



Research article

Governance challenges of China’s major repair fund under structural cognitive imbalance: An empirical study based on social cognitive theory

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Abstract: The maintenance and renewal of residential communities are central to urban sustainability. As a key financial mechanism, the Housing Maintenance Fund directly affects the community governance efficiency and the residents’ living quality. The study finds that, in practice, a large proportion of homeowners exhibit systematic misunderstandings regarding the payment schedule, purpose, and management of the Housing Maintenance Fund, thus indicating a widespread knowledge gap. These gaps stem not from individual deficiencies but from a structural mismatch between policy communication and the residents’ cognitive frameworks. Drawing on Bandura’s Social Cognitive Theory, this research employs a quantitative analysis to examine how interactions between cognitive ability and the information environment shape these disparities. Based on international experience, the study proposes governance strategies such as multi-channel information systems and real-time transparency platforms. By introducing a social cognitive perspective, the study uncovers the underlying mechanisms of fund governance and provides theoretical and practical insights to enhance the accessibility, transparency, and citizen participation in housing policy.

Keywords: knowledge gaps; major repair fund; policy comprehension; social cognitive theory; urban governance; sustainable housing

1. Introduction

Before the 1980s, China’s urban housing was mainly built by employers and distributed to employees according to a program, at which time employees only had the right to use the housing

rather than to pursue ownership. In the 1990s, as economic reforms deepened, the commercialization of housing accelerated, and the real estate market experienced rapid growth. Influenced by the traditional notion of “settling down” through homeownership, housing gradually became one of the most important assets for Chinese households. By 2002, urban resident expenditures on the purchase and construction of new and used housing reached about RMB 800 billion, thus accounting for 29.4 percent of urban homeowners final consumption expenditures, which greatly boosted the rapid growth of commercial housing and urban residential construction. By the end of 2024, China’s urban permanent population reached 943.5 million, with an urbanization rate of 67.00%. Alongside the booming real estate market, high-rise buildings and residential communities have proliferated across urban areas [1]. According to the latest national urban housing census, the number of residential units built before the year 2000 exceeded 6.09 million, which accounted for 31.9% of the total urban housing stock. These aging housing units commonly suffer from structural deterioration and worn-out facilities, thus leading to a significant rise in maintenance demands for shared components and communal infrastructure.

In 1998, the Ministry of Construction and the Ministry of Finance jointly issued the Measures for the Administration of Maintenance Funds for Common Facilities and Equipment in Residential Shared Areas in order to solve such maintenance problems. However, the Measures were replaced by the Measures for the Administration of Housing Maintenance Fund, which came into effect on 1 February 2008, and which have been effectively enforced since its promulgation, thus marking a more systematic and standardized exploration of the management of Housing Maintenance Fund in China [2]. In recent years, China’s property services and management have gradually become standardized, and the Major Repair Fund system has been implemented across various types of communities. The Major Repair Fund, also known as the Housing Maintenance Fund, is paid by the owners of commercial properties according to the relevant laws and regulations. The fund, also known as the housing “pension”, is used for common parts, common facilities, and equipment needed to perform major repairs, updates, renovation of the funds required on housing after a period of time due to wear and tear, damage, and other reasons[3]. As a reserve fund for maintaining the common property of property owners, it directly impacts the interests of property owners and the sustainable management of public resources, thus influencing the resilience of residential communities and the sustainability of urban housing systems. However, the fund faces significant implementation challenges in practice. On the one hand, complex policy provisions and fragmented communication channels have led to a lack of basic understanding among many owners. On the other hand, this ambiguous state of “visible but unused” further erodes a homeowners’ trust in and motivation to participate in the fund system, which creates a significant disconnect between the policy’s original intent and its actual implementation outcomes. For example, take a certain S community in Chongqing City, China. The developer and property management company illegally misappropriated maintenance funds, totaling over 800,000 yuan, combined with some owners failing to pay the Major Repair Fund, leading to chaotic account management and unverifiable arrears. The significant funding shortfall and unclear fund flow have resulted in the community’s shared facilities being neglected for years without the ability to initiate repair mechanisms. These long-standing unresolved issues have sparked ongoing conflicts between the owners and property management, which became a local petitioning issue. Similar issues are common in many residential complexes. The root cause of these practical challenges lies in the structural knowledge gap between homeowners and policies. When policy implementation is distorted due to cognitive deficiencies, irregularities such as misappropriation and non-payment become

inevitable outcomes of knowledge disparities. This systemic cognitive divide not only constrains the individual participation effectiveness but also accumulates multiple derivative risks at the governance level. Therefore, this study employs a triadic model of environment-individual-behavior based on the social cognitive theory, thereby using a structured questionnaire to measure the homeowners' subjective cognitive evaluations and objective knowledge acquisition in two dimensions. It systematically analyses the causal spectrum of the homeowners' cognitive gaps, thus providing empirical support to construct adaptive information dissemination pathways to advance participatory urban governance, and offers new perspectives to strengthen the resilience and sustainability of urban housing systems.

2. Research perspectives

2.1. Social cognitive theory

The research perspective is based on the social cognitive theory, which aims to deeply explore the social background of an individual's cognitive formation and effectively reveal the social factors in their cognitive process. The social cognitive theory was first proposed by Stanford University psychologist Bandura [4], who analyzed the social basis of thoughts and actions in detail, and concluded that in addition to individual factors, environmental and social factors are also involved in prompting behavioral changes [5]. The social cognitive theory emphasizes the social nature of the cognitive process, and argues that an individual's cognition is shaped by social interactions. When processing information, individuals are subject to limitations in attention, memory, emotion, motivation, etc. These limitations may restrict the comprehensiveness and accuracy of the information acquired by individuals, which can result in incomplete knowledge acquisition and knowledge gaps.

In the context of this study, the social cognitive theory helps to explain the sources of variability in an owner's knowledge of the Major Repair Fund. These differences are closely related to external factors such as the community environment, information transmission methods, and policy transparency. Complementing this perspective, the knowledge gap hypothesis identifies how structural inequities—such as an unequal access to information channels and educational resources—compound these mismatches [6]. The knowledge gap hypothesis and social cognitive theory converge to explain disparities in a homeowners' understanding of the Major Repair Fund. While the former attributes knowledge imbalances to structural inequities (e.g., socioeconomic status, information access), the latter emphasizes how individual capacities (e.g., education, cognitive skills) mediate these environmental constraints. By redefining knowledge gaps as the dynamic interplay between structural constraints and individual agency, this theoretical integration shifts the attribution of responsibility from individual cognitive deficits to policy design flaws, offering practical insights for adaptive interventions. By framing knowledge gaps as dynamic interactions of structure and agency, the study advances urban governance research beyond conventional policy analyses.

Overall, the social cognitive theory provides a powerful theoretical framework to understand how an owners' knowledge of the Major Repair Fund is formed in a particular social context and the mechanism by which the knowledge gaps arise. This has important theoretical and practical implications for developing effective interventions aimed at bridging the owners' knowledge gaps regarding the Major Repair Fund and improving their understanding of and engagement with the policy.

The social cognitive theory has been applied in a variety of fields, including psychology [7],

medicine [8], and education [9–13], and demonstrated its strong explanatory power and practical value in understanding an individual's behavior and cognitive processes (Figure 1).

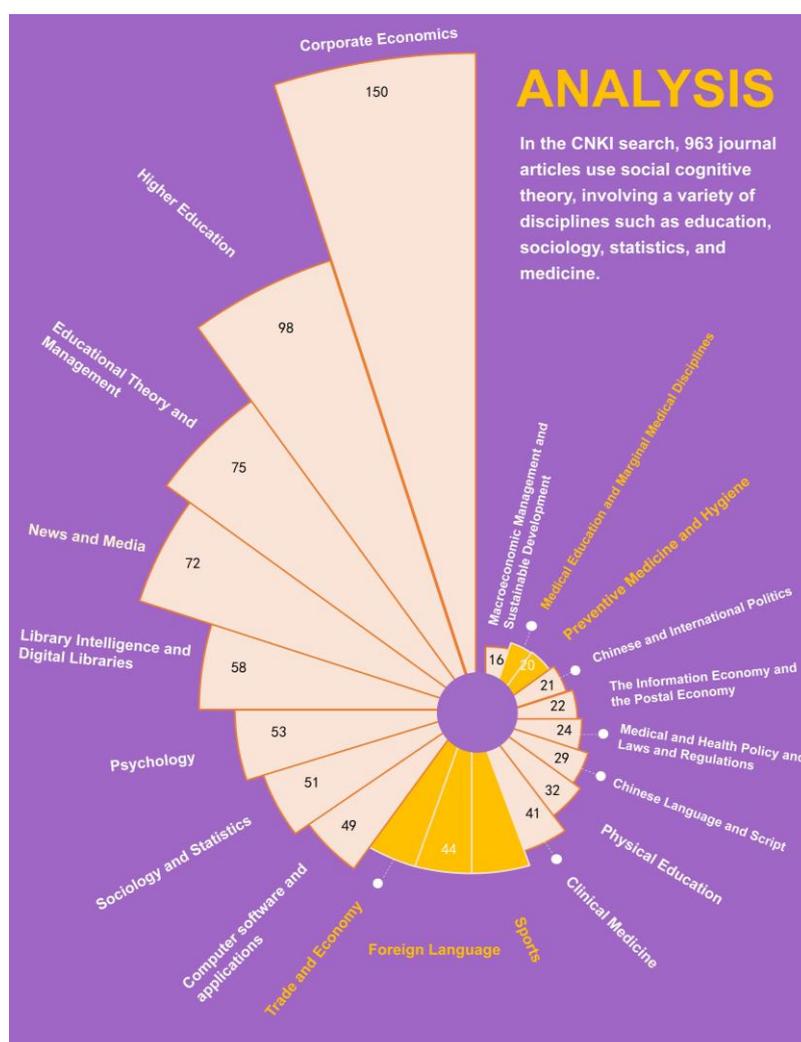


Figure 1. Applications of social cognitive theory across disciplines.

2.2. The knowledge gap hypothesis

The concept of the knowledge gap hypothesis first appeared in 1970 by Tichenor et al. [6]. They argued that disparities in socioeconomic status, educational attainment, and access to information channels create systemic inequities in knowledge acquisition. Higher-socioeconomic status groups, equipped with financial resources, social capital networks and cognitive tools, tend to acquire and assimilate information more efficiently through diverse channels (e.g., professional consultations, digital platforms). Conversely, disadvantaged groups face compounded barriers, including limited access to credible and vetted information sources, lower literacy levels, and cognitive overload when processing complex content. Over time, this “cumulative advantage” dynamic widens knowledge gaps, thus perpetuating social stratification [14].

In addition to the socio-economic status and access to information, the knowledge gap theory

explores the impact of information complexity and dissemination methods on knowledge acquisition. Information of a higher complexity tends to require more background knowledge and cognitive ability, which makes it easier for those with higher levels of education to understand and absorb. In contrast, populations with relatively low levels of education may face more difficulties due to a lack of appropriate background knowledge. In addition, the way in which information is disseminated (e.g., using digital channels, social media, or traditional mass media) plays an important role in the formation of the knowledge gap [15]. The existence of a digital divide exacerbates the knowledge gap because not all people have equal access to technology and access to equipment.

The knowledge gap theory has evolved from a resource distribution paradigm to a cognitive efficacy paradigm. The foundational research by Tichenor et al. revealed the deterministic role of the socioeconomic status in the rate of information acquisition, while Wei and Hindman [16], within the digital age context, demonstrated that disparities in information decoding capabilities become the key mechanism of knowledge reproduction once physical access barriers are eliminated. This shift exposes a structural contradiction in public policy: Disclosure-oriented policy frameworks aimed at ensuring the “right to know” have failed to effectively translate into a citizens’ substantive participatory capacities.

The integration of the knowledge gap theory with the social cognitive theory further elucidates the interplay between structural barriers and individual agency. The social cognitive theory posits that knowledge acquisition is shaped by environmental constraints and individual capabilities. While higher-educated groups mitigate structural flaws through cross-referencing multiple sources, marginalized groups, burdened by cognitive exhaustion, remain dependent on one-way information channels. This dual dynamic redefines knowledge gaps which result from policy blind spots and cognitive limitations.

This study introduces the “Structure–Capacity Dual Framework” to provide a systematic analytical path to understand the underlying causes of knowledge gaps:

Structural dimension: Information asymmetry is not a single communication issue, and it emphasizes addressing the inequality in the access to policy information through policy adjustments.

Capacity dimension: Highlighting the importance of integrating cognitive and behavioral perspectives in policy analyses, it emphasizes the dynamic role of individuals in responding to complex systems (Figure 2).

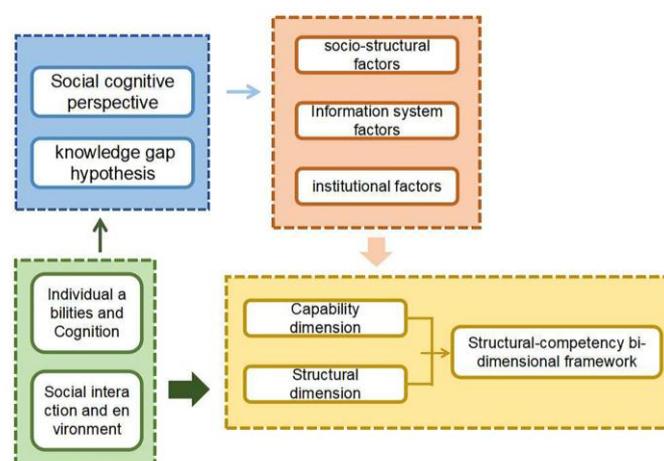


Figure 2. Theoretical framework.

3. Literature review

In the field of research on the management of major repair funds, Chinese scholars have extensively focused on the effectiveness of the fund operation and its role in residential maintenance. Dong Yongmei [17] pointed out that although the “Measures for the Administration of Housing Maintenance Fund” provide a framework for fund management, there are still many loopholes in its implementation, especially regarding the transparency and homeowner participation, which weaken the policies effectiveness. Wang Chaoqun [18] further revealed problems related to the lack of transparency in the fund’s operational mechanism and the absence of effective supervision, thereby emphasizing the importance of oversight in the management process to ensure that the fund is used correctly and according to its intended purpose. Geng Xiaoping [19] conducted an in-depth analysis of major repair fund management issues and proposed comprehensive reforms to improve the efficiency, thereby emphasizing the need to strengthen legal frameworks, innovate management models, and enhance homeowner education. Additionally, he noted persistent challenges such as difficulties in capital appreciation, weak supervision, and cumbersome application procedures. The article “Analysis and Reflection on the Operation Status of Housing Maintenance Fund” [20] suggests that international experience should be drawn upon, particularly by introducing mature management methods such as insurance mechanisms, to enhance the transparency, reduce information asymmetry, and achieve the goal of preserving and increasing the value of funds. In the article “Supervision Mode of Using Housing Maintenance Fund”, the author proposed a new model that combines routine supervision with third-party oversight to address existing issues in the management of the Major Repair Fund [21]. Drawing on the property rights theory, it argued that the current supervisory body—property management departments and their affiliated fund centers—serves as both “player” and “referee”, thus compromising fairness. The study recommended introducing independent third-party supervision to clarify responsibilities and enhance transparency.

International scholars have typically focused on how effective policies, transparent management, and technological innovations can improve the efficiency and credibility of fund management. The article “Evaluating Housing Maintenance Costs with Loss-Distribution Approach in South Korean Apartment Housing” examined the management of maintenance costs in South Korean apartments [22]. By combining a loss-distribution model with historical data and a risk matrix, the study provided a method to accurately predict the maintenance costs, thus effectively optimizing the budget allocation. In Russia, Zilberova et al. [23] analyzed the role of regional maintenance funds and the “public pool” system, thereby highlighting how property owners can achieve effective maintenance by participating in fund management, thus demonstrating practical paths for policy and management system improvements. Straub [24] conducted a comprehensive study on the management of Dutch housing associations, thereby covering aspects from maintenance policies to repair strategies, particularly emphasizing systematic maintenance strategies to ensure housing quality and long-term sustainability. This holistic focus on maintenance quality provides valuable insights to improve the housing repair fund management. In Malaysia, Wahab et al. [25] explored the classification and transparency issues of maintenance funds for high-rise residential buildings, thereby revealing the importance of different types of funds in effective management and allocation mechanisms, particularly in enhancing the overall management efficiency and fund transparency.

Research on the management of housing maintenance funds shows that countries have adopted different strategies to improve the management transparency, monitoring mechanisms, capital

appreciation, and resident participation. Chinese studies mainly focused on how to solve the problems of insufficient transparency and ineffective supervision in management, while international studies emphasizes technical means and policy innovations to improve the management efficiency and scientific use of funds. While existing research extensively addressed fund management mechanisms and policy design [26–29], few studies have examined a homeowners' cognition and understanding of the fund. In fact, the effectiveness of the fund operation depends not only on the soundness of the policy implementation mechanisms but also on a homeowners' comprehension and participation. However, there is still a lack of research that systematically analyzes how variations in a homeowners' cognition influence the policy implementation process from the dynamic perspective of the “cognition–execution–outcome” relationship. To address this gap, this study draws upon previous research on the cognitive inequalities which arise from differences in education, income, and media exposure in social information dissemination, as well as on the role of public participation in enhancing the policies effectiveness during implementation. The former highlights the structural impact of information and cognitive disparities on policy comprehension and performance, while the latter underscores the crucial role of public participation in ensuring policy responsiveness and sustainable operation. Building on these insights, the study incorporates social cognition and knowledge gap theories and adopts a dual-path framework of information dissemination and cognitive empowerment from a micro-level perspective of grassroots governance to explore mechanisms for improving policy comprehensibility and public engagement, thus enriching the cognitive dimension of fund governance research.

Therefore, exploring the differences in an owners' perceptions of policies is not only of theoretical interest, but also responds to the practical needs of real governance. Based on this, this study surveys a homeowners' understanding of the Major Repair Fund, thereby focusing on three questions: What is the overall level of a homeowners' understanding of the Major Repair Fund?; What knowledge gaps exist?; and What are the causes of these knowledge gaps?

4. Research methodology and design

4.1. Overview of research methodology

The study assesses a homeowners' understanding of the Major Repair Fund policy through a structured questionnaire and compares the results with actual policy provisions to identify knowledge gaps. A quantitative analytical approach is adopted, thereby using statistical tools for empirical testing to ensure systematic data collection and the scientific validity of findings. Descriptive statistics are applied to present the overall level of a homeowners' policy comprehension, while an inferential analysis explores the relationships between demographic characteristics and cognitive differences. Guided by the Social Cognitive Theory, the study follows a logical sequence of “cognitive measurement–differential identification–mechanism interpretation” to uncover the underlying mechanisms which shape variations in policy understanding among different homeowner groups.

4.2. Data sources and questionnaire construction

The data sources of this paper are mainly primary data obtained through questionnaires and field research. The scope of the research mainly focuses on the cities of Taiyuan and Xi'an in China, alongside samples from other cities. In order to ensure the scientific and systematic nature of the

questionnaire, this paper draws on relevant previous studies when constructing the questionnaire to ensure the rationality and effectiveness of the questionnaire design [30].

The questionnaire was designed following a branching logic, with the homeowners' cognitive stages regarding the Major Repair Fund as the main framework, thus reflecting a dynamic process from information exposure to re-learning. It consisted of two parts with a total of 24 items. The first part focused on demographic characteristics and adopted closed-ended questions. The second part included a preliminary classification question: "Were you aware of the Major Repair Fund before this survey"? Based on the respondents' answers, the questionnaire applied differentiated pathways for subsequent questions.

For respondents who selected "first time hearing", the study focused on identifying barriers to information access. Follow-up questions "What do you think are the main reasons why you were previously unaware of the Major Repair Fund"? and "Through which channels do you think homeowners' understanding of the Major Repair Fund can be improved"? directly addressed the core concern of the Knowledge Gap Hypothesis—namely, examining deficiencies in the information dissemination process—and provided strategic insights to narrow the knowledge gap.

For respondents who indicated that they were "somewhat familiar" or had "previously participated in decision-making", the study further explored the learning process emphasized in the Social Cognitive Theory. The questionnaire included items such as "Do you know how to access and monitor the use of the Major Repair Fund"? to measure the respondents' perceived knowledge. A five-point Likert scale was applied, with response options ranging from "completely unfamiliar", "somewhat unfamiliar", "neutral", "somewhat familiar", to "completely familiar", scored from 1 to 5. Meanwhile, the objective knowledge was examined through items concerning the fund's usage, contribution cycle, and management mechanisms, thus revealing the cognitive structures homeowners developed through social learning. In addition, specific questions such as "Do you think the contribution standards of the Major Repair Fund are too high and inconsistent with your community's actual maintenance needs"? were designed to assess perceptions of transparency and whether the fund's use aligns with the homeowners' needs, thus reflecting behavioral attitudes and participation intentions following cognitive formation. Additionally, the questionnaire asked the respondents what types of information about the fund they would like to obtain, thus capturing their intrinsic motivation for cognitive adjustments and re-learning. The questionnaire design captures the dynamic cycle of social cognition and provides empirical evidence to develop targeted public communication strategies.

4.3. Data analysis methods

4.3.1. Descriptive statistical analysis

A descriptive statistical analysis was used to summarize and present the main characteristics of the sample data. Through a descriptive statistical analysis, a comprehensive understanding of the distribution and basic conditions of the sample data was obtained, thus laying the foundation for further statistical analyses (Eq 1).

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i, \quad (1)$$

where \bar{X} is the mean of the sample, n is the total number of observations, and X_i represents each individual data point in the sample.

4.3.2. Chi-Square test

A chi-square test was used to analyze the association between different demographic variables (such as age, education level, duration of residence, and type of residence) and the knowledge gaps among homeowners. The Chi-square test highlights statistically significant differences between groups. For categorical data, frequency and percentage were used for the description, and the Chi-square test was applied to determine the significance of the relationship between the variables and the knowledge gaps. The Chi-square statistic was calculated using the following formula 2:

$$x^2 = \sum \frac{(O_i - E_i)^2}{E_i}, \quad (2)$$

where x^2 is the chi-square value, O_i is the observed frequency, and E_i is the expected frequency.

4.3.3. Regression analysis

To further explore the impact of different variables on the knowledge gaps, a multivariate logistic regression analysis was conducted. In the regression analysis, the total score was used as the dependent variable, while the statistically significant variables from the univariate analysis were used as independent variables, thus establishing a multivariate binary logistic regression equation. In this study, a p-value of less than 0.05 was considered statistically significant, and all tests were two-sided. The basic form of the regression model is as follows (Eq 3):

$$\log(Odds) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k, \quad (3)$$

where logarithm of the odds ratio $\log(Odds)$ represents the knowledge gaps, β_0 represents the constant term, and $\beta_1, \beta_2, \dots, \beta_k$ represent the regression coefficients for each independent variable X_1, X_2, \dots, X_k , respectively. The logit transformation formula is as follows (Eq 4):

$$Odds = \frac{P}{1-P}, \quad (4)$$

where P represents the probability of the event occurring. By estimating the regression coefficients of each variable, the impact of these variables on the knowledge gaps is assessed.

5. Findings and analyses

The study employed a regionally distributed convenience sampling method, which covered homeowner samples from Taiyuan, Xi'an, and several other cities to ensure diversity in the housing types and socioeconomic backgrounds. A total of 395 questionnaires were distributed, and 387 valid responses were collected. Although the study adopted a non-probability sampling approach, the sample size was evaluated with reference to Cochran's sample size estimation formula (with a 95% confidence level and a $\pm 5\%$ margin of error). The theoretical minimum sample size derived from this method is approximately 384, thus indicating that the data scale of this study meets the general standards of statistical representativeness in social survey research and provides a sufficient empirical basis for the subsequent inferential analysis.

5.1. Demographic characteristics of survey respondents

The main age group of the owners interviewed is concentrated under the age of 50 and 53% of the owners' education levels are concentrated at the undergraduate degree level. The main forms of property acquisition among the respondents are self-purchased and family-owned property, which account for 38.2% and 43.4% of the respondents, respectively (as shown in Table 1).

Table 1. Basic demographic data.

		Quorum	Component Ratio (%)
Age (years)	Under 30	162	41.9
	31–40	166	42.9
	41–50	50	12.9
	51 and over	9	2.3
Length of Residence (years)	Less than 1	61	15.8
	1–3	110	28.4
	3–5	85	22.0
	More than 5	131	33.8
Academic qualifications	Junior high school and below	8	2.0
	High school/secondary school	31	8.0
	University college	76	19.6
	University undergraduate course	205	53.0
	Postgraduate and above	67	17.3
Residency	Owned property	148	38.2
	Family property	168	43.4
	Tenancy	71	18.3

5.2. Homeowners' awareness

In this survey, 60.5% of the owners indicated that they had come across information about the Major Repair Fund for the first time. Figure 3 is based on self-reported responses and illustrates the perceived reasons for the homeowners' lack of knowledge as well as their preferred information channels. Limited public dissemination (57.3%) and the absence of awareness-raising activities (74.8%) were cited as the primary causes, while 62% of the homeowners believed that they "do not pay attention to public affairs". These results suggest that the persistence of the knowledge gap arises not only from structural barriers to information access but also from the homeowners' limited engagement in public affairs.

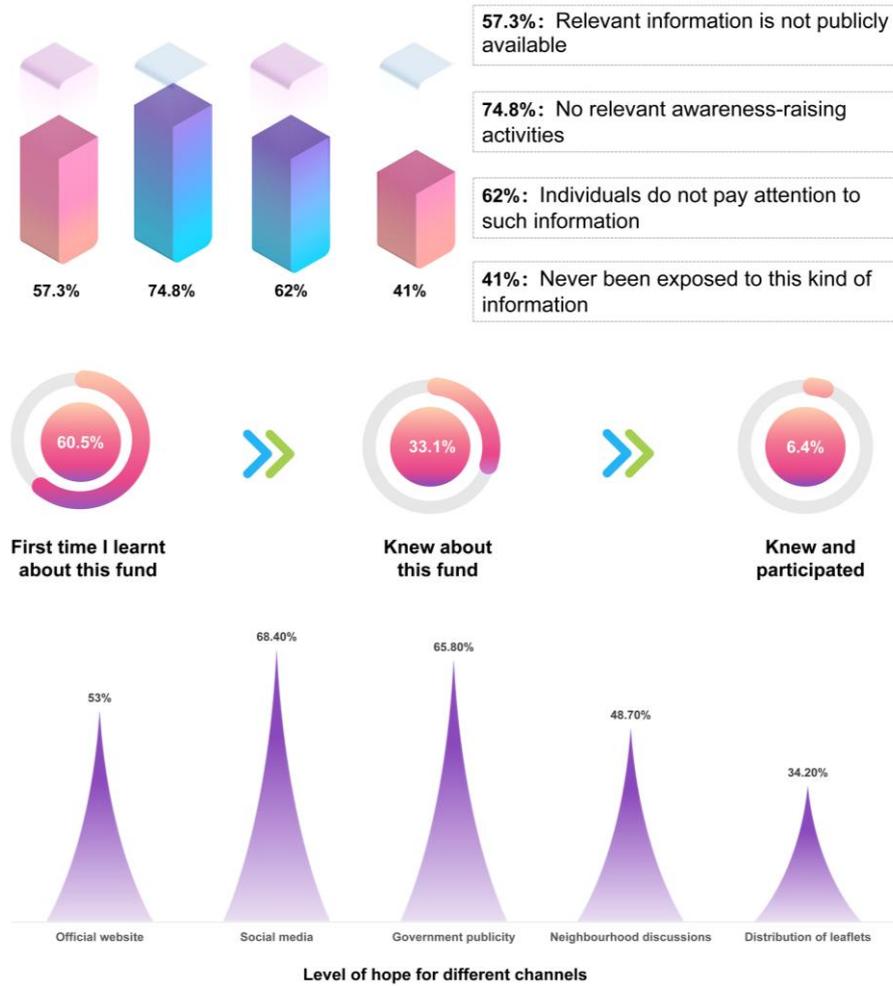


Figure 3. Owners' perception status analysis chart.

5.3. Homeowners' knowledge gaps

Based on the collected data, it is evident that the homeowners exhibit low awareness regarding the Major Repair Fund. 153 homeowners reported “some awareness” or “prior involvement”, which accounts for 39.5% of the total respondents. Among this group with basic knowledge, significant knowledge gaps were found concerning the timing of fund collection, its purpose, and the management methods. According to the Housing Maintenance Fund Management Regulations in cities such as Taiyuan and Xi'an, the Major Repair Fund should be deposited before the homeowners complete the move-in formalities, and the deposited Major Repair Fund belongs to the homeowners. A dedicated account should be established for unified management. Regarding the timing of the deposit, 58.1% of the homeowners demonstrated knowledge gaps, thereby believing it was collected quarterly such as property fees or after several years of housing use. In terms of management, 41% of the homeowners incorrectly believed that the fund belonged to the property management company, individuals, or did not require management. Regarding the fund's purpose, 29.4% of the homeowners mistakenly thought that the Major Repair Fund could be used for personal housing repairs.

To assess the knowledge gaps among homeowners, the study evaluated responses in three areas:

Timing of deposit, ownership, and management. Answers were assigned a value, with correct answers given 1 point and incorrect answers given 0 points, and the total score was calculated accordingly. A full score indicated that the respondent answered all three items correctly, while a lower score reflected a certain degree of cognitive deficiency. Table 2 presents the demographic characteristics of the respondents who were aware of the Major Repair Fund. These data were further used to analyze how individual attributes and social background factors influence variations in policy understanding.

Table 2. Categorising variables for descriptive statistical analysis.

Variant		Total
Conclusion	Less than 3	106 (69.3)
	Equivalent to 3	47 (30.7)
Age	30 years and under	45 (29.4)
	31–40 years	78 (51)
	41 years and over	30 (19.6)
Academic qualifications	University college and below	62 (40.5)
	University undergraduate course	55 (35.9)
	Postgraduate and above	36 (23.5)
Duration of residence	Less than 1 year	31 (20.3)
	1–3 years	27 (17.6)
	3–5 years	31 (20.3)
	More than 5 years	64 (41.8)
Residency	Owned property	68 (44.4)
	Family property rights	58 (37.9)
	Tenancy	27 (17.6)

In the group comparison of demographic and social characteristics, it was found that the differences in age and residential pattern were not significant ($P > 0.05$), whereas those in education level and length of residence were statistically significant ($P < 0.05$). Specifically, respondents scoring below 3 tended to have lower education levels and longer residence durations, indicating that knowledge gaps are structurally associated with certain social attributes (as shown in Table 3).

To further examine the influence of these variables on knowledge disparities, a binary logistic regression analysis was conducted (see Table 4). The model validation results demonstrated satisfactory robustness. The Omnibus test yielded a significant result ($\chi^2 = 29.002$, $df = 9$, $p = 0.001$), thus indicating that the overall model was statistically effective. The Hosmer–Lemeshow goodness-of-fit test produced $\chi^2 = 5.452$ ($p = 0.708 > 0.05$), thus suggesting that the model fit the data well. The Pseudo R^2 values (Cox & Snell $R^2 = 0.173$; Nagelkerke $R^2 = 0.244$) indicated a moderate explanatory power, thus suggesting that the model's fit was acceptable. To rule out potential multicollinearity among independent variables, a Variance Inflation Factor (VIF) test was performed. The results showed that all tolerance values exceeded 0.90 and all VIFs were below 1.1, well under the conventional threshold of 10, thus confirming the absence of multicollinearity in the model.

Table 3. Results of one-way analysis of variance.

Variant		Conclusion		χ^2	P
		Equivalent to 3 (n = 47)	Less than 3 (n = 106)		
Age	30 years and under	13 (27.7)	32 (30.2)	2.842	0.241
	31–40 years	21 (44.7)	57 (53.8)		
	41 years and over	13 (27.7)	17 (16)		
Academic qualifications	University college and below	9 (19.1)	53 (50)	16.257	0.001
	University undergraduate course	19 (40.4)	36 (34)		
	Postgraduate and above	19 (40.4)	17 (16)		
Duration of residence	Less than 1 year	18 (38.3)	13 (12.3)	14.224	0.003
	1–3 years	8 (17)	19 (17.9)		
	3–5 years	7 (14.9)	24 (22.6)		
	More than 5 years	14 (29.8)	50 (47.2)		
Residency	Owned property	22 (46.8)	46 (43.4)	0.154	0.926
	Family property rights	17 (36.2)	41 (38.7)		
	Tenancy	8 (17)	19 (17.9)		

Table 4. Regression analysis results.

Variant	β	Standardised Inaccuracies	Wald	P	OR	95% confidence interval for OR	
						lower limit	upper bound
Age (reference level = 30 and under)	0.000				1.000		
Age (31–40)	–0.082	0.467	0.031	0.861	0.922	0.369	2.299
Age (41 and over)	–0.949	0.585	2.634	0.105	0.387	0.123	1.218
Academic qualifications (reference level = university college and below)	0.000				1.000		
Education (undergraduate)	–1.041	0.493	4.464	0.035	0.353	0.134	0.927
Academic qualifications (postgraduate and above)	–1.753	0.528	11.002	0.001	0.173	0.062	0.488
Length of residence (reference stratum = less than 1 year)	0.000				1.000		
Length of residence (1–3 years)	1.166	0.586	3.966	0.046	3.210	1.019	10.118
Length of residence (3–5 years)	1.325	0.618	4.602	0.032	3.761	1.121	12.616
Length of residence (more than 5 years)	1.397	0.518	7.272	0.007	4.042	1.465	11.155
Mode of residence (reference stratum = self-purchased property)	0.000				1.000		
Type of residence (family ownership)	–0.160	0.462	0.119	0.730	0.852	0.345	2.109
Mode of residence (rental)	0.402	0.569	0.498	0.480	1.494	0.490	4.559
constant	0.918	0.695	1.744	0.187	2.505		

*Note: Hosmer-Lemeshow = 5.452, $p = 0.708 > 0.05$, model holds true.

The analysis results show that, controlling for other variables, homeowners with a bachelor's

degree have a significantly lower probability of having a knowledge gap (i.e., a score less than 3) compared to those with a diploma or lower ($P < 0.05$, $OR < 1$). This finding indicates that homeowners with a bachelor's degree have more accurate knowledge of the Major Repair Fund, with a lower risk of knowledge gaps than those with an associate degree or lower. The analysis results for the group with a graduate degree or higher also support this conclusion, showing that, when controlling for other variables, homeowners with a postgraduate degree or higher have a significantly lower probability of knowledge gaps compared to those with an associate degree or lower ($P < 0.05$, $OR < 1$). This further confirms that higher education levels correspond to more accurate homeowner knowledge of the Major Repair Fund and the lower the risk of knowledge gaps.

In terms of the impact of the length of residence, the analysis was conducted using those who had lived in their residence for less than one year as the reference group. The results indicate that as the length of residence increases, the risk of homeowners having a knowledge gap also significantly increases. Specifically, compared to homeowners who had lived in their residence for less than one year, those who had lived in their residence for 1–3 years, 3–5 years, and more than 5 years had a significantly higher probability of having a knowledge gap regarding the Major Repair Fund ($P < 0.05$, $OR > 1$). This suggests that the longer the length of residence, the more likely homeowners are to develop knowledge gaps based on outdated or inaccurate information.

6. Discussion

The findings robustly affirm the social cognitive theory's tenet that individual capacities—particularly education—critically mediate knowledge acquisition in complex policy environments. This finding aligns with Rindermann and Ceci, who identified education as a moderating factor in the development of cognitive disparities, thus supporting the argument that educational attainment substantially influences an individual's ability to process complex policy information [31]. The data indicates that education, as an important indicator of an individual's cognitive ability and information processing capacity, has a significant impact on the knowledge gaps among homeowners regarding the Major Repair Fund. Education not only reflects an individual's academic achievement but also implies their ability in critical thinking, logical reasoning, and information evaluation [32]. Individuals with a higher education have typically received more systematic trainings, including how to search for, analyze, and utilize information. Such trainings help individuals effectively identify key elements, perform logical reasoning, and make informed judgments when faced with complex information. Therefore, when these individuals encounter information about the Major Repair Fund, they are more likely to analyze it from multiple perspectives, assess its authenticity and relevance, and form a more accurate understanding. Additionally, individuals with a higher education often have access to a broader range of information sources and possess stronger information filtering abilities. They can discern the reliability of different information channels and choose the most credible sources for decision-making. Conversely, individuals with lower educational attainment often lack such cognitive scaffolding and tend to excessively rely on heuristic processing when engaging with information about the Major Repair Fund—either by defaulting to simplified cognitive schemas or by being constrained by informal information networks and pre-existing experiential frameworks, which aligns with Bandura's theory of self-efficacy disparity.

This study advances prior research by revealing a paradoxical association between long-term residence and the persistence of knowledge gaps—a topic rarely examined in existing literature. Within

the framework of the Social Cognitive Theory's "person–environment reciprocity", the findings suggest that long-term homeowners, though embedded in close community networks, often inhabit information environments shaped by static, experience-based narratives rather than evolving policy knowledge, which leads to cognitive inertia over time [33]. Over time, the repeated exposure to these localized interactions reinforces entrenched cognitive schemas, where Major Repair Fund-related knowledge becomes filtered through historical precedents rather than current regulatory realities. Crucially, the interplay of environmental stagnation (obsolete information sources) and cognitive path-dependence (resistance to schema updating) generates a self-perpetuating cycle. Despite deeper community embeddedness, long-standing homeowners increasingly diverge from policy realities, where their knowledge base is fossilized by the very social interactions meant to sustain engagement.

The study further reveals that the persistence of knowledge disparities is not a result of a single dimension but emerges from the long-term interaction between an individual's capacities and their social environments. Educational attainment shapes a homeowners' ability to interpret policy complexity, while residential duration and community information ecology influence the breadth and timeliness of accessible knowledge. The interaction between these dimensions constitutes the structural foundation of cognitive inequality in grassroots policy understanding. This mechanism indicates that knowledge gaps arise neither from individual deficits nor from static structural barriers, but from the co-evolution of cognitive habits and informational environments. Therefore, policy design that solely focuses on information supply or public education is insufficient for effective interventions.

7. Measures

Building on these findings, this study offers several governance-oriented implications. According to the triadic reciprocal determinism of the Social Cognitive Theory, coordinated efforts in environmental reconstruction and individual empowerment are required to disrupt the self-reinforcing cycle of knowledge deficiency. To address this challenge, it is necessary to simultaneously weaken structural information barriers and strengthen a homeowners' cognitive support systems. On this basis, the study proposes three directions for policy optimization: first, to reconstruct the policy information system by improving accessibility and interpretability of information channels; second, to develop communication interfaces that align with diverse cognitive patterns; and third, to establish a dynamic feedback mechanism that enables continuous interactions between governance practice and community cognition. The core of policy intervention should shift from passive information dissemination toward the coordinated enhancement of cognitive capacity and informational infrastructure.

There is a need to integrate cross-sectoral resources to achieve policy synergy [34]. Given that the Housing Maintenance Fund involves multiple domains, including finance, property management, and municipal administration, it faces challenges such as lengthy implementation processes, fragmented procedures, and weak regulatory coordination. The complexity of the policy and the participation of multiple actors have reduced the implementation efficiency and, to some extent, undermined public trust in the system. The government should assume a coordinating role and establish a regular cross-departmental collaboration mechanism to achieve vertical and horizontal policy integration through institutional alignment and data sharing [35]. Departments must clearly define their responsibilities in key stages such as fund deposit, approval, and supervision, thus forming an accountable and traceable workflow. Meanwhile, the establishment of a unified information management and supervision platform should be promoted to systematically integrate financial flows,

approval processes, and accountability chains. Such integration would enable the visualization and standardization of the entire process, thereby enhancing the transparency and coherence of policy implementation.

The persistent knowledge gaps in the Major Repair Fund awareness stem from structural mismatches between policy communication modes and the homeowners' cognitive schemas, as evidenced by widespread reports of inaccessible policy language and fragmented dissemination channels. In this survey, 64% of the owners said that the access to information was limited, 42.4% of the owners said that they had not been exposed to relevant publicity activities, and in the open-ended answer of the questionnaire, the most frequent response for "What do you think should be done to improve the owners knowledge of the Major Repair Fund?" was to "strengthen publicity". These results highlight the necessity of developing an information dissemination system that integrates multiple communication channels with sufficient content depth [36]. Policy texts should adhere to the "principle of comprehensibility", thereby simplifying technical terminology, contextualizing expressions, and illustrating policies through practical examples to lower the linguistic threshold and enable homeowners to connect institutional information with their daily experiences. Meanwhile, dissemination channels should adopt a diversified layout—combining traditional community announcements and property notices with digital media platforms such as community apps and WeChat official accounts—to form an integrated online–offline communication network that improves both the reach and continuity. Guided by the environmental–individual–behavior interaction framework of the Social Cognitive Theory, a stratified communication strategy can be adopted in practice. For homeowners with lower education levels or limited information exposure, voice explanations, visual animations, or scenario-based infographics can enhance the comprehension and retention; for those with stronger information-processing abilities, interactive simulations or question-and-answer-style mini-programs can help them understand the operational logic and management mechanisms of the fund. Digital information platforms can serve as dual-function tools for policy communication and public participation [37]. Such platforms may include Frequently Asked Questions and interactive feedback modules that continuously refine the content and format of information dissemination based on user feedback and behavioral data, thus forming a virtuous cycle in which "cognitive feedback drives communication improvement". At the same time, the communication system should also address groups with limited access to digital devices. The survey indicates that middle-aged and elderly homeowners rely more on personal networks and community-based channels for information, thus leaving them more vulnerable to marginalization in policy cognition. In this context, community-level organizations play a vital role [38]. Drawing on Bandura's concept of collective efficacy, communities can empower trusted local actors—such as resident representatives or homeowner committee members—to act as "policy interpreters". Through face-to-face conversations or small discussion sessions, they can translate the abstract regulations of the fund's contribution, management, and use into concrete, relatable narratives. This trust-based interpersonal communication not only complements digital dissemination but also facilitates more equitable information flow across different social groups, while strengthening the homeowners' sense of agency and engagement in the process.

Enhancing the transparency and fairness of the management process is also a point of concern [39]. In order to increase the owners' trust in the management of the Major Repair Fund, transparency and fairness are key. In the questionnaire, 78.5% of the owners indicated that there was not enough transparency in the use of the fund. In this survey, it was found that the owners are more concerned

about the criteria for collecting the fund, the management of the fund, the utilization plan, and the details of the expenditure (Figure 4). This requires the government and property management companies to be open and transparent in the collection and use of the Major Repair Fund, alongside actively incorporating the owners' opinions and suggestions in the decision-making process. Improving transparency should not solely rely on periodic financial reports or public meetings; rather, it requires the establishment of a well-developed information disclosure and participation mechanism that enables homeowners to observe decisions, understand their rationale, and express opinions at key stages. Government and property management departments can create a unified information disclosure platform that presents data on fund revenues and expenditures, approval processes, and construction progress in a visualized format, thus transforming complex management procedures into interfaces that are comprehensible to the public. Resident feedback should also be integrated as a vital component of governance. Through an interactive cycle of information, deliberation, and response, transparency can be transformed into genuine participation. At the community level, the function of digital systems should extend beyond policy communication to encompass feedback and collaborative management after fund utilization. The platform may include modules to issue reporting and construction feedback, thus allowing homeowners to directly report quality concerns, delays, or administrative omissions during repair processes. The system can automatically synchronize such information with property managers and relevant departments while updating the handling progress in real time. This governance model, centered on transparency, shifts information disclosure from a one-way process to an ongoing and interactive social dynamic. As the homeowners gain understanding, raise questions, and participate in co-construction, their sense of engagement and trust deepens, while policy implementation becomes more credible through its responsiveness. Aligning policy procedures with community cognitive frameworks can effectively reduce procedural distrust and enable the governance of the Major Repair Fund to achieve true synergy at both the cognitive and social levels.

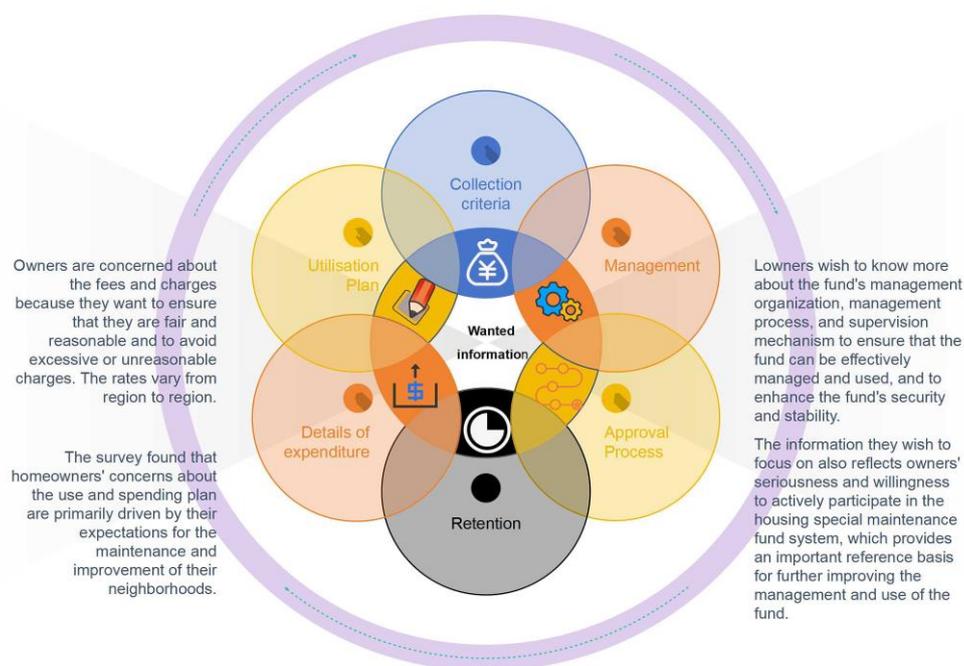


Figure 4. Overview of owner information preference analysis.

8. Conclusion

By integrating Bandura's social cognitive theory and Tichenor's knowledge gap hypothesis, this study revealed that disparities in understanding the Major Repair Fund arose not from individual deficiencies but from structural mismatches between policy complexity and public cognitive frameworks. The findings highlighted that effective governance of the Major Repair Fund is essential for community resilience and sustainable housing management. By examining the closure of information dissemination, the influence of educational level on cognitive variation, and motivational factors in policy participation, the study proposed a dual structural cognitive framework that broadens the analytical scope of urban governance. The research underscores that effective policy implementation depends on cognitive accessibility and inclusive participation, thus highlighting the need for alignment between policy frameworks and community understanding. Such an approach transcends conventional transparency reforms, instead cultivating schema-compatible governance where official rigor and grassroots cognition symbiotically evolve.

While the descriptive approach effectively highlights the broad differences between policy design and community understanding, its exploratory nature focuses more on the overall patterns than on the specific causes. Similarly, while community-level data reveals general patterns of knowledge gaps, it also calls for future studies to explore how kinship networks or physical closeness influence the way knowledge is shared within neighborhoods.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Author contributions

Conceptualization, W.Z. and X.C.; methodology, X.C.; software, X.C.; validation, W.Z. and X.C.; formal analysis, X.C.; investigation, X.C.; resources, W.Z.; data curation, X.C.; writing—original draft preparation, X.C.; writing—review and editing, W.Z. and X.C.; visualization, X.C.; supervision, W.Z.; project administration, X.C.; funding acquisition, W.Z. All authors have read and agreed to the published version of the manuscript.

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