

Article

Key Variables for Decision-Making on Urban Renewal in China: A Case Study of Chongqing

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Abstract: Currently, the Chinese government leads urban renewal via a top-down management style with the government playing the role of decision-maker. The decision-making opinions held by groups of stakeholders are divided, which creates many social problems, project technical issues and even civil disorder. This paper uses factor analysis to extract the key variables for decision-making on urban renewal and the entropy weight method to sort these key variables by importance. Based on this order, the differing opinions of stakeholders regarding urban renewal decision-making are explored. First, contradictory opinions exist concerning the importance of the ecological environment, housing and facilities, social welfare and commercial activities, which are the main driving forces behind urban renewal, due to the groups of stakeholders having different interest demands. Second, these varying interest demands of the stakeholders affect the urban renewal decision-making results. Finally, compensation to people for the demolition of their homes, infrastructure supplements and the investment behaviour of developers display the greatest lack of consensus of all the variables tested in urban renewal decision-making between different stakeholders.

Keywords: urban renewal decision-making; stakeholders; key variables; sorting for importance

1. Introduction

Together with adjustment to the industrial structure and technological processes [1], many problems occur in old districts, such as economic depression, poor living conditions, absence of private services and social conflicts. These districts have a rich history and experienced the earliest construction with the most investment and perfect facilities during that time; however, they have declined in recent decades [2]. These phenomena seriously hinder the development of the city and potentially cause social unrest if they remain unresolved. In response, a large number of redevelopment projects are occurring around the world to revive old districts [3,4]. These types of projects are called “urban renewal” and are the best way of addressing the decline of old districts [5].

Useful examples of advanced urban development and governing networks have been utilised by many countries including Britain [6] and America, where public facility renewal projects are usually initiated by governments as the decision-maker for site selection. A construction company is then entrusted to implement the planning. For commercial renewal projects, the government purchases the properties that benefit urban development and then resells them to real estate developers who execute decision schemes [5]. The technical decision of renewal mode is made by the developers based on their investment preferences. Communities and residents find it difficult to control the critical decision-making, site selection and renewal mode because they are not strong enough, although they have more opportunities to participate in these types of urban renewal decision-making. In recent years, the American government has strengthened the role of the community in urban renewal by making them third-party decision-making participants. This participation method involves the government soliciting

public opinion on renewal planning, obtaining feedback, adjusting previous renewal planning and then making the appropriate decision [7]. In recent years, community renewal projects have accounted for the largest percentage of urban renewal projects. Communities have the right to decide the renewal program that best conforms to city planning. Community renewal involves the community-initiated update, which is a newer model of bottom-up decision-making.

The government-led decision-making mode of urban renewal seen in Figure 1 commonly exists in the majority of large- and medium-sized cities of China including Chongqing [8]. Chongqing is a major city in southwest China and one of the five national central cities in China. Administratively, it is one of China's four direct-controlled municipalities (the other three being Beijing, Shanghai and Tianjin), and the only such municipality in inland China. Chongqing's population as of 2015 was over 30 million with an urban population of 18.38 million. It is the most populous Chinese municipality (greater than Beijing with 21.71 million, Shanghai with 24.15 million, and Tianjin with 15.47 million). Chongqing is the economic and financial centre of southwest China. Together with rapid development of the economy, urban construction has also matured. Chongqing has experienced, and continues to experience, the process of urban renewal for the past 10 years. The decisions regarding squatter settlement renovation projects are made by the government in a top-down mode because the conditions of poor facilities, old buildings and low living standards force the government as the unique decision-maker to make rapid responses. The main objective of these projects tends to be of physical renewal. The government usually makes decisions about site selection and renewal mode based on economic drivers that result in overall economic improvement and regional coordination. Before the implementation of squatter settlement renovation projects, the government played a policymaker role, instituting developmental rules and real estate developers, and then applying for the project based on these rules. Stakeholders with low social status and participation did not have a large influence on the decision-making process. Therefore, squatter settlement renovation that occurs in the fragmentation form ignores social welfare improvements and continuity of the social fabric and cultural context, as well as creates problems such as social contradiction and urban development disharmony. Although the government increases the residents' participation role by posting announcements and consulting public opinion to solve these problems, the method of equal rights for all stakeholders does not actually improve the decision-making power of any other group apart from the government, especially for the public.

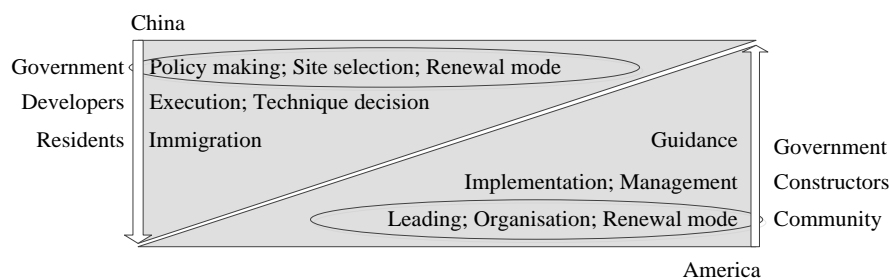


Figure 1. Residential district renewal process in China and America.

Previous studies [4,9–11] have discussed the issues concerning success factors of urban development. These authors suggest that urban development depends on the implementation of quality of life standards and the promotion of future investment via urban renewal [12]. Decision-making is the initial process that can affect the whole orientation of urban renewal. It is essential to explore the key variables for decision-making on urban renewal. These key variables can represent the intention of decision-making, and thus guide the urban renewal pattern. Several key factors have been identified via questionnaire surveys and development projects case analyses, mainly covering ecology, society, economics, policy, land use, culture and physics. The research results from these researchers are shown in Table 1. Although these variables identified from the literature or

practical projects cover information in almost all aspects, several of them have not been adopted by practicing policymakers during the renewal plan. Indeed, these variables are identified based on all stakeholders' concerns theoretically; however, there has been little guidance for practice due to the large gap between decision-makers and stakeholders.

Table 1. Mark-up variables for decision-making on urban renewal in previous studies.

Author	Key Variables
Wang et al. 2014 [4]	Vegetation rate; noise pollution; local population; local employment; property values; rents; legal boundaries; land ownership; statutory requirements for development; current land uses; neighbouring land uses; road network; traffic volume; internal circulation; access to major living services; utilities for basic housing; visual quality; solar access; wind direction
Chan et al. 2008 [10]	Satisfaction of welfare requirements; conservation of resources & the surroundings; creation of harmonious living environment; provision facilitating daily life operations; form of development; availability of open spaces
Adair et al. 2002 [13]	Rates of capital appreciation; rental growth; quality neighbouring environment; grant regimes; construction and land costs; taxation breaks; investment risk; complexity of management; public/private sector partnerships; quality of development; market conditions; quality of labour force
Adair et al. 1999 [14]	Perceived total return; security of investment/spreading of risk; new business opportunities; competitor behaviour; company image; social/community reasons
Nappi-Choulet, 2005 [15]	Expected return; diversification benefits; risks (risk-level and risk-return); new business opportunities; exit strategies
Frantál et al. 2015 [16]	Foreign direct investments; physical conditions; national policy; information availability; financial incentives; size of brownfield area; ecological burden; concentration of brownfields; project quality and feasibility; infrastructure networks
Sun and Yan, 2004 [17]	Laws and regulations and planning management (the government); economic interests (real estate developers); recommended measures, publicity and education (experts); the improvement of material conditions and the demolition compensation (the public)
Zhao, 2008 [18]	National policy, investment, construction, etc. (external tension); contradiction between supply and demand in land and housing, demand for environmental quality improvement; adjustment for demand of network structure; public resource distribution; the gap of living conditions (internal thrust)
Liu and Zhao, 2006 [19]	Regeneration policy; economic benefit; social and cultural benefit; ecological benefit
Wang et al. 2016 [20]	City economic; civil benefit; environment; historical and cultural heritage protection; civil participation

Sun and Yan [17] analysed the mechanisms behind the main driving variables for decision-making on urban renewal. The authors stated that: (1) the government effectively manages and controls urban renewal through laws, regulations and planning management to promote the city's rapid socio-economic development; (2) developers become the main investors and the executives of urban renewal projects to pursue economic interests, and for investment choice standards associated with lightened environmental and social benefits; (3) experts propose measures and promote publicity and education through investigation and research of the current situation, history and culture, protection and development, and other aspects of old districts; and (4) the relocation households pay more attention to the improvement of the material conditions and compensation than on its influence on living conditions. Each group of stakeholders focuses on one particular aspect that contains only a few factors as seen in Figure 2 (i.e., the government focuses on urban and industrial economy, social welfare and network; the market entity focuses on company profit, working environment and public facilities; and the property right subject focuses on physical condition, compensation and social welfare); however, they are unable to form a comprehensive urban renewal decision-making system. Urban renewal decision-making where one group of stakeholders occupies the dominant

position of decision-maker cannot play the role of processing the whole situation and guiding the resulting implementation phase. Therefore, combined participation by the government, developers and the public is proposed by many researchers. In practice, however, conventional approaches are that the government controls urban renewal planning and decision-making, disregarding the role of the participation process, which is a facilitator to catalyse urban renewal processing during the implementing or operating stage [20]. The government exercises macro control over the overall urban renewal program by developing a certain amount of renewal regulations. In addition, detailed work is involved in identifying renewal areas via a set of assessment criteria, and then reaching a resettlement and compensation agreement with owners purchasing in the renewal areas. After the above-mentioned work is completed, the government can embark on housing demolition and land use right assignment. The use of land in redevelopment is also governed by the government based on urban planning.

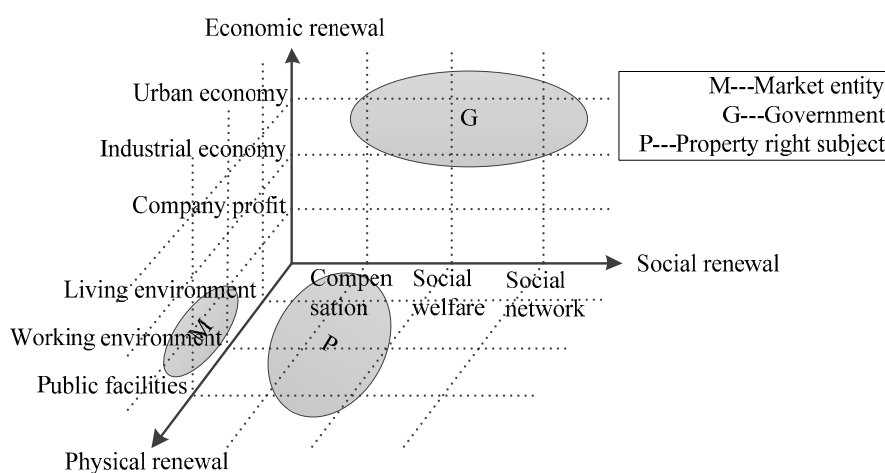


Figure 2. Concerning factors of different stakeholders on urban renewal.

Urban renewal involves a variety of stakeholders and, therefore, their interest demands have a strong relationship to project success [21]. Besides, effective urban renewal needs to change the declining status quo of the old district via social, economic and material level approaches [22]. Each aspect of urban renewal objectives matches the demands of several groups of stakeholders. The absence of groups of stakeholders in the decision-making process will result in whole objectives not being achieved. The failure of many urban renewal projects can be traced back to the gap between decision-makers and stakeholders, such as Qintailu in Chengdu that was positioned only by the government and disregarded market demand. Since some key variables differ between different subject oriented urban renewal, the key variables distinguished by each group of stakeholders are very important and worthy of further study. Mao et al. [23] proposed an idea about “intelligent analysis and decision system” to build the Smart City. Based on similar thought processes, the identified variables are conducive to build the decision-making and evaluation system of urban renewal, as well as develop urban renewal towards the direction of equilibrium within the physical condition, economy, policy and culture.

As the core city of the prosperous southwest region, Chongqing is the representative for inland cities in China. Chongqing’s urban construction features and problems are also a typical sample of China’s inland cities. This city offers many cases and resources for tracking and research, with Chongqing being an active city for urban renewal. We chose Chongqing as a case study to explore key variables for decision-making on urban renewal, and to compare the importance of variables for decision-making between different groups of stakeholders to explore the main similarities and differences. Further, we explore differences in opinion that occur in the urban renewal decision-making process, and propose relevant suggestions to provide the basis for effective decision-making and the smooth implementation of urban renewal.

2. Identifying Influence Indices Based on a Literature Review

Urban renewal is the reallocation of urban land and population resources [24]. The goals of urban renewal include the physical, economic, social and cultural contents of updating, the functional adjustment of space structures and the optimisation of the humanistic environment [25]. Decision-making is carried out based on the goals of the urban renewal project. This paper uses a literature review and an expert interview method to identify the influence indices of urban renewal decision-making to explore the key variables for decision-making on urban renewal.

To remedy deficiencies in earlier studies and to construct variables for decision-making on urban renewal that are in accordance with current urban renewal projects in China, we selected and optimised influence indices from the literature. Ten urban renewal experts were invited to discuss the selected indices using an expert structure interview form. Eighty-two indices, I_i ($I = 1, 2, \dots, 82$), for decision-making on urban renewal were selected (Table 2) from summarising and analysing the interview results.

Table 2. Mark-up indices for decision-making on urban renewal.

No.	Index	No.	Index
I ₁	Geology (Terrain, Seismic hazards, Landslide hazards)	I ₄₂	Differences in the average level of urban real estate market
I ₂	Topography (Elevation, Slope gradient, Slope aspect)	I ₄₃	Participation and cooperation of the government
I ₃	Climate (Solar access, Wind direction)	I ₄₄	Local development strategy
I ₄	Land use type	I ₄₅	Urban planning
I ₅	Building use life	I ₄₆	Local marketing
I ₆	Building quality	I ₄₇	Financial incentive
I ₇	Building function layout	I ₄₈	Landscape protection restriction
I ₈	Building appearance	I ₄₉	Total population
I ₉	Building density	I ₅₀	The proportion of floating population and permanent residents
I ₁₀	Average area of each building	I ₅₁	Employment rate
I ₁₁	Total building area of the district	I ₅₂	Occupation
I ₁₂	Discrepancy between the building and surroundings	I ₅₃	Income
I ₁₃	Kindergarten, primary school, middle school	I ₅₄	Employment opportunity
I ₁₄	Hospital, clinic	I ₅₅	Job skills
I ₁₅	Commercial bank	I ₅₆	Internal social contact
I ₁₆	Shopping center	I ₅₇	External connection
I ₁₇	Sports facilities	I ₅₈	Education level
I ₁₈	Open space	I ₅₉	Medical condition and level
I ₁₉	Water supply	I ₆₀	Crime and social security
I ₂₀	Electricity supply	I ₆₁	The number and level of landmark heritage
I ₂₁	Gas supply	I ₆₂	The uniqueness of Architectural/landscape
I ₂₂	Sewerage	I ₆₃	Housing demolition and relocation difficulty
I ₂₃	Road network setup	I ₆₄	Housing demolition and relocation cost
I ₂₄	Traffic flow	I ₆₅	Relocation compensation method (monetary compensation/housing compensation)
I ₂₅	Functional area traffic	I ₆₆	Resettlement method
I ₂₆	External public transportation	I ₆₇	Land use and building type
I ₂₇	Greening rate	I ₆₈	Land and construction costs
I ₂₈	Vegetation type	I ₆₉	Total return/internal rate of return
I ₂₉	Air quality	I ₇₀	Investment time period
I ₃₀	Water quality	I ₇₁	The opportunity for investors to participate in real estate cycle
I ₃₁	Soil pollution	I ₇₂	New business opportunity
I ₃₂	Noise pollution	I ₇₃	Impact on corporate image
I ₃₃	Light pollution	I ₇₄	Competitor behavior
I ₃₄	Discrepancy between the environment and surroundings	I ₇₅	Relationship with government

Table 2. Cont.

No.	Index	No.	Index
I ₃₅	GDP (Gross domestic product)	I ₇₆	Labor market condition
I ₃₆	Commercial activity (commercial scale, level and pulling power)	I ₇₇	Investment security/risk spread
I ₃₇	Business investment and investment enterprise status	I ₇₈	Enterprise exit strategy
I ₃₈	Differences with the average level of urban economy	I ₇₉	Competitive regional function positioning
I ₃₉	Local real estate investment	I ₈₀	Amount of investment attracted by competitive area
I ₄₀	Local land and housing price	I ₈₁	Amount of population absorbed by competitive area
I ₄₁	Local rent level	I ₈₂	Competitive regional development/updating effect

3. Extraction and Analysis of the Key Variables Based on Questionnaire Surveys and Factor Analysis

3.1. Questionnaire Design and Distribution

The questionnaire was designed with the content of the respondents' basic information and the 82 indices to extract key variables for decision-making on urban renewal in the form of the Likert Scale. A total of 300 questionnaires were randomly distributed via e-mail or street interception in Chongqing. We did targeted distribution to determine the respondents, with those receiving e-mails being relevant personnel in close contact with the authors, and only those that accepted the street survey who met the identity requirements and completed the questionnaire could be included in the questionnaire statistics.

To discern each stakeholder's interest demand in the urban renewal decision-making process, decision-makers should match with stakeholders that contain the government, real estate developers/investors, experts/scholars and the public (a generalized concept containing the demolished households and other residents of the city). The respondents of this questionnaire survey focus on these four categories of people who are associated with urban renewal in Chongqing. By investigating the variables that each group of stakeholders focus on in the decision-making process, the variables identification affecting urban renewal decision-making is completed using comprehensive and whole-staff participation.

A total of 278 questionnaires were collected and 244 were valid according to the criteria that all the questions in the questionnaire were answered and the answers were consistent. In the valid questionnaires, there were 44 government officers who engaged in work related to urban renewal (18.03%), 58 real estate developers/investors and employees (23.77%), 41 experts/scholars (16.80%), and 101 members of the public (41.39%). In total, 54% of the respondents in the cognitive situation of urban renewal including its concept, participants, process, and so on were above the level of understanding. Further, 38.6% of the respondents were actively participating in urban renewal at the time of the survey.

3.2. Extraction of Key Variables for Decision-Making on Urban Renewal

First, a reliability analysis was carried out using SPSS statistical software. Then, the key variables were extracted using factor analysis.

3.2.1. Reliability Analysis

Nunnally [26] proposed that the reliability analysis has high credibility if Cronbach's alpha is above 0.6 in general exploratory research or above 0.8 in benchmark studies. Cronbach's alpha was 0.977 for the reliability analysis of the collected questionnaires, suggesting that the statistical data has high internal consistency and reliability. We then deleted the correction indices of the

correlation coefficient with a total score less than 0.4 [20]. Seventy-seven indices were preserved after the following indices were deleted: “geology”, terrain, seismic hazards, and landslide hazards; “topography”, elevation, slope gradient, and slope aspect; “climate”, solar access and wind direction; “building used life”; and “building quality”.

3.2.2. Key Variable Extraction

We applied factor analysis to extract the key variables for decision-making on urban renewal from the 77 indices. The KMO (Kaiser–Meyer–Olkin) value was 0.812 and the significant probability of the χ^2 statistical value for the Bartlett’s test was 0.000. The Kaiser test gives the common KMO metric: 0.9 is very suitable for representation, 0.8 is suitable for representation, 0.7 is general for representation, 0.6 is unsuitable for representation and 0.5 is extremely unsuitable for representation. If the statistical value of the Bartlett’s test is large, and the corresponding probability value is less than the given significant level, the assumption should be rejected. Otherwise, we can accept the hypothesis, the significant probability is 0, and it is not suitable for factor analysis. The questionnaire data was suitable for factor analysis according to the above basis.

In total, 45 indices, I_i ($i = 1, 2, \dots, 45$), were extracted after the first factor analysis. The cumulative explained variance was 67.81%. Wu [27] suggested that if the combined interpretation of reserved factors can achieve greater than 60% after extraction, it is an ideal result for use in science. Therefore, the 45 indices are good representations for the impact of all variables in urban renewal decision-making. A second-time factor analysis was performed because the factor structure changed after some of the indices were deleted. We classified the indices of these second factor analysis results according to their contents and internal relationships. Nine key variables (Table 3) were classified: social welfare (V_1); economic and real estate development level (V_2); public facility (V_3); demolition and resettlement compensation (V_4); infrastructure (V_5); ecological environment (V_6); policy and planning (V_7); construction status (V_8); and investment behaviour of developers/investors (V_9).

The nine key variables corresponded with the statistical requirements in the second factor analysis mentioned above in regards to internal consistency, and also explain the variance and KMO value. Therefore, the factor analysis is valid.

Table 3. Selection for key variables.

Key Variables	Index	Index	FL ¹	CEV ²	Key Variables	Index	Index	FL ¹	CEV ²	
V ₁	I ₅₁	I' ₁	0.663	14.305	V ₄	I ₆₃	I' ₂₄	0.798	46.651	
	I ₅₂	I' ₂	0.765			I ₆₄	I' ₂₅	0.820		
	I ₅₃	I' ₃	0.732			I ₆₅	I' ₂₆	0.890		
	I ₅₄	I' ₄	0.805			I ₆₆	I' ₂₇	0.844		
	I ₅₅	I' ₅	0.793			I ₆₇	I' ₂₈	0.756		
	I ₅₆	I' ₆	0.752			V ₅	I ₁₉	I' ₂₉		0.870
	I ₅₇	I' ₇	0.747		I ₂₀		I' ₃₀	0.875		
	I ₅₈	I' ₈	0.734		I ₂₁		I' ₃₁	0.886		
	I ₅₉	I' ₉	0.608		I ₂₂	I' ₃₂	0.729			
V ₂	I ₃₅	I' ₁₀	0.770	27.037	V ₆	I ₃₀	I' ₃₃	0.641	62.658	
	I ₃₆	I' ₁₁	0.806			I ₃₁	I' ₃₄	0.797		
	I ₃₇	I' ₁₂	0.856			I ₃₂	I' ₃₅	0.785		
	I ₃₈	I' ₁₃	0.816			I ₃₃	I' ₃₆	0.753		
	I ₃₉	I' ₁₄	0.783		V ₇	I ₄₃	I' ₃₇	0.665		68.969
	I ₄₀	I' ₁₅	0.610			I ₄₄	I' ₃₈	0.806		
	I ₄₁	I' ₁₆	0.651			I ₄₅	I' ₃₉	0.828		
	I ₄₂	I' ₁₇	0.743			I ₇	I' ₄₀	0.603		
V ₃	I ₁₃	I' ₁₈	0.653	36.867	V ₈	I ₉	I' ₄₁	0.735	74.139	
	I ₁₄	I' ₁₉	0.672			I ₁₀	I' ₄₂	0.684		
	I ₁₅	I' ₂₀	0.720			I ₁₁	I' ₄₃	0.570		
	I ₁₆	I' ₂₁	0.747		V ₉	I ₇₃	I' ₄₄	0.715		78.188
	I ₁₇	I' ₂₂	0.751			I ₇₄	I' ₄₅	0.658		
	I ₁₈	I' ₂₃	0.691							

3.2.3. Key Variables Analysis

(1) Social welfare (V_1)

The social welfare variable includes the employment rate, employment opportunity, occupation, income, job skills, internal and external social contacts, education, medical condition and level indices. Among them, employment and education explain the majority of the variation in the social welfare variable, with Wang et al. [4] also reporting that local employment and education are key influencing factors. Employment and education might reflect the physical and mental states of residents living in districts to be regenerated. Negative emotion of low-income residents easily leads to social problems and is harmful to social stability due to the low level of social welfare, updated job insecurity, poor income and livelihood insecurity. To mitigate social conflicts, reduce the gap between rich and poor and stabilise regional migration, the government tends to provide employment opportunities and increase educational and medical institutions via urban renewal. However, renewal attempts often force indigenous people to leave the region. The social welfare of indigenous peoples has not improved because social welfare efforts following renewal are focused on new residents.

(2) Economic and real estate development level (V_2)

The economic and real estate development level variable includes gross domestic product, commercial activity, business and real estate investment, housing price and rent level and differences in the average level of urban real estate market indices. This variable was fully recognised by most scholars who have performed similar studies, such as Sun and Yan [17], Liu and Zhao [19] and Wang et al. [20]. Regional economic development levels are not only the embodiment of current economic situations, but also reflect the development potential following renewal, and are the main consideration factor that the real estate developers take into consideration for investment decision-making and the judgment basis that the government balances the regional development on. Commercial activity and business investments are the economic basis of regional development, and are economic and feasible evaluation criteria in urban renewal decision-making. Regional economics, real estate development level and the feasibility of urban renewal are positively correlated, and help promote each other. Therefore, the regional choice of urban renewal, which is dominated by real estate development, tends to be based on economic benefits and not on the ageing of buildings.

(3) Public Facility (V_3)

The main public facility indices relate to education, health, sports, entertainment and other public facilities, which were detailed by Zhao [18] in his research. The government supplies the public facilities to meet the demand for these and for space. Shortages of public facilities inconvenience residents living in the district, negatively affecting their quality of life. The government tends to use real estate development for the supply of public facilities. However, real estate developers who only pursue profits reduce public facilities to improve their own benefits, contrary to the original intentions of the government. This pattern of urban renewal is not effective for improving the shortage status of public facilities in the district to be regenerated.

(4) Demolition and Resettlement Compensation (V_4)

The demolition and resettlement compensation variable has five indices, which are housing demolition and relocation difficulty and cost, land use, and the compensation method for demolition and resettlement. Demolition and resettlement are not only the primary link, but are also the most important factor that impacts the overall progress of urban renewal. Urban renewal creates an increase in regional housing prices because real estate developers have to increase housing prices to protect yields. Lees [28] holds the view that indigenous people living in limited financial conditions are forced to move out because they cannot afford the expensive housing prices. To protect their rights and interests, indigenous people require very high compensation. However, due to financial constraints, the government cannot meet these requirements, resulting in conflicts over compensation levels, making

demolition difficult. The high housing prices then lead to more compensation conflicts between indigenous people and the government. Demolition and resettlement compensation is the biggest conflict between stakeholders of urban renewal.

(5) Infrastructure (V5)

The indices with the highest interpretation degree include water, electricity, gas and sewage treatment, which are associated with local infrastructure and are basic living securities. These variables were also considered by Frantal et al. [16] as being the key factors affecting urban renewal. The government invests in constructing infrastructure to maintain the needs of residents. However, due to financial constraints, the government cannot fully meet the needs of all regions and, therefore, can only selectively invest in infrastructure construction. The government tries to obtain the maximum urban development effect with the lowest fiscal expenditure in district selection. High amounts of governmental revenue are needed to compensate for not providing funds to ignored regions due to their neglected infrastructures. The high cost associated with regenerating these areas results in further neglect by the government. Additionally, the outdated infrastructure acts as an obstacle for real estate development because it limits investment options for real estate developers.

(6) Ecological environment (V6)

The ecological environment variable mainly considers water, soil, noise and light pollution. Good ecological conditions are the basis of a good living environment and residents cannot be healthy when they live in a highly polluted area. Wang et al. [4] and Frantal et al. [16] both insisted that ecological burden is an obstacle to the healthy development of a city and a driving force to promote urban renewal. Due to the low-income levels of many indigenous communities, the ecological environment of the region to be regenerated cannot be maintained in a timely manner, resulting in the ecological environment worsening. Many indigenous communities are eager to improve the quality of their ecological environment. However, they must rely on the government to do so due to the poor financial situation of these communities. The government attempts to change the current situation via regional development; however, because regional development often results in the removal of these communities, they do not personally benefit from increased governmental assistance.

(7) Policy and planning (V7)

Urban renewal is subject to urban development policy. Frantal et al. [16] and Zhao [18] illustrated that national policy is a key factor that influences urban renewal implementation. However, urban renewal also affects urban planning. The local development strategy not only guides the developmental direction of urban renewal, but also guides the investment direction of real estate developers via preferential policies. Through urban planning, the government restricts development behaviour by real estate developers so that the renewal results are in line with the overall development of the city. The old district's current development situation and the possibilities and feasibilities for renewal can also provide a basis for urban planning.

(8) Construction status (V8)

The construction status variable that affects urban renewal decision-making can be explained by four indices: building function layout, building density, building size and building scale, which are summarised in "living environment" by Chan et al. [10]. The original building function layout has gradually been eliminated by residents due to changing living habits. To adapt to modern lifestyles, residents meet their demand for building functional layouts by housing replacement. Within the scope of their financial conditions, residents also tend to move to low-density housing in better environments. However, the building density, building size and building scale of the district to be regenerated have an impact on costs and make compensation difficult. These three indices are some of the main considerations associated with renewal implementation by the government and investment decision-making of real estate developers.

(9) Investment behaviour of developers/investors (V9)

Although urban renewal is mainly led by the government in China, it is implemented by real estate developers, so developer investment behaviour plays an important role in urban renewal decision-making. It is also the most important variable for the implementation of urban renewal, matching the conclusion that Mao et al. [23] and Nappi-Choulet [15] regarded “investment” as a key factor in their studies. The key indices identified using factor analyses are the impact on corporate image and the behaviour of competitors. Although it does not directly highlight the pursuit of profit, the corporate image established by redevelopment projects can broaden future development paths for the enterprise. It can also deepen the cooperation between the government and these enterprises, contributing to their long-term development. The behaviour of competitors can provide the basis for an enterprise’s investment decision-making. However, it also relates to the growth of the enterprise. Therefore, investment decision-making of real estate developers tends to be for those districts that can enhance the corporate image and ensure a better earning rate.

3.3. Key Variable Importance Sequencing

We used the entropy weight method to calculate and sort the importance of the above selected 45 indices from the questionnaire data. The quantity and quality of information accessed by decision-makers determines the accuracy and reliability of their decision-making. Entropy technology utilises the output entropy of each variable to determine the weight coefficient. From the angle of information entropy, the objective information of the variables can be used to improve the objectivity and scientificity of the evaluation method [29]. We defined the entropy of the key influence index “i” using Equation (1) (named “ H_i ”), and the entropy weight of the key influence index “i” using Equation (3) (named “ W_i ”). “ W_i ” is the weight coefficient of the key influence index in urban renewal decision-making.

$$H_i = -K \sum_{j=1}^{n'} f_{i,j} \ln f_{i,j} \quad (1)$$

$$f_{i,j} = \frac{I'_{i,j}}{\sum_{j=1}^m I'_{i,j}}, K = \frac{1}{\ln m} \quad (2)$$

$I'_{i,j}$ is constructed with the coordinates of the respondents and the 45 selected indices, and shows that the “j” questionnaire respondent judged the influence degree of urban renewal decision-making on the key influence index “i”. The larger the value is, the higher the impact of the index.

$$W_i = \frac{1 - H_i}{n' - \sum_{i=1}^{n'} H_i} (i = 1, 2, \dots, m) \quad (3)$$

We then calculated the average weight of each index within each key variable to show the importance coefficient of the key variable. We found that the ranking of key variables from strong to weak based on the importance coefficient is: ecological environment (V_6); social welfare (V_1); public facility (V_3); infrastructure (V_5); construction status (V_8); investment behaviour of developers/investors (V_9); demolition and resettlement compensation (V_4); economic and real estate development level (V_2); and policy and planning (V_7) (Table 4).

Table 4. Sorting of key variables.

Key Variables	Index	H _i	W _i	CW ¹	Key Variables	Index	H _i	W _i	CW ¹
V ₁	I ₁	0.9900	0.0210	0.0256	V ₄	I ₂₄	0.9924	0.0159	0.0192
	I ₂	0.9885	0.0241			I ₂₅	0.9918	0.0172	
	I ₃	0.9883	0.0245			I ₂₆	0.9909	0.0191	
	I ₄	0.9889	0.0233			I ₂₇	0.9902	0.0206	
	I ₅	0.9881	0.0249			I ₂₈	0.9889	0.0233	
	I ₆	0.9845	0.0325		V ₅	I ₂₉	0.9879	0.0254	0.0241
	I ₇	0.9862	0.0289			I ₃₀	0.9888	0.0234	
	I ₈	0.9870	0.0273			I ₃₁	0.9890	0.0232	
	I ₉	0.9888	0.0235			I ₃₂	0.9883	0.0246	
V ₂	I ₁₀	0.9883	0.0246	0.0173	V ₆	I ₃₃	0.9840	0.0336	0.0274
	I ₁₁	0.9921	0.0165			I ₃₄	0.9886	0.0239	
	I ₁₂	0.9926	0.0155			I ₃₅	0.9880	0.0252	
	I ₁₃	0.9926	0.0155			I ₃₆	0.9872	0.0268	
	I ₁₄	0.9914	0.0180		V ₇	I ₃₇	0.9927	0.0153	0.0159
	I ₁₅	0.9941	0.0123			I ₃₈	0.9926	0.0156	
	I ₁₆	0.9919	0.0169			I ₃₉	0.9920	0.0168	
V ₃	I ₁₇	0.9910	0.0189	0.0255	V ₈	I ₄₀	0.9912	0.0185	0.0218
	I ₁₈	0.9890	0.0230			I ₄₁	0.9897	0.0216	
	I ₁₉	0.9894	0.0222			I ₄₂	0.9868	0.0277	
	I ₂₀	0.9875	0.0263		V ₉	I ₄₃	0.9907	0.0195	0.0208
	I ₂₁	0.9891	0.0229			I ₄₄	0.9901	0.0207	
	I ₂₂	0.9868	0.0278			I ₄₅	0.9901	0.0208	
	I ₂₃	0.9853	0.0308						

¹ CW means comprehensive weight.

Effective urban renewal decision-making requires the participation of all stakeholders. In the analysis, the respondents were composed of the main stakeholders in urban renewal. The key variables can comprehensively reflect the decision-making of the various stakeholders. Of the 45 selected indices, 30 are based on the present situation of the district to be regenerated, accounting for 66.67% of the total indices. These 30 indices are mainly from the five key variables V₁, V₃, V₅, V₆ and V₈. The importance coefficients of the five key variables are ranked in front of all variables. The five key variables include four dimensions in ecological environment, building and facility, social welfare and commercial activities. The importance of these five key variables shows that ageing buildings, out-of-date service facilities and serious environmental pollution become the main impetus to promote urban renewal. The remaining 15 indices point to the interests of stakeholders in the process of urban renewal in which the government is in pursuit of economic and social development of the city, real estate developers/investors are in pursuit of high profits, the indigenous people are in pursuit of reasonable compensation and the public are in pursuit of more public resources.

The great contradiction between the demand of the people and the present situation in terms of the four dimensions in ecological environment, buildings and facilities, social welfare and commercial activities provides a possibility for the development of urban renewal. Various stakeholders have certain abilities and are forced to implement the demands in each aspect. To promote coordinated development of the city, as well as safeguarding social stability and harmony, the government needs to increase public resource supply to old districts via the construction of infrastructure and municipal facilities projects. Additionally, the government must also guide the social capital flow and adjust the industrial structure layout via laws and regulations such as urban planning. Real estate developers/investors approach urban renewal from a business standpoint, aiming for maximum financial benefits. The judgment basis of investment decision-making is based on the present situation feasibility research of the old district to determine the investment intention for economic, social and other aspects. Experts/scholars aim to make their research universal so that it can guide healthy development in urban renewal. These researchers often explore the internal rules using scientific analysis, guiding the practice to realise a balanced development of urban renewal. Demolished households, as the most relevant interest group of urban renewal, are keen to change the currently

declining situation of old districts via urban renewal to improve their quality of life. Other public citizens also hope more public resources will be provided with urban renewal.

However, the demand of each stakeholder cannot be fully realised due to various restrictions. For example, the government is limited by finance, so it tends to selectively choose which districts receive urban construction investments, resulting in infrastructure and municipal facilities not perfectly matching social demand. Moreover, the lack of a legal system and slow city planning makes the government lose control of macroeconomic factors. The real estate developers/investors in pursuit of profits tend to avoid the poorer areas to ensure a higher profit margin in investment decision-making. This contradiction with the inner drive of urban renewal is not conducive for implementing effective decision-making. The public are in a passive position and cannot find the right way to maintain their rights and interests. Public demand cannot be expressed in urban renewal. Businessmen also tend to select commercial hubs with developed economies and convenient transportation when choosing where to invest. This causes the economy of old districts to worsen and, as a result, the out-dated status prevents renewal. The many contradictions, the out-dated situation, the interest demand of each stakeholder group and the limited rights to claim influence urban renewal decision-making.

As each group of stakeholders shows different interest demands, there are divergences in the importance of key variables for decision-making on urban renewal among different groups of stakeholders. Research with each group of stakeholders analyses the opinion bifurcation in urban renewal decision-making. The corresponding solutions are of great benefit to the urban renewal decision-making system that wishes to equally address all interests.

3.4. Comparative Analysis on the Importance of Key Variables among Different Groups of Stakeholders

We classified the questionnaires according to the type of stakeholders that completed the survey. We divided the people into four categories: government officers, real estate developers/investors and employees, experts/scholars and the public (who are the main stakeholders in urban renewal). We sorted the importance of the key variables for decision-making on urban renewal for each group of stakeholders using the entropy weight method. The calculation equation and process is the same as in the previous section. The calculation results are shown in Table 5 and Figure 3, where one (1) represents the most important and ten (10) represents the least important variable.

Table 5. Sorting of key variables for each group of stakeholders.

Importance Sorting	Government Officers	Real Estate Developers/Investors and Employees	Experts/Scholars	The Public
1	V ₃	V ₅	V ₆	V ₆
2	V ₅	V ₄	V ₉	V ₁
3	V ₁	V ₁	V ₃	V ₃
4	V ₆	V ₆	V ₄	V ₂
5	V ₈	V ₉	V ₁	V ₈
6	V ₉	V ₃	V ₈	V ₄
7	V ₂	V ₈	V ₇	V ₅
8	V ₇	V ₇	V ₂	V ₉
9	V ₄	V ₂	V ₅	V ₇

Those associated with the government reported the most important variables as being V₃, V₅ and V₁. The government's point of view is matched with urban construction and public service, which are provided by the government to promote urban development; thus, maintaining social stability.

Real estate developers/investors hold the view that V₅, V₄ and V₁ are the most important variables. Because real estate developers/investors provide funds for urban redevelopment projects, investment costs and returns are their greatest concerns. The status of the infrastructure and social welfare in the district to be regenerated is directly related to project positioning and determines the benefit level of regional development. As an important part of the development costs, relocation compensation directly affects the level of total costs and the progress of the project.

Experts/scholars believe that V_6 , V_9 and V_3 are the most important variables. As researchers of urban regeneration, experts/scholars often approach these issues objectively. They explore the best development direction for urban renewal using their research and suggestions. The ecological environment is the foundation of urban sustainable development. The investment behaviour of developers/investors and the public facilities should be guaranteed in urban renewal. They are also the direction of experts'/scholars' education to realise public participation in urban renewal in the right way.

The public consider the most important variables for decision-making on urban renewal are V_6 , V_1 and V_3 . As a place for living and working, the status of the region affects the living standards of the public both directly and indirectly. These three variables are reflected in the needs of physical quality, leisure, entertainment and welfare. They are also missing in most old districts at present. The public urgently need to change the current status through urban renewal.

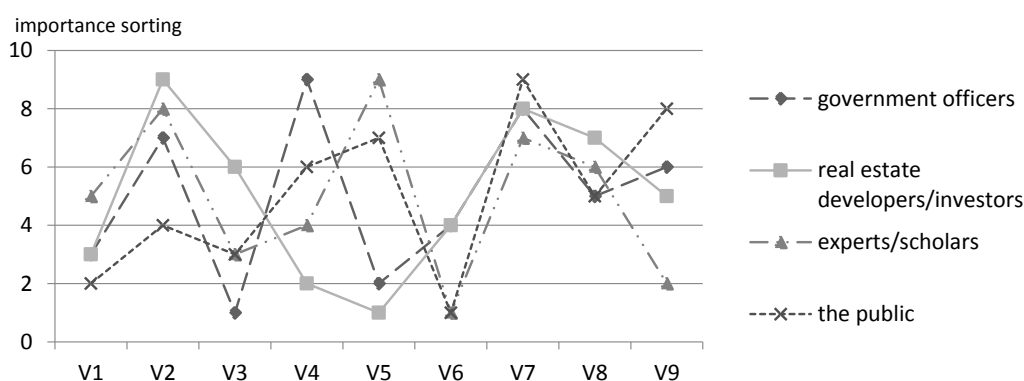


Figure 3. Comparison chart of sorting for key variables in each group of stakeholders.

The similarities and divergences of all the important key variables among the different groups of stakeholders are clearly shown in Figure 3. V_1 , V_7 and V_8 show high consistency with no opinion bifurcation among the different groups of stakeholders for these variables. The contradictions among the different groups of stakeholders exist for V_4 , V_5 and V_9 . The government and real estate developers/investors seriously disagree on V_4 (demolition and resettlement compensation). Because the relocation compensation is directly related to regional development costs, real estate developers/investors attach great importance to this variable. The government does not regard the relocation compensation as a key variable for decision-making on urban renewal to improve and coordinate the overall level of economic and society. There is serious opinion bifurcation in V_5 (infrastructure) between experts/scholars, the public and the government, and real estate developers/investors. Currently, water, electricity and gas conditions are good in most old areas, so the public do not wish to change these before they fix the ageing buildings, the deterioration of the ecological environment, out-of-date public facilities and other major problems. In addition, experts/scholars pay more attention to social contradiction. As a result, V_5 has not been a key evaluation criterion for experts/scholars and the public to carry out urban renewal decision-making. As the main direction of government investment, infrastructure construction has been the core work of the government. Besides, infrastructure facilities restrict the development positioning and investment orientation. Therefore, the government and real estate developers/investors consider V_5 to be an important variable that affects their interests and positions in urban renewal decision-making. For V_9 (investment behaviour of developers/investors), the public and experts/scholars strongly disagree. The public do not pay much attention to the development trend of old districts. Therefore, the investment behaviour of developers/investors has little influence on their urban renewal decision-making. The experts/scholars are more familiar with the urban development trend through

research on economic behaviour, and it is one of the main variables they use for decision-making on urban renewal.

To summarise, there exist similarities and divergences in opinion on which variables have the strongest influence on urban renewal decision-making among the different groups of stakeholders. These divergences result in opinion bifurcation. The predicament of unbalanced benefit in each group of stakeholders will continue to exist without resolving the opinion bifurcation. This is the root cause of imbalance interests due to the different statuses of stakeholders under the imperfect urban renewal decision-making mechanism [30]. Addressing variables with opinion bifurcation between different groups of stakeholders is the key problem when trying to achieve equalisation development of interests in urban renewal.

4. Applications of Key Variables for Decision-Making on Urban Renewal

4.1. Application of Time Sequence for Urban Renewal Projects

All groups of stakeholders have initial motivation driven by their own interest demands on the movement of old district renewal. Key variables for decision-making are a reflection of stakeholders' interests and points they hope to reinvigorate. The gap level between the present situation and the desired state for each key variable can be utilised to measure stakeholders' desires for area renewal. Therefore, an evaluation indicator system on urban renewal decision-making can be established on the basis of the key variables identified above. The importance of key variables can assist in determining the index weight coefficient of the evaluation system and, then, the area that should be updated can be filtered out according to the evaluation results.

There are many old districts that need to be placed on the agenda for renewal in Chongqing. However, many of them cannot be implemented in a timely fashion in order to maintain orderly construction within the city. The time sequence of urban renewal projects is particularly essential. The evaluation system of urban renewal decision-making based on the key variables for decision-making is an effective method to determine the time sequence, which can maximise interest demand and minimise opposition mood. Additionally, the key variables can propose an overall perspective to decision-makers, for example, "Which factors or aspects should be considered in site selection?"

In urban renewal practice, key variables for decision-making are the fundamental basis expanding to a scientific method to make urban renewal site selection and time sequence decisions.

4.2. Application of Decision-Maker Diversification

Conflicts that exist in urban renewal find origins in the fact that decision-making fail to give full consideration to the interest demands of all stakeholder groups. The gap between importance sorting of variables for decision-making on urban renewal gives favourable evidence that each group of stakeholders has particular points of concern. The situation of the government-led urban renewal decision-making system that has long existed in Chongqing and the social problems commonly occurring in many urban renewal projects is evidence of the analysis of relationships between decision-making and conflicts among stakeholders presented in this paper. The results suggest to the government that decision-makers diversification may be an effective way to ease definite tensions between stakeholders.

Different stakeholders represent a certain component of interest claims; therefore, if decision-makers have only included some groups of stakeholders, the decision-making would have been an incomplete consideration. Urban renewal has complex targets on aspects of environment, economy, society and culture. The renewal orientation according to decision-making made by partial groups of stakeholders cannot match the renewal targets, which leads to failure in terms of the definition of urban renewal.

The divergences in opinion on which variables have the strongest influence on urban renewal decision-making between the different stakeholder groups is a persuasive reason promoting the development of decision-maker diversification to dissolve conflicts and achieve all targets.

4.3. Application of Decision-Making Model Innovation

An innovative urban renewal decision-making model is urgently needed to change the unbalanced decision-making pattern in control of a single subject, which usually is the government or an advanced market entity. It is reasonable to explore an optimised model in which the main groups of stakeholders participate together in urban renewal decision-making with their duties [31] (Figure 4).

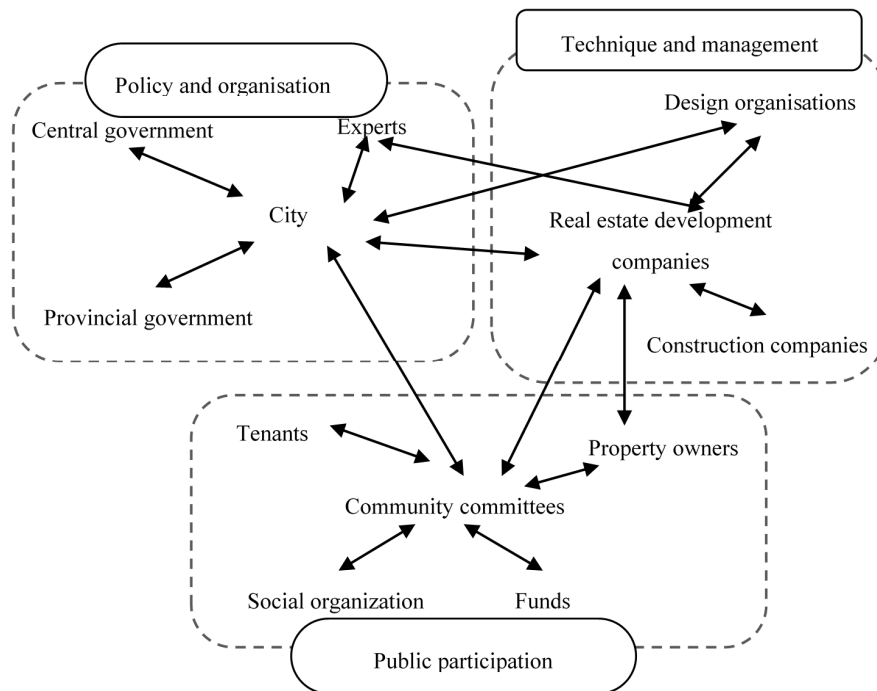


Figure 4. Structure of urban renewal decision-making model.

The analysis from this paper shows that the government advocates the adoption of urban renewal to improve social welfare and city image and achieve the development of urban economy in decision-making. The government always focuses on the overall development of the city; however, it lacks sufficient resources and energy to put these into practice and their duty is suitable for strategic guidance and orientation control. The market has adequate funds and strong executive power to support project development despite its profit demand. In addition, what should not be ignored is the public interest demand that is represented by demolished households and other citizens in urban renewal. Besides, research with innovative ideas and advanced explorations has been helpful for improving the decision-making mode. The key variables for decision-making of each group of stakeholders and their interest demands provide an idea to develop an advanced urban renewal decision-making model “government guidance; marketing operation; public participation” for achieving urban renewal targets of balanced and maximised interest.

4.4. Application of Optimisation of Participants in Decision-Making Processes

The current urban renewal decision-making process has four levels in planning and implementation (shown in Figure 5). The first level is urban renewal master planning. The municipal government develops an evaluation system and assesses the urban land under the overall spatial layout of the city to carry out area division, and to determine renewal areas and renewal time sequences.

Then, the district government conducts area planning after the master planning [4]. It subdivides the lands in areas that are planned to be updated based on the master planning, and then defines land attributes, as well as the arrangement of subdivision area renewal time sequence. This is followed by the project planning for a specific land area. The market entity begins to be involved in area redevelopment at this stage, where it mainly takes the economic and market assessment of the project as the basis for decision-making [22]. The last decision-making level is project implementation. The decision-making body is also the one who accesses the land redevelopment rights. In the whole urban renewal decision-making process, the government carries out the macro planning, while the market entity carries out the project planning and implementation. Public participation is clearly absent, whose interest demand cannot be reflected, resulting in an uneven distribution of benefits and deviation from redevelopment project positioning.

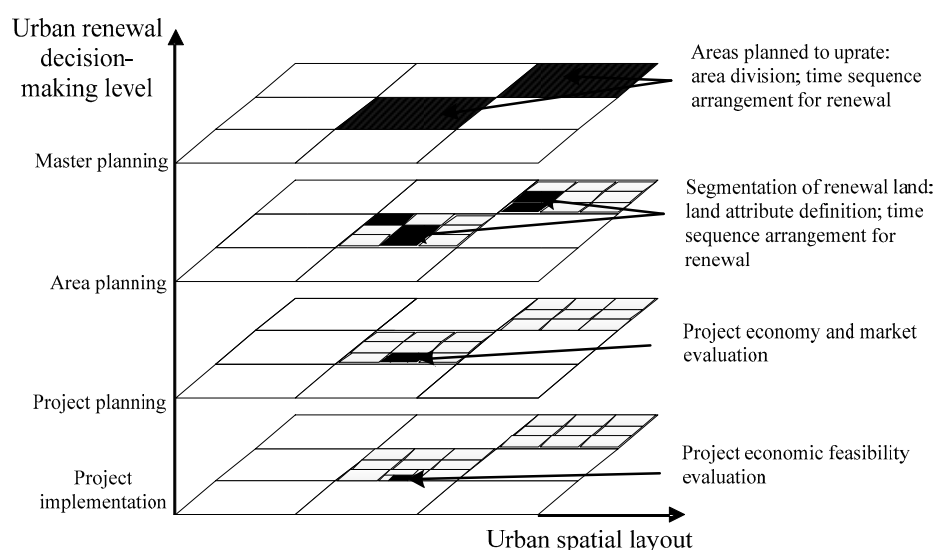


Figure 5. Current urban renewal decision-making process.

Market-oriented urban renewal creates urban construction projects with a serious problem of patchiness distribution. To address the problem, this section proposes optimisation of participants in decision-making processes to balance the role of each stakeholder group in urban renewal decision-making. After that, the site selection and time sequence planning for urban renewal can be arranged orderly and executed smoothly. The role of different stakeholders in urban renewal decision-making is critical to the quality of decision-making [23]. Public participation in urban renewal is especially helpful to the government for working out more acceptable urban renewal plans [20,32,33]. Therefore, according to the opinions of each stakeholder, full consideration should be given to their role in the urban renewal process. Table 6 shows the participant optimisation scheme. In the master planning, all members of the public are encouraged to participate in urban renewal decision-making. Through the collection of all parties' views, the municipal government can determine the most satisfactory urban renewal master planning. In the level of area planning, the market entity should be invited to participate in planning because of its good understanding with market demands. The residents living in the district and its influencing areas are also needed to participate in the decision-making to claim their rights and interests. At the project planning level, the government must supervise the market entity so that the project can be carried out according to the master and area planning's requirements. Demolished households involved in the project need to actively coordinate with the market entity and put forward their views and ideas to safeguard their interests.

Table 6. Optimisation of participants in urban renewal decision-making process.

Urban Renewal Decision-Making Level	Participants					
	Current Situation			Optimization		
	The Government	Market Entity	The Public	The Government	Market Entity	The Public
Master planning	●	○	○	●	○	●
Area planning	●	○	○	●	●	●
Project planning	○	●	○	●	●	●
Project implementation	○	●	○	○	●	○

“●” means participation; “○” means no participation.

This optimisation scheme can ensure the correct control by the government and increases the initiative participation of the public in urban renewal decision-making. In addition, it matches the solution of divergence opinion on key variables' importance sorting for urban renewal decision-making proposed in this paper. It can also assist with balancing interest demands of each group of stakeholders, which should be widely popularised in inner cities of China. Additionally, the government can improve the public hearing system by consulting public opinions before urban renewal decision-making. The root for solving conflicts on urban renewal is intensifying public participation.

5. Conclusions

This paper identifies the key variables for decision-making on urban renewal and how the importance of key variables diverges between the different stakeholder groups. A total of 82 influence indices were identified via a literature review and using expert interviews. Then, 300 questionnaires designed in the five Likert scale form were sent to four groups of stakeholders, governments, real estate developers/investors, experts/scholars and the public, associated with urban renewal. A total of 45 key indices were selected using factor analysis by recycling the questionnaire data. Nine key variables, social welfare (V_1), economic and real estate development level (V_2), public facilities (V_3), demolition and resettlement compensation (V_4), infrastructure (V_5), ecological environment (V_6), policy and planning (V_7), construction status (V_8) and investment behaviour of developers/investors (V_9), were identified, which cover nine aspects of the buildings and facilities, ecological environment, economy, society, policy and regulations, development investment, and demolition. These variables embody the various goals of the stakeholders involved with urban renewal projects and can provide a decision-making basis for the comprehensive development of urban renewal. This information is helpful for further research on constructing urban renewal decision-making evaluation systems.

The variables with different importance were identified by looking at differences in opinion among different groups of stakeholders. The three main contradicting variables were demolition and resettlement compensation (V_4), infrastructure (V_5) and investment behaviour of developers/investors (V_9), which are the basis to explore opinion bifurcation in urban renewal decision-making among different groups of stakeholders. From our analysis, it is necessary to balance the demand of stakeholders to create sustainable urban development.

Our analysis also offers several proposals for the application of a time sequence arrangement, decision-maker diversification, decision-making model innovation, and participant optimisation in the decision-making process based on the key variables for decision-making identified in this paper and divergences in opinion between stakeholder groups. These proposals do not contain enough detail, and so require further research.

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