Key variables for decision-making on urban regeneration

——A case study of Chongqing

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Abstract: Currently, the Chinese government leads urban regeneration through top-down management. Decision-making opinions held by groups of stakeholders are divided, which creates many social problems, project technical problems and even civil disorders. This paper uses factor analysis to extract the key variables for decision-making on urban regeneration, and then the entropy weight method to sort the key variables by importance. Based off this order, we then explore the differing opinions of the stakeholders about decision-making on urban regeneration. First, we found that the contradictory opinions about the importance of the ecological environment, housing and facilities, social welfare, commercial activities are the main driving force behind urban regeneration due to groups of stakeholders with different interest demands. Second, the different interest demands of the stakeholders affect the urban regeneration decision-making results. Finally, compensation to people for the demolition of their homes, the infrastructure supplements, and the investment behavior by developers are where there is greatest lack of consensus for variables of urban regeneration decision-making between the different stakeholders.

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

1. Introduction

[1]Urban development occurs either as urban sprawl or urban regeneration. Shortage of land resources seriously limits urban sprawl, driving most urban development towards urban regeneration. Along with the adjustment of the industrial structure and technological processes [1], many problems associated with economic depression, poor living conditions, absence of private services, and social conflicts frequently occur in old districts, the region with long history and the earliest construction, the most investment, the perfect facilities but declined in recent decades [2]. These phenomena will seriously hinder the development of the city, and potentially cause social unrest if they remain resolved. In response, a large number of redevelopment projects are taking place around the world to revive of old districts [3-4].

Effective urban regeneration needs to change decline status quo of the old district through social, economic and material level approaches [5]. However, urban regeneration decision-making is mainly lead by the government through top-down management, and the governments usually make judgments about old districts on the economic level that result in overall economic improvement and regional coordination. In addition to the government, urban regeneration stakeholders with low social status and participation do not have a large influence on the decision-making process. Therefore, urban regeneration that occurs in the plaque form based on developing profits ignores social welfare improvements and the continuity of social fabric and cultural context, as well as creating problems such as social contradiction and urban development disharmony.

The development history of urban regeneration decision-making in the West occurred in three stages, and changes occurred following government-led to public-private partnerships, and then to public-private-community partnerships. The mode of single physical renewals and community improvement, expanding to the growth orientation material update, and then to the full and comprehensive update in objective existence hardware, natural and social environment helps the urban regeneration process sustainably improve urban development [6-8]. Britain began urban renewal projects in the 1970s. The affected regions were primarily core districts and waterfronts, and rarely involved residential areas in the slums. This mode of urban renewal decision-making did not integrate material updates with economic and social regeneration. It also failed to achieve participatory mechanisms with all stakeholders [9]. The weakness of the American City Planning program is that it effectively limited city functioning, leading to imbalanced development between city

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centers and suburb regions [10]. The American government has accumulated experience from these failures, realizing that social problems cannot be successfully solved through automatic adjustment, because the market relies on real estate development. They began to strengthen the role of community in urban renewal by making them third-party decision-making participants following the addition of public and private sections. They then implemented the urban regeneration decision-making model of top-down and bottom-up (The government puts forward regeneration planning and solicits the public opinions. The public receives information and feedback. The government adjusts previous regeneration planning and makes decision-making. Real estate developers execute decision scheme), and equal rights for all stakeholders [6].

Urban regeneration in China rapidly expands with urban development. Most old residential district regeneration projects are conducted through overheated real estate development, except for districts with special historical value that have received adequate attention from the government. The government-leading mode of urban regeneration exists commonly in most large and medium-sized cities, and aims to pursue economic interests as "the local state-owned enterprises alliance" in urban regeneration [11]. This mode of urban regeneration decision-making is similar to the foreign public-private partnership, with weakening public participation, ignores the interests of the community, and lacks humanistic care and a discrete social fabric [6]. This mode is not conducive to scientific development. Effective urban regeneration should be emphasized in urban constructions to equally encourage economic, political, social, and cultural growth.

Several previous studies [4, 12-14] have carried on discussed success factors based on sustainable development theory. These authors suggest that sustainable urban development depends on the implementation of quality of life standards and the promotion of future investment through urban regeneration [15]. Sustainable urban regeneration requires the common participation of the government, developers and the public. The government should take macro-control measures through urban planning, land use regulation, and should supply policy support and supervision to the investment behavior of developers [16]. Alastair Adair (2002) and Ingrid Nappi-Choulet (2005) studied the basis of urban development investment decision-making, as well as evaluation factors of the private sector (real estate developers and investors). The found that real estate developers or investors of urban redevelopment projects mainly make decisions based on the profitability of the investment by considering the community population structure, economic foundation and infrastructure [5, 19]. Under the effective participation of the government and developers, the government should enhance the community's decision-making role in urban regeneration through guidance and authorization to community residents and service users. It is conducive to safeguard the rights and interests of the community, and to increase the real benefits received by the community, by increasing participation in training and employment, and increasing employment opportunities and social capital [20].

Currently, Chinese scholars are in the process of analyzing experiences from American and European decision-making modes. Another research direction is to innovate and explore successful modes used by foreign nations in combination with the current modes used in China [21-25]. Because of the different positions of the decision makers, the modes of urban regeneration decision-making mainly include the following [26]: (1) The government agency leading mode, where the government takes the whole situation into account and coordinates the fairness of stakeholders to achieve urban regeneration goals. The renovation of the City Council, the city planning and Construction Bureau in Holland is a representative example. (2) The third sector leading mode, where the government imposes economic assistance to non-profit organizations for the implementation of specific projects. The Housing Associations and Housing Action Trusts in England is a representative example. (3) The architects and residents leading mode. Since the 1970s, the United States and many European countries have taken this decision-making model for increasing resident participation efforts to realize their due rights and interests. (4) The public enterprises leading mode, where the government combines a number of private enterprises to set up an organization and offers it some support to lead the urban redevelopment project. (5) The private enterprises leading mode, where the government introduces private capital for urban regeneration in order to ease financial pressures. This mode has become the main urban regeneration decision-making mode in foreign countries, especially in the United States. Urban regeneration in China is developed based on the transformation of urban renewal. Several studies [27-29] have analyzed and suggested the Chinese typical urban renewal in decision-making and operation to an optimization mode in the 90s of the 20th Century. Affected by the reform of the housing system and urban development, urban development in China is dominated by the government and implemented by the private enterprises. Although this mode can alleviate the government financial pressure, it damages the interests of the public because real estate development enterprises pursue profit, hindering sustainable urban development in interest of equalization.

Chinese scholars sum up problems that exist in Chinese urban regeneration decision-making, including the imbalance in decision-making that results in an uneven distribution of benefits, and one-sided decision-making that leads to disorderly updating. Urban regeneration stakeholders include the regional and local governments, real estate developers, demolition households, as well as the public and community organizations. Although the government occupies the dominant position in the current decision-making process of urban regeneration, real estate developers are the real leader because they directly control investment flows in urban regeneration, taking power away from government regulations. The absent participation of demolition households and the public restricts their interest orientation embodied. The limited strength of organizations weakly influences the decision-making process. Therefore, urban regeneration decision-making

with the imperfect mode on the benefit expression mechanism and benefit safeguard mechanism cannot enhance the overall urban development, and social welfare cannot be achieved. In the face of the current problems in the Chinese urban regeneration decision-making process, Chinese scholars have begun suggesting potential solutions [26, 30-32]. In these studies, they construct an urban regeneration decision-making system based on theories of the interest, driving and operation mechanisms. They comprehensively consider the effect of the urban regeneration on external and internal forces within the physical condition, economy, policy and culture, and make full use of dynamic stakeholders in urban regeneration decision-making to realize the main decision-making body diversification, ensuring that the decision-making process is multi-faceted and diversified.

Urban regeneration decision-making is a complex process because of the various stakeholders and a wide range regeneration targets. Although urban regeneration is more comprehensive and higher standards on practice and research in western countries, the key variables for decision-making is based on subjective experiences, not on unified recognition criteria. Therefore, it is necessary for the main stakeholders to be the decision makers so that they can identify the factors affecting urban regeneration using scientific statistical methods. The identified variables are conducive to build the decision-making and evaluation system, as well as to develop the urban regeneration to the direction of equilibrium within the physical condition, economy, policy and culture.

Chongqing is an active city for urban regeneration. This city supplies us with many cases and resources for tracking and research conveniently. We choose Chongqing as a case study with its data to explore key variables for decision-making on urban regeneration, and then compare the importance between the variables for decision-making among different kinds of stakeholders to explore the main similarities and differences. Further, we explore differences in opinion that occur in the urban regeneration decision-making process, and put forward relevant suggestions to provide the basis for effective decision-making and the smooth implementation of urban regeneration.

2. Influence indices of urban regeneration decision-making based on a literature review and expert interview method

Urban regeneration is the reallocation of urban land resources and population resources [22]. The goals of urban regeneration include the social, economic and cultural contents of material updating, the functional adjustment of space structures, and the optimization of the humanistic environment [33]. Decision-making is carried out based on the goals of the urban regeneration project. This paper uses a literature review and expert interview method to identify the influence indices of urban regeneration decision-making in order to explore key variables for decision-making on urban regeneration.

2.1. Influence indices of urban regeneration decision-making based on the literature method

Hao Wang [4] summarized 37 indices that lead to urban regeneration decision-making, including information regarding ecology, society, economics, policy, land use, culture and physics using published literature. He then identified the key decision-making variables through three development projects case analyses in combination with real life examples in Hong Kong. He pointed out that only a small portion of the key decision-making variables that are esthetics, odors, and heritage landmarks, associated with urban regeneration vary across projects. Although practicing policymakers have not adopted some of the variables considered in his theory, theoretical research can still help guide the practice in a better direction.

Edwin Chan [13] selected key variables for decision-making on urban regeneration using questionnaire surveys and statistical analyses. The questionnaire included 30 indices from the literature in combination with a pilot study, which a number of selected industry practitioners were invited in. He issued 1800 questionnaires to architects, designers, developers and local residents through E-mail and street survey. He extracted six key variables from the questionnaire results using factor analysis, including social welfare, resources and environmental protection, harmonious living environment, daily life convenience, the form of regional updating and development, and public space availability.

The proportion of the mode that real estate developers implement urban regeneration is very large; studying the investment choice of the developers and investors in redevelopment projects is an important means to learn about urban regeneration decision-making. Adair Alastair [5] investigated 108 developers with different types of property through the Likert Scale questionnaire. The results showed that income and market risk are the key variables used to determine whether to invest the project in keeping the balance of project's property portfolio, or program evaluation.

From the perspective of the government, the Urban Regeneration and Community Development Group Department for Social Development analyzed the variables for decision-making based on the public interest of the society. Six key variables, physical isolation, construction and ecological environment, public service, employment and education, population structure, and social security were obtained. They tried to guide and to control the behavior of the investors and developers in order to coordinate the common interests of the public and investment developers.

Chinese scholars are still only working on constructing the decision-making system. Decision-making failure is a problem that needs to be solved because of the defects of the decision-making mechanism. However, research on the key

variables for decision-making needs to be considered after the decision-making mechanism built. Sun Lianghui [34] analyzed the mechanisms behind the three main driving variables for decision-making on urban regeneration, the government, developers, experts and the public. He pointed out that (1) the government effectively manages and controls urban regeneration through laws, regulations and planning management; (2) developers become the main investors and the executives of urban regeneration 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; (4) The relocation households pay more attention to the improvement of the material conditions and compensation than on its influence on living conditions.

Reviewing the urban renewal history of Chengguan District of Lanzhou City, Zhao Wei [26] found that Chengguan District results in regeneration affected by the external variables of the national policy, investment, construction and other external forces, and the internal variables of contradictions between land supply/demand and land use structure, contradictions between housing supply and demand, demands led by the improvement of environmental quality, demands of road network structure adjustment, imbalance in allocation of public resources, large discrepancy in living conditions and other internal contradictions.

Liu Yan [35] established a diversified and multi-level evaluation framework for counterbalancing economy, society and environment in urban redevelopment projects by combining theory with the practice of urban regeneration. She then suggested that the evaluation of urban regeneration should focus on the long-term balance of all variables that affect urban regeneration to promote coordinated development between economic, resource, environmental and social needs.

Further, there are also many scholars studying the influential variables associated with urban regeneration decision-making (Ingrid Nappi-Choulet [18], Bohumil FRANTÁL [36] etc.). The research results from these scholars are shown in Table 1.

Through reviewing the scientific literature, we find that the variables for decision-making on urban regeneration are complicated and complex, and different stakeholders place different values on the variables. Research from China generally focuses more on improving the social matters than literature from other countries, and the Chinese use it as a starting point for their work on urban regeneration. In China, urban construction land is State-owned. The government can levy land and houses on it according to the urban development demand and urban planning, with monetary or housing as compensation for the loss of the demolition households' real estate. But the relocation compensation causes great conflict between demolition households and the government. As a special social situation, the housing demolition and relocation problem becomes a major category of variables for decision-making on urban regeneration in China.

Table 1. Mark-up Variables for Decision-making on Urban Regeneration in Previous Studies

Literature	Author	Index	Key variables
A framework of decision-making factors and supporting information for facilitating sustainable site planning in urban renewal projects.	Hao Wang etc.	37	(15/19/15) Vegetation rate; Noise pollution; Local population; Local employment; Property values; Rents; Legal boundaries; Land ownership; Statutory requirements for development; Current land uses; Neighboring land uses; Road network; Traffic volume; Internal circulation; Access to major living services; Utilities for basic housing; Visual quality; Solar access; Wind direction
Critical factors for improving social sustainability of urban renewal projects	Edwin Chan etc.	30	(6) 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
Factors Affecting the Level and Form of Private Investment in Regeneration	Alastair Adair etc.	14	(12) rates of capital appreciation; rental growth; Quality neighboring 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 labor force
Evaluation of Investor Behavior in Urban Regeneration	Alastair Adair etc.	9	(6) Perceived total return; Security of investment/spreading of risk; New business opportunities; Competitor behavior; Company image; Social/community reasons
The Role and Behavior of Commercial Property Investors and Developers in French Urban Regeneration: The Experience of the Paris Region	Ingrid Nappi-Choulet	12	(5) Expected return; Diversification benefits; Risks (risk-level and risk-return); New business opportunities; Exit strategies
Urban Regeneration and Community Development- Literature review	Urban Regeneration and Community Development Group Department for Social Development	11	(6) Physical isolation; Environment; Private services; Employment and education; Composition of the Population; Public Security
Assessing Success Factors of Brownfields Regeneration International and Inter-stakeholder Perspective	Bohumil FRANTÁL etc.	25	(10) 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
Main Motive Factor and Its Function Mechanism of Urban Renewal	Sun Lianghui,Yan Zebo	/	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)
Research on Urban Re Strategy	Zhao Wei	/	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)
Exploration of Appraisal Methods for Urban Renovation Projects	Liu Yan, Zhao Min	31	Regeneration policy; Economic benefit; Social and cultural benefit; Ecological benefit

2.2. Selection and optimization of the influence indices of urban regeneration decision-making based on the expert interview method

In order to remedy deficiencies of early studies, and construct variables for decision-making on urban regeneration that are in accord with current urban regeneration projects in China, we select and optimize influence indices from the literature review. Ten urban regeneration experts were invited to discuss the selected indices using the expert structure interview form. Eighty two indices, I_i(i=1,2,…,82), for decision-making on urban regeneration were selected (Table 2) by summarizing and analyzing the interview results.

Table 2. Mark-up Indices for Decision-making on Urban Regeneration

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}	Building size	I_{51}	Employment rate
I_{11}	Building scale	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
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}	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 for decision-making on urban regeneration based on questionnaire surveys and factor analysis

3.1. Questionnaire design and distribution

The questionnaire is designed with the content of the respondent's basic information and 82 indices to extract the key variables for decision-making on urban regeneration in the form of the Likert Scale. Two hundred and fifty questionnaires are randomly distributed via email or street interception in Chongqing.

In order to discern each stakeholder's interest demands in the urban regeneration decision-making process, the decision makers should contains governors, real estate developers/investors and employees, experts/scholars, and the public (a generalized concept containing the demolished households and other residents of the city). The respondents of this

questionnaire survey focuses on these four categories of people, who are associated with urban regeneration in Chongqing. By investigating the variables that different stakeholders focus on in the decision-making, the variables identification affecting urban regeneration decision-making is completed using comprehensive and whole-staff-participation.

Two hundred and eleven questionnaires were collected, and 204 were valid according to the criteria whether the questions in the questionnaire are all answered and the answers are consistent. In the valid questionnaires, there were 44 governors (21.6%), 58 real estate developers/investors and employees (28.4%), 29 experts/scholars (14.2%), and 101 members of the public (35.8%). Fifty-four percent of the respondents in the cognitive situation of urban regeneration including its concept, participants, process, etc. were above the level of understanding. Further, 38.6% of the respondents were actively participating in urban regeneration at the time of the survey.

3.2. Extraction of key variables for decision-making on urban regeneration

The reliability text was carried out first using SPSS statistical software. Then, the key variables were extracted using factor analysis.

3.2.1. The reliability text

Nunnally suggests that the reliability text can have high credibility if Cranbach's alpha is above 0.6 in general exploratory researches, or above 0.8 in benchmark studies. The Cranbach's alpha was 0.977 for the reliability text of the collected questionnaires, suggesting the statistical data has high internal consistency and reliability. We then deleted the correction indices of its correlation coefficient with total score less than 0.4 [37]. Seventy-seven indices were preserved after geology (terrain, seismic hazards, landslide hazards), topography (elevation, slope gradient, slope aspect), climate (solar access, wind direction), building used life, and building quality were deleted.

3.2.2. Key variable extraction

We used factor analysis to extract the key variables for decision-making on urban regeneration from the 77 indices. The KMO 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; 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.

Forty-five indices, I'_i (i=1,2,…,45), were extracted after the first factor analysis. The cumulative explained variance was 67.810%. Wu Minglong [37] suggested that if the combined interpretation of reserved factors can achieve more 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 regeneration decision-making. The second factor analysis must be made because the factor structure changed after some of the indices were deleted. We classified the indices of the second factor analysis result according to its contents and internal relationship. Nine key variables (Table 3) were classified as 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), or investment behavior of developers/investors (V_9).

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

Table 3. Selection for Key Variables

Key variables	Index	Index	Factor load	Cumulative explained variance	Key variables	Index	Index	Factor load	Cumulative explained variance
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	55.434
	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

V_3	I_{40}	I'_{15}	0.610	36.867	V_8	I_{44}	I'_{38}	0.806	74.139
	I_{41}	I'_{16}	0.651			I_{45}	I'_{39}	0.828	
	I_{42}	I'_{17}	0.743			I_7	I'_{40}	0.603	
	I_{13}	I'_{18}	0.653			I_9	I'_{41}	0.735	
	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 most of the variation in the social welfare variable. Employment and education may reflect the physical and mental states of residents living in districts to be regenerated. Negative emotion of low-income residents easily leads to many social problems and is harmful for social stability due to the low level of social welfare, updated job insecurity, poor income and livelihood insecurity. In order to mitigate social conflicts, reduce the gap between the rich and poor, and stabilize regional migration, the government tends to provide employment opportunities and increase educational and medical institutions through urban regeneration. However, regeneration attempts often force indigenous people to move out. The social welfare of indigenous peoples has not improved, because social welfare efforts following regeneration are focused on new residents.

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

The economic and real estate development level variable includes the GDP, commercial activity, business and real estate investment, housing price and rent level, and differences in the average level of urban real estate market indices. Regional economic development levels are not only the embodiment of current economic situations, but also reflect the development potential following regeneration, and are the main consideration factor that the real estate developers take investment decision-making and the judgment basis that the government balances the regional development. Commercial activity and business investments are the economic basis of regional development, and are an economic and feasible evaluation criterion in urban regeneration decision-making. Regional economic, real estate development level and the feasibility of urban regeneration are positively correlated, and help promote each other. Therefore, the regional choice of urban regeneration, which is dominated by real estate development, tends to be based on the economic benefits, not on building aging.

(3) public facility (V_3)

The main public facility indices relate to education, health, sports, entertainment and other public facilities. The government supplies the public facilities to meet demands of public facilities and space. The shortage of public facilities inconveniences residents living in the district, negatively affecting their quality of life. The government tends to use real estate development effective supply of public facilities. However, real estate developers who only pursue profit reduce public facilities to improve their own benefits, contrary to the original intentions of the government. This pattern of urban regeneration 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 compensation method for demolition and resettlement. Demolition and resettlement is not only the primary link, but also the most important factor that impact the overall progress of urban regeneration. Urban regeneration brings about a rise in regional housing prices, because real estate developers have to raise housing prices to protect yields. 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 a 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 the indigenous people and the government. Demolition and resettlement compensation is the biggest conflict in stakeholders of the urban regeneration.

(5) infrastructure (V_5)

The indices with the highest interpretation degree are water, electricity, gas, and sewage treatment, and are associated with local infrastructure and are basic living securities. The government invests in constructing infrastructure in order to maintain the needs of residents. However, due to financial constraints, the government cannot fully meet the needs of all regions, and can only selectively invest in infrastructure construction. The government tends to get the maximum urban development effect with lowest fiscal expenditure in district selection. High amounts of governmental revenue are needed to make up 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 backward infrastructure acts as an obstacle for real estate development because it limits investment options for real estate developers.

(6) ecological environment (V_6)

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. 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 getting worse. Many indigenous communities are eager to improve the quality of the ecological environment. However, they must rely on the government due to their poor financial situation. The government tends to change the current situation through regional development. However, because regional development often results in driving out these communities, they do not benefit from governmental assistance.

(7) policy and planning (V_7)

Urban regeneration is subject to urban development policy. However, it also affects the urban planning. The local development strategy not only guides the development direction of urban regeneration, but also guides the investment direction of real estate developers through preferential policies. Through urban planning, the government restricts development behavior by real estate developers so that the regeneration results are in line with the overall development of the city. The old district's current development situation and its regeneration's possibility and feasibility also can provide the basis for urban planning.

(8) construction status (V_8)

The construction status variable that affects urban regeneration decision-making can be explained by four indices, building function layout, building density, building size and building scale. The original building function layout has gradually been eliminated by residents due to changing living habits. In order to adapt to modern lifestyles, residents meet their demands for building functional layouts through housing replacement. Within the scope of their financial conditions, the 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 the cost and make compensation difficult. These three indices are some of the main considerations associated with regeneration implementation by the government and investment decision-making of real estate developers.

(9) investment behavior of developers/investors (V_9)

Although urban regeneration is mainly led by the government in China, it is implemented by real estate developers, so developer investment behavior plays an important role in urban regeneration decision-making. It is also the most important variable for the implementation of urban regeneration. The key indices identified using factor analysis are the impact on corporate image and the behavior of competitors. Although it does not directly highlight the pursuit of profit, the corporate image established by urban regenerated 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 behavior of competitors can provide the basis for an enterprise's investment decision-making. However, it also relates to the growth of the enterprise. Therefore, the investment decision-making of real estate developers tends to choose the district that can enhance the corporate image and ensure a better earning rate.

3.3. Analysis of key variables for decision-making on urban regeneration

We used the entropy weight method to calculate and sort the importance of the above selected 45 indices with the questionnaire data. The quantity and quality of information accessed by decision-makers determines the accuracy and reliability of their decision-making. Entropy technology can use 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 [38]. We defined entropy H_i of the key influence index i using Equation (1), and the entropy weight W_i of the key influence index i using Equation (2). W_i is the weight coefficient of the key influence index i in urban regeneration decision-making.

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

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

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

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

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 behavior of developers/investors (V_9), demolition and resettlement compensation (V_4), economic and real estate development level (V_2), policy and planning (V_7) (Table 4).

Table 4. Sorting of Key Variables

Key Variable	Index	H_i	W_i	Comprehensive weight	Key Variable	Index	H_i	W_i	Comprehensive weight
V_1	I'_1	0.9900	0.0210	0.0256	V_4	I'_4	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			I'_{29}	0.9879	0.0254	
	I'_7	0.9862	0.0289		V_5	I'_{30}	0.9888	0.0234	0.0241
	I'_8	0.9870	0.0273			I'_{31}	0.9890	0.0232	
	I'_9	0.9888	0.0235			I'_{32}	0.9883	0.0246	
	I'_{10}	0.9883	0.0246			I'_{33}	0.9840	0.0336	
	I'_{11}	0.9921	0.0165		V_6	I'_{34}	0.9886	0.0239	0.0274
	I'_{12}	0.9926	0.0155			I'_{35}	0.9880	0.0252	
V_2	I'_{13}	0.9926	0.0155	0.0173		I'_{36}	0.9872	0.0268	
	I'_{14}	0.9914	0.0180			I'_{37}	0.9927	0.0153	
	I'_{15}	0.9941	0.0123		V_7	I'_{38}	0.9926	0.0156	0.0159
	I'_{16}	0.9919	0.0169			I'_{39}	0.9920	0.0168	
	I'_{17}	0.9910	0.0189			I'_{40}	0.9912	0.0185	
	I'_{18}	0.9890	0.0230		V_8	I'_{41}	0.9897	0.0216	0.0218
	I'_{19}	0.9894	0.0222			I'_{42}	0.9868	0.0277	
V_3	I'_{20}	0.9875	0.0263	0.0255		I'_{43}	0.9907	0.0195	
	I'_{21}	0.9891	0.0229		V_9	I'_{44}	0.9901	0.0207	0.0208
	I'_{22}	0.9868	0.0278			I'_{45}	0.9901	0.0208	
	I'_{23}	0.9853	0.0308						

Effective urban regeneration decision-making requires the participation of all stakeholders. In the analysis, the respondents covered the main stakeholders of urban regeneration. The key variables can comprehensively reflect the decision-making of the various stakeholders. Of the 45 selected indices, 30 are from are based off the present situation of the district to be regenerated, accounting for 66.67% of the total indices. These 30 are mainly from the five key variables V_1, V_3, V_5, V_6, V_8. And the importance coefficients of the five key variables are ranked in front of all variables. The five key variables include ecological environment, building and facility, social welfare and commercial activities. The importance of these five key variables shows that aging buildings, backward service facilities and serious environmental pollution become the main power to promote urban regeneration. The remaining 15 indices point to the interests of stakeholders in the process of urban regeneration that respectively 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, the public are in pursuit of more public resources.

The great contradiction between the demands of the people and the current situation in the aspects of the ecological environment, buildings and facilities, social welfare and commercial activities provides a possibility for the development of urban regeneration. Various stakeholders have certain demands and force to implement the demands in each aspect. In order to promote the coordinated development of the city, safeguard social stability and harmony, the government needs to increase public resource supply to old districts through the construction of infrastructure and municipal facilities projects. Additionally, the government must also guide the social capital flow and adjust the industrial structure layout through laws and regulations such as urban planning. Real estate developers/investors approach urban regeneration from a business standpoint, aiming for maximum financial benefits. The judgment basis of investment decision-making is based on the current 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 regeneration. These persons often explore the internal rules using scientific analysis, guiding the practice to realize balanced development of urban regeneration. Demolition households, as the most relevant interest group of urban regeneration, are keen to change the currently declining situation of old districts through urban regeneration to improve their quality of life. Other citizens of the public also hope more public resources will be provided with urban the regeneration.

However, the demands of each stakeholder cannot be fully realized due to various restrictions. For example, the government is limited by financially, so it tends selectively choose which districts receive urban construction investments, resulting in infrastructures and municipal facilities that do not perfectly match social demands. Moreover, the lack of a legal system, and slow city planning make the government lose control of the macroeconomic. The real estate developers/investors in pursuit of profits tend to avoid the poor areas to ensure a higher profit margin in the investment decision-making. This contradiction with the inner drive of urban regeneration is not conducive for implementing effective decision-making. The public in a passive position can't find the right way to maintain their rights and interests. Public demands cannot be expressed in urban regeneration. Businessmen also tend to select commercial hubs with developed economies and convenient transportation when choosing where to invest. This makes the economy of old

districts get worse. As a result, the old backward status prevents the regeneration. The many contradictions, the backward situation, as well as the interest demands of each type of stakeholder and few rights limited to claim all influence the urban regeneration decision-making.

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

3.4. Comparative analysis on the importance of key variables for urban regeneration decision-making among different kinds of stakeholders

We classified the questionnaires according the type of stakeholder that completed the survey. We divided the people into four categories, the government, real estate developers/investors and employees, experts/scholars, and the public part, which are the main stakeholders in urban regeneration. We sorted the importance of the key variables for decision-making on urban regeneration for each sort of stakeholder. We used the entropy weight method to sort the variables. The calculation Equation and process is the same as the previous section. The calculation results are shown in Table 5 and Figure 1.

Table 5 Sorting of Key Variables for Each Sort of Stakeholder

Importance Sorting	governors	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 insisted that the most important variables on urban regeneration are public facilities (V_3), infrastructure (V_5) and social welfare (V_1). This government's point of view is matched with the urban construction and public service, which are provided by the government to promote urban development, maintaining social stability.

Real estate developers/investors hold the view that infrastructure (V_5), demolition and resettlement compensation (V_4), and social welfare (V_1) 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. It determines the benefit level of regional development. As an important part of the development costs, relocation compensation directly affects the level of the total costs and the project progress. Therefore, as the variables affecting benefit level in regional development are infrastructure, demolition and resettlement compensation and social welfare, and are the influence variables that real estate developers/investors value most.

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

The public thinks that the most important variables for decision-making on urban regeneration are ecological environment (V_6), social welfare (V_1) and public facilities (V_3). As the place of 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 needs to change the current status through urban regeneration.

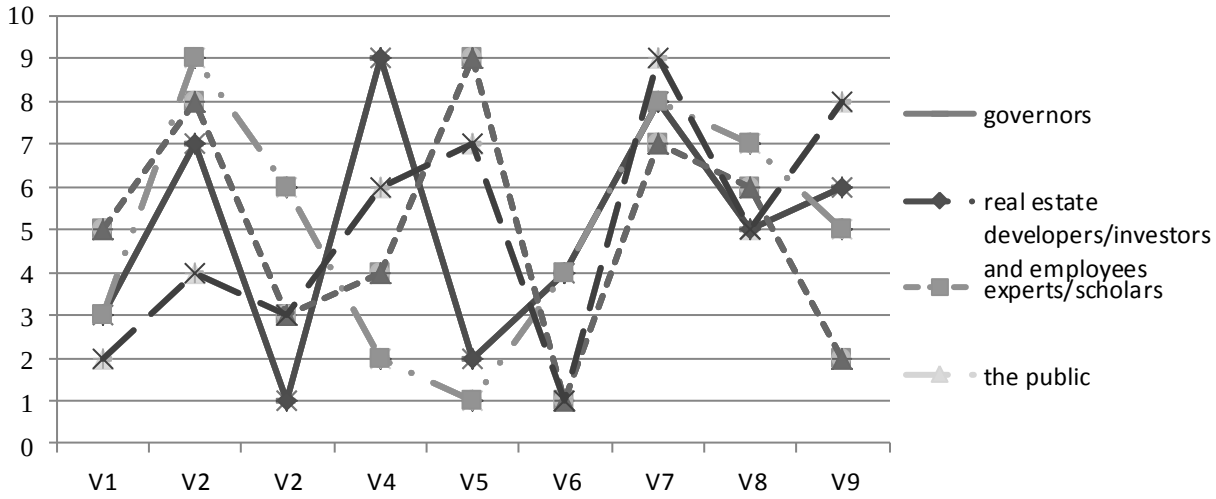

Figure1. Comparison Chart of Sorting for Key Variables in Each Sort of Stakeholder

The similarities and divergences of all the important key variables among the different kinds of stakeholders are clearly shown in Figure 1. The six variables that are most important for the four types of stakeholders are social welfare (V_1), economic and real estate development level (V_2), public facilities (V_3), ecological environment (V_6), policy and planning (V_7) and construction status (V_8). Social welfare (V_1), policy and planning (V_7) and construction status (V_8) show high consistency. There is little opinion bifurcation among the different kinds of stakeholders in urban regeneration decision-making for economic and real estate development level (V_2), public facilities (V_3) and ecological environment (V_6). Further, there is no opinion bifurcation among the different kinds of stakeholders for urban regeneration decision-making about social welfare (V_1), policy and planning (V_7) and construction status (V_8). The contradictions among the different kinds of stakeholders exist for demolition and resettlement compensation (V_4), infrastructure (V_5) and investment behavior of developers/investors (V_9). The government and real estate developers/investors seriously disagree on demolition and resettlement compensation (V_4). 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 regeneration to improve and coordinate the overall level of economic and society. There is serious opinion bifurcation over infrastructure (V_5) between experts/scholars, the public and the government, and real estate developers/investors. Currently, water, electricity, and gas condition are good in most old areas infrastructures, so the public does not wish to change these before they fix the building aging, the deterioration of the ecological environment, backward public facilities and other major problems. But experts/scholars pay more attention to social contradiction. As a result, infrastructure (V_5) has not been a key evaluation criteria that experts/scholars and the public to carry out in urban regeneration 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 infrastructure (V_5) to be an important variable affecting their interests and positions in urban regeneration decision-making. For the investment behavior of developers/investors (V_9), the public and experts/scholars do not agree. The public does not pay much attention to the development trend of old districts. So the investment behavior of developers/investors has little influence on their urban regeneration decision-making. The experts/scholars are more familiar with the urban development trend through research on economic behavior, and it is one of the main variables they use for urban regeneration decision-making.

To sum up, there exist similarities and divergences in opinion on which variables have the strongest affect urban regeneration decision-making among the different kinds of stakeholders. These divergences result in opinion bifurcation. The predicament of unbalanced benefit in each sort of stakeholder will be long existing without resolving the opinion bifurcation. This is the root cause of imbalance interests due to the different statuses of stakeholders under the imperfect urban regeneration decision-making mechanism. How to make a trade-off for variables which exists opinion bifurcation among different kind of stakeholders is the key problem to realize equalization development of interests in urban regeneration.

4.Conclusion

This paper identifies the key variables for decision-making on urban regeneration and how the importance of key variables diverges among the different kinds of stakeholders. Eighty-two influence indices were identified through a

literature review and using expert interviews. Then, 250 questionnaires designed in the 5 Likert scale form were sent to four sorts of stakeholders, governments, real estate developers/investors and employees, experts/scholars and the public, associated with urban regeneration. Forty-five 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 behavior of developers/investors (V_9), were identified, and 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 regeneration projects. They can provide a decision-making basis for comprehensive development of urban regeneration. This information is helpful for further research on constructing urban regeneration decision-making evaluation systems.

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

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