Risk Acceptability of Urban NIMBY Facilities Based on Structural Equation Modeling: A Case Study of Tianchang City (Postprint)

Authors: Luo Li, Wu Yunqing

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Abstract

Drawing upon 1,250 questionnaire responses from Tianchang City, this study conducted validity and factor analysis using SPSS, establishing "risk perception," "government trust," "public participation," and "compensation measures" as latent variables influencing public acceptability towards NIMBY facilities. Original hypotheses were formulated through literature review. A structural equation model was developed using AMOS 21.0 software to test these hypotheses and analyze the relationships between latent variables and "acceptability." The results demonstrate that "risk perception" exhibits a path coefficient of -0.262 on "acceptability," followed by "public participation" with a coefficient of -0.242, both indicating negative effects. In contrast, "government trust" and "compensation measures" positively influence "acceptability." Additionally, positive interrelationships exist among the four latent variables. Among demographic variables, age and education level exert certain influences on "acceptability." This survey research in Tianchang City analyzed and quantified the factors influencing public risk acceptability, enabling objective comparison of their relative importance. The findings provide valuable implications for government officials and practitioners, suggesting that policies and measures should be tailored to local conditions based on the relationships between influencing factors and "acceptability," thereby mitigating or preventing NIMBY conflicts.

Full Text

Abstract

Based on the results of 1,250 questionnaires in Tianchang City, Anhui Province, China, four variables including "risk cognition," "government trust," "public participation," and "compensation measures" were defined as latent variables to assess the risk acceptability of the public to urban NIMBY (not in my backyard)

facilities using SPSS for validity and factor analysis. The original hypothesis was determined through literature review. The software AMOS 21.0 was used to establish a structural equation model to test whether the original hypothesis is true or not, and the relationship between each latent variable and "acceptability" was analyzed. The results showed that "risk recognition" had an influence coefficient of -0.262 on "acceptability," and the variable "public participation" had the influence coefficient of -0.242. Both were negative correlation. The variables "Government trust"and "compensation measures"had a positive impact on "acceptability." Besides, there was a certain positive effect among the four latent variables. The age and level of education in the demographic variables had some influence on the "acceptability." Through this study, the influence factors were quantified and the importance of the factors can be compared objectively. The results had provided some information for the government and related workers when they formulate relevant policies and measures in setting up urban NIMBY facilities.

2.2.2 Structural Equation Model Specification

The structural equation model was constructed with four latent variables: risk cognition, government trust, public participation, and compensation measures. Each latent variable was measured through multiple observed indicators derived from the questionnaire items. The measurement model follows the standard formulation where endogenous observed variables (y) are expressed as linear functions of their latent constructs, and exogenous observed variables (x) are expressed as functions of their corresponding latent factors. The model specifies the relationships between these latent variables and the outcome variable of acceptability, with hypotheses H1 through H4 representing the direct effects of each latent variable on acceptability, and h1 through h3 representing the interrelationships among the latent variables.

2.4 Data Collection and Sample Characteristics

A total of 1,500 questionnaires were distributed, yielding 1,250 valid responses for an effective response rate of 83.3%. The sample demonstrated adequate representation for subsequent statistical analysis.

Table 1. Latent and Observed Variables in the Structural Equation Model

Latent Variable	Observed Indicators	Measurement Items
Risk Cognition	Q12.2, Q12.3, Q12.4, Q12.5	Perceived risk levels and concerns
Government Trust	Q10.1, Q10.4	Trust in government management capability

Latent Variable	Observed Indicators	Measurement Items
Public Participation	Q16.1, Q16.2	Participation opportunities and effectiveness
Compensation Measures	Q13.x	Compensation scheme satisfaction

3.2 Main Effects of Latent Variables on Acceptability

The analysis revealed that both risk cognition and public participation exhibited significant negative relationships with acceptability. Risk cognition demonstrated a standardized coefficient of -0.242 ($P < 0.001$), indicating that higher perceived risk substantially reduces public acceptance of NIMBY facilities. Similarly, public participation showed a negative coefficient of -0.242, suggesting that inadequate participation mechanisms diminish acceptance. Conversely, government trust and compensation measures displayed positive coefficients, enhancing acceptability. The structural model confirmed hypothesis H1 regarding the negative impact of risk cognition, while hypothesis H2 regarding public participation was also supported. The results align with theoretical expectations that risk perception and procedural justice critically shape public attitudes.

3.3 Influence of Personal Attributes

Demographic variables exhibited measurable effects on acceptability. The regression equation for personal attributes was:

Risk Acceptance = 0.011 × Age - 0.114 × Education + 2.154

Education level demonstrated a stronger negative effect (= -0.114, $P < 0.001$) than the positive effect of age (= 0.011, $P < 0.001$). This suggests that higher educational attainment correlates with lower acceptance, possibly due to increased risk awareness and environmental concerns, while older respondents show marginally higher acceptance rates.

Table 5. Influence of Personal Attributes on NIMBY Risk Acceptance

Variable	Coefficient	Std. Error	t-value	P-value
Age	0.011	0.003	3.765	0.000
Education	-0.114	0.027	-4.218	0.000
Constant	2.154	0.117	18.359	0.000

The model explains that when age and education are zero, baseline acceptance is 2.154. Each additional year of age increases acceptance by 0.011 points, while each education level increment decreases acceptance by 0.114 points. The negative education coefficient dominates, indicating that educational attainment is a stronger predictor of opposition to NIMBY facilities.

4. Conclusion

The structural equation model quantified key factors influencing public acceptance of urban NIMBY facilities. Risk cognition and public participation negatively affect acceptability, while government trust and compensation measures exert positive influences. Interrelationships among these latent variables further moderate public attitudes. Demographic factors, particularly education level, significantly shape risk perceptions and acceptance. These findings provide empirical evidence for policymakers to develop targeted strategies that address risk communication, enhance public participation mechanisms, build governmental credibility, and design effective compensation schemes when siting controversial urban facilities.

5. References

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Note: Figure translations are in progress. See original paper for figures.