50	2261.22	1923.00	1912.55
Hosmer–Lemeshow p	.002	.112	.599	.243
Note:		* p < .05, ** p < .01, *** p < .001		

2.3 Interaction Interpretation

Predicted probability and marginal effect analyses demonstrate that while the *Social norm* positively affects SMR acceptance across all levels of *Knowledge*, the magnitude of this effect decreases as *Knowledge* increases. At the mean level of *Social norm* (M=3.046), the marginal effect of a one-unit increase in *Social norm* is approximately 0.38 for the lowest level of *Knowledge* (score 0), whereas it declines to 0.10 for the highest level of *Knowledge* (score 4). This indicates that individuals with lower nuclear energy knowledge rely more heavily on perceived social norms when forming attitudes toward SMRs.

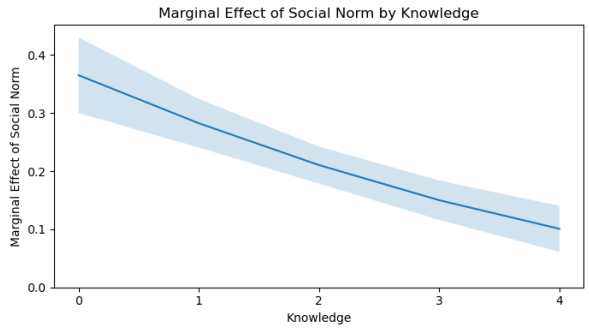

Figure 1. The marginal effect of Social norm on SMR acceptance as Knowledge increases. Colored region represents 95% confidence interval.

3. Conclusion

This study provides empirical evidence that perceived social norms play a dominant role in shaping SMR acceptance, with knowledge regarding nuclear energy acting as a critical moderator. The findings suggest that the normative climate is particularly influential among populations with lower levels of knowledge regarding nuclear energy.

Therefore, policy communication strategies for SMR deployment should be differentiated based on public knowledge levels. For less-informed groups, norm-based communication emphasizing positive social discourse may be highly effective. Conversely, for highly informed groups, knowledge-enhancing interventions can foster more stable and cognitively grounded acceptance patterns.

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