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The Pre-Adoption Evaluation Method for Environmental Protection#

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Abstract: Urban planning is the space expression of urban resource configuration. Its central goal is using the effective resource with the lowest ecological cost in exchange for the greatest economic benefits. The current city's expansion which is dominated by the development, is too fast, which has overlooked the balance between planning and environmental protection. The contradiction between urban development and environmental protection is becoming more and more acute. In the current urban planning practice, planning is required due to lack of effective analysis and evaluation for environmental problems. Related researches regard "environmental impact assessment (EIA)" as the central content of the planning. The article summarized some methods of "the pre-adoption evaluation" that are related to environmental impact assessment; and try to put forward the basic train of thought which is according to "the pre-adoption evaluation" for urban planning.

Keywords: Environmental impact assessment (EIA), evaluation methods, the pre-adoption evaluation, urban planning.

1. RESEARCH BACKGROUND

In 2013, "smog" became the annual keywords. According to a report, in 500 largest cities in China, only less than 1% of the cities are up to the air quality standards which recommends by world health organization and 10 of the world's most polluted cities out of which seven are in China.

Look from the view of overall development around the world, economic development and environmental quality deterioration presents a certain degree of positive correlation. American ecologist ***Paul r. Ehrlich*** has put forward the IPAT equation, I = PAT. I (impact) shows the effect of human activities on the resources and environment; P (population) express the population; A (the affluence) indicates the degree of resource consumption per capita; T (technology) denotes the extent of the damage to the environment which is made by the various technical requirements of consumer goods [1]. In 1991, American economist ***Grossman*** and ***Krueger*** proposed the Environmental Kuznets Curve (the EKC curve) (Fig. **1**) [2]. The curve showed that only when there is economic development to a certain level, and the whole society attaches great importance to environmental protection and management, the positive correlation will appear as a "critical point", then the environmental quality may turn better.

As Chinese urbanization process, the contradiction between urban development and environmental protection is very sharp. The core content of urban planning is the reasonable configuration of space. Based on the further study of land use, spatial form and so on can be scientific guiding urban development activities, reducing motor vehicle traffic, protecting the ecological green land, and balancing the relationship between human economic activities and environmental protection. A lot of research on "compact city" in Europe is trying to confirm the close contact between space morphology and environment [3].

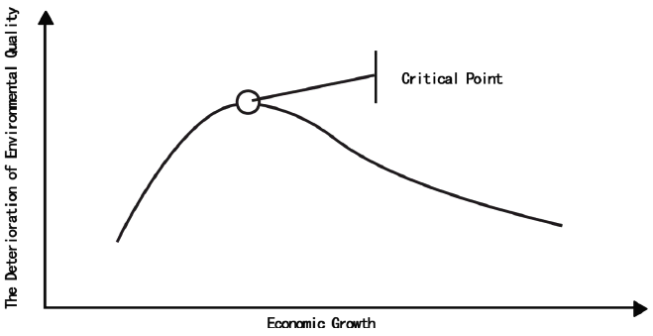

Fig. (1). The environmental Kuznets curve [2].

2. THE MAIN REASONS OF THE "ABSENCE" OF ENVIRONMENTAL PROBLEMS IN URBAN PLANNING

2.1. One-Sided Pursuit of "Expansion" While Ignoring the Ecological Costs

Since the 1990s, under the "separate of powers" of financial system and the "GDP as the core" performance evaluation standard, the first task of the planning has become how to increase the attraction of cities, and to attract investment better [4]. City governments make decisions more based on their own economic interests, similar to the competition between enterprises [5]. Only pursuit of economic growth leads to ignore of natural ecological, the "big increment" as the goal, that is the government relying too much on administrative means to promote the development of economy and urbanization. Ignoring the planning has important role in maintaining social justice and ecological balance [6, 7].

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2.2. Lack of "Pre-Adoption Planning Evaluation" to Environmental Problems

Urban planning evaluation refers to the "on urban land use and growth management planning about environmental, social, economic, financial and infrastructure of the implementation of the systematic assessment" [8, 9]. According to the process of planning evaluation, Edward· J· Kaiser (1995) put forward "pre - adoption " and "post - adoption" evaluation [10]; E. Talen (1996) put forward "Evaluation prior to plan implementation "and" Policy implementation analysis" [11]. Alexander (2006) proposed three kinds of evaluations: "in advance", "process" and "afterwards". "Pre-adoption" evaluation has a great significance for rational and carefully chosen planning guidelines.

At present, the urban planning evaluation of our country is mainly based on "post-adoption evaluation". In 《The overall urban planning implementation evaluation measures (trial)》 (Build rules [2009] No. 59), specify the content of the overall urban planning implementation evaluation, mainly including the alignment of development of the city and the spatial structure to the planning, the implementation of periodic planning objectives and the compulsory goals. Therefore, in view of the overall urban planning evaluation, primarily a conformity assessment is required [12].

2.3. Separation of EIA and Planning, Objectively Caused a "Fait Accompli"

Urban planning and EIA is not really a fusion, often the planning is planning, and the EIA is the EIA. Technical personnel cannot be fully involved in the formation of the planning scheme and the optimization process [13], since both are not associated fully. From the point of intervention time, environment evaluation was not involved in planning formation stage of the project. Now most EIA are reflective evaluation, namely, planning at first, followed by environmental assessment. Evaluation personnel can only evaluate restrictive on the basis of planning, give suggestions for adjustments, and therefore, it is difficult to fully participate in the planning process from the environment point of view [14].

3. THE BASIC METHOD OF "PRE-ADOPTION EVALUATION"

The "Pre-adoption evaluation" is not only the design tool, but also is a decision making tool. At this stage, the evaluation method is mainly used to put forward the mitigation measures and analysis strategy for the impact of the facilities, and social and environmental disasters which bring about by the developmental projects. [15] At present, combined with environmental protection issues, pre-adoption evaluation method mainly has the following categories.

3.1. Scheme Comparison Method

The most intuitive evaluation method is scheme comparison, comparing the two alternatives together. This evaluation method is simple and practical, especially makes a non-professional quickly understand the visual image of the difference between different planning. Intuitive scheme comparison method was qualitative discrimination before the next step of quantitative evaluation. Making use of comparison and selection can undertake the preliminary assessment, and determine the apparent advantages and disadvantages, at the same time, exclude the obvious adverse scheme to simplify the difficulty of the follow-up in-depth evaluation.

In 1972, Gruft and others put forward a more concrete planning scheme "comparative research and professional evaluation" [16]. On evaluation, usually put together a few schemes for systematic comparison; what needs special attention is that these schemes must have "main distinction", that is different from the concept of specific planning results; such as forbid development of agricultural land, ban to destroy culturally historical building, *etc.* In accordance with specific conditions, several evaluation index of one project can be put forward, like no effect, uncertainty, beneficial effects and harmful effects. If it is for social impact evaluation, it may also be divided into short-term effect and long-term effect. If it is based on the aspect of environmental impact, the assessment will be reversible affects and irreversible affects, *etc.* This schemes comparison after a detailed classified is beneficial to identify the key factors affecting the potential effect, which can help policymakers make their choice.

3.2. Tabulation Method

Planning is a complex process of relative balance, seeking the interests of all parties. Intuitive "scheme comparison" often cannot reflect the comprehensive correlation factors, therefore, it needs to list the potential impact of assessment which needs to be considered in the process of evaluation, to evaluate the influence of various factors individually, to finally obtain the evaluation results.

Schenman (1976) [17] proposed the list (Table **1**) of indicators to evaluate the land development, including environment, aesthetics, culture, *etc.* He thinks that the indicators will be a very effective comparison tool, they can be used by general planning personnel, and compiled into easy-use form. If the output data are comparable, they will be adopted by policy makers, as decision-making basis.

For the relationship between planning and environmental impact, evaluators can put forward some special consideration of indicators as a critical value or "threshold" to assess the impact. For example, the frequency of air pollutant concentration is changed; farmland loss is achieved to a certain degree, *etc.*; The association between number and importance is no longer presented as a simple linear relationship. There may be a single limit relationship, multi-limit relationship, no regression point for relationships, and other conditions.

3.3 Elements Overlap Method

In the 1960s, Ian McHarg I put forward "layer-cake model", by which he hoped to scientifically analyze the causal relationship between factors of planning. Namely, according to the performance of the regional natural environment and resources, through the analysis and sorting results of the matrix, compatibility degree and so on to ensure that the land development coordinate with the human activities, the characteristics, and the natural process (Fig. **2**).

For example, in his Richmond road selected scheme research, using the method of superposition of images obtained

Table 1. Standards of land development impact [17].

Affected areas and sub areas		Usually available to evaluate			
		Comprehensive planning. Cumulative effect. Large rezoning	Small and medium-sized rezoning		
The preferred standard	Alternative standards		Live redistricting	Commercial, industrial division again	Basic of Evaluation
The natural environment					
Air quality Health The frequency of air pollutant concentration change and the number of at risk	The standard relative to the Air pollutant concentration change	×		×	Current environmental pollution concentration: current and expected emission concentration and diffusion model: population map
	The change of pollutant emissions relative to the "budget" or the target				
Public nuisance Air quality in the visual (smoke, fog) or changes in the sense of smell (smell), and the number of people affected	Air quality hazards (qualitative judgment) the possibility of change or different severity	×		×	Citizens of baseline survey of industrial processes: it is estimated that the transportation capacity
The water quality Allows each related and can tolerate change with water and water affect the number of people	Each of the standards of water pollutants concentration relative to the change	×		×	Current and anticipated wastewater: environmental concentration at present: the water quality model
	All kinds of pollutants discharged into water bodies relative to the "budget" change				
The noise The noise level and the change of the frequency and the number of people suffer harassment	Traffic volume, the change of noise barrier and other factors may affect the noise level and cognitive degree of satisfaction	×	×	×	Near the traffic or other noise source and the change of the noise barrier: the noise propagation model and involves the monograph: such as traffic noise, noise barriers for the noise level of satisfaction of citizens baseline survey
Wild animals and plants Wild animals and plants (including trees) changes of common species diversity and population size (abundance)	(a) according to the habitat of the classification of the animal; (b) green space; Or (c) the number of mature trees in the change of the quantity and quality	×	×	×	Wildlife and vegetation of the listing, expected vegetation to reduce or habitat change
The change of the rare and endangered species	Same as above	×	×	×	Same as above
Natural disasters Flood, earthquake, landslide, debris flow and other natural disasters caused the frequency of life and property loss	The change of flood frequency	×	×	×	Flood plains and other disasters distribution: the change of local topography and drainage: the change of the proportion of water seepage surface water flow and hydraulic model
	The proportion of impervious cover land relative to the "budget" level of change	×	×	×	
Aesthetic and cultural value					
Attractive Satisfied with the neighborhood features of quantity and proportion of citizens	Appeal to the physical condition of interference; Conditions of eliminating/improvement There is no appeal	×	×	×	The attractiveness ratings and assets and citizens of baseline investigation: through modification pictures, draft and the image simulation methods such as 3 d model to evaluate development plan for the future of the parameter selection of sampling survey
View the opportunities Family (enterprise) vision satisfaction for changes in the proportion of citizens	Vision is blocked, deterioration and improve the family number (enterprise)	×	×	×	Citizen of baseline investigation: geometric structure analysis. To make sure that vision before and after the development opportunity
Landmark Culture, history, or science to reduce the number of landmarks and important consciousness. Lead to more difficult to close to or more accessible	Rare landmarks and to the recent decline in similar (or make) more accessible to the landmark case of distance	×	×	×	List of landmarks and importance ranking: and scholars about the importance of investigation on the community

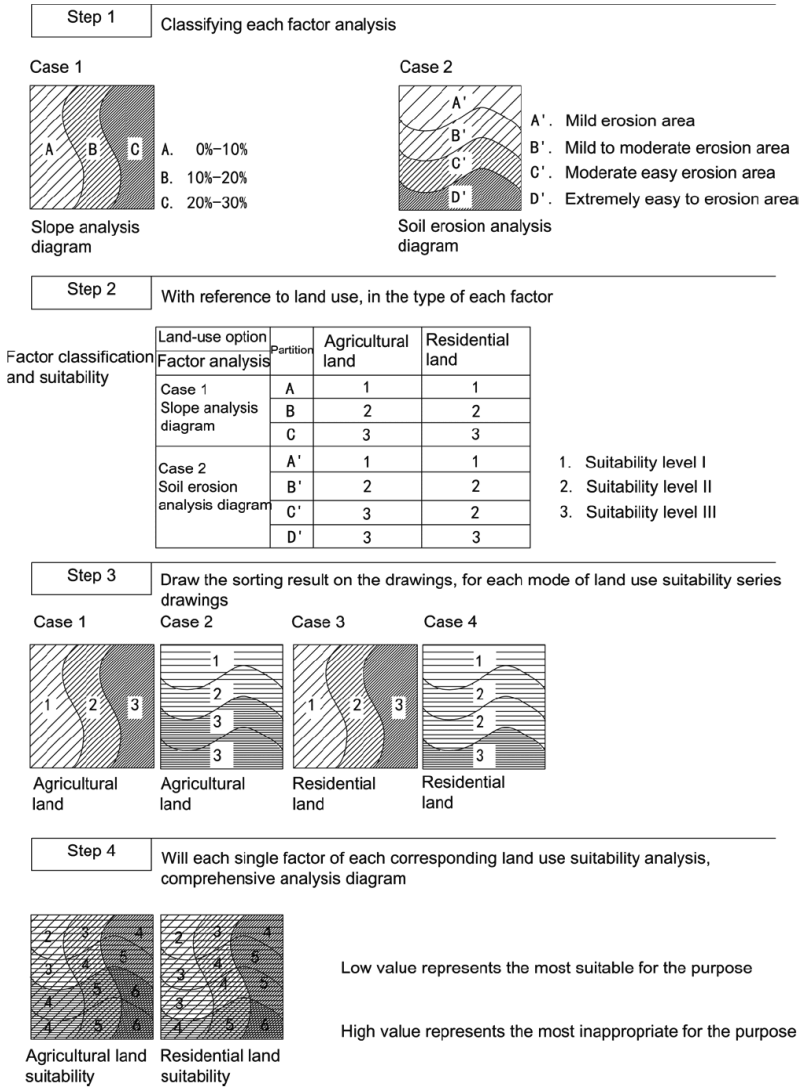

Fig. (2). Suitability analysis process of McHarg [19].

the image of the social value and natural geographical barriers. Use of this conclusion persuades transportation committee to give up the decision that the highway across the precious green belt, is accepted for the route selection scheme which has the lowest social cost and the better bearing capacity of natural resource. Thus, it could achieve the effect "best route should be the biggest social benefits and minimum social cost" [18].

Elements overlap method has the advantage of decomposition factors such as society, economy and environment, and shows the overall social value and social loss item by item by using the method of superposition. These ingredients mutually accumulate to form a value system. The basic logic of this approach is that the result made by different elements overlap is the most scientific and reasonable. For some plan elements which cannot be accurately given the weight of the evaluation, this method is more intuitive, and guarantee the possibility of operation.

3.4. Cost-Benefit Analysis

In economics "Karl - hicks" standard, it is believed that only when the winner income can completely offset the losers loss to make things better, a policy will be adopted [20]. Let's plan the positive effect as earnings, and negative effects as cost, according to the economics principle, a plan is to try to bring the maximization of social surplus.

In 1956, Nathaniel Lichfield put forward the theory of "social impact assessment" for the first time, combining the cost-benefit analysis method and subjective values orientation, which can use quantitative or qualitative methods for analysis. This method first applied in the evaluation of traffic planning, and then popularized for land use planning, *etc.* (Fig. **3**).

In 1968, Hill combines cost-benefit method and quantitative value list method to "Goals - achievement matrix". The study is very important for the problem in that who benefits and who pays out when using different solutions to reach their goals. Although on abstraction, Goals-achievement matrix is attractive for it showed the influence of planning, but its feasibility is restricted to the degree of the required special cost-benefit analysis, and how to reach a consensus on the weight allocation, and the final score presenting possible variant in the process of measuring. Whether the

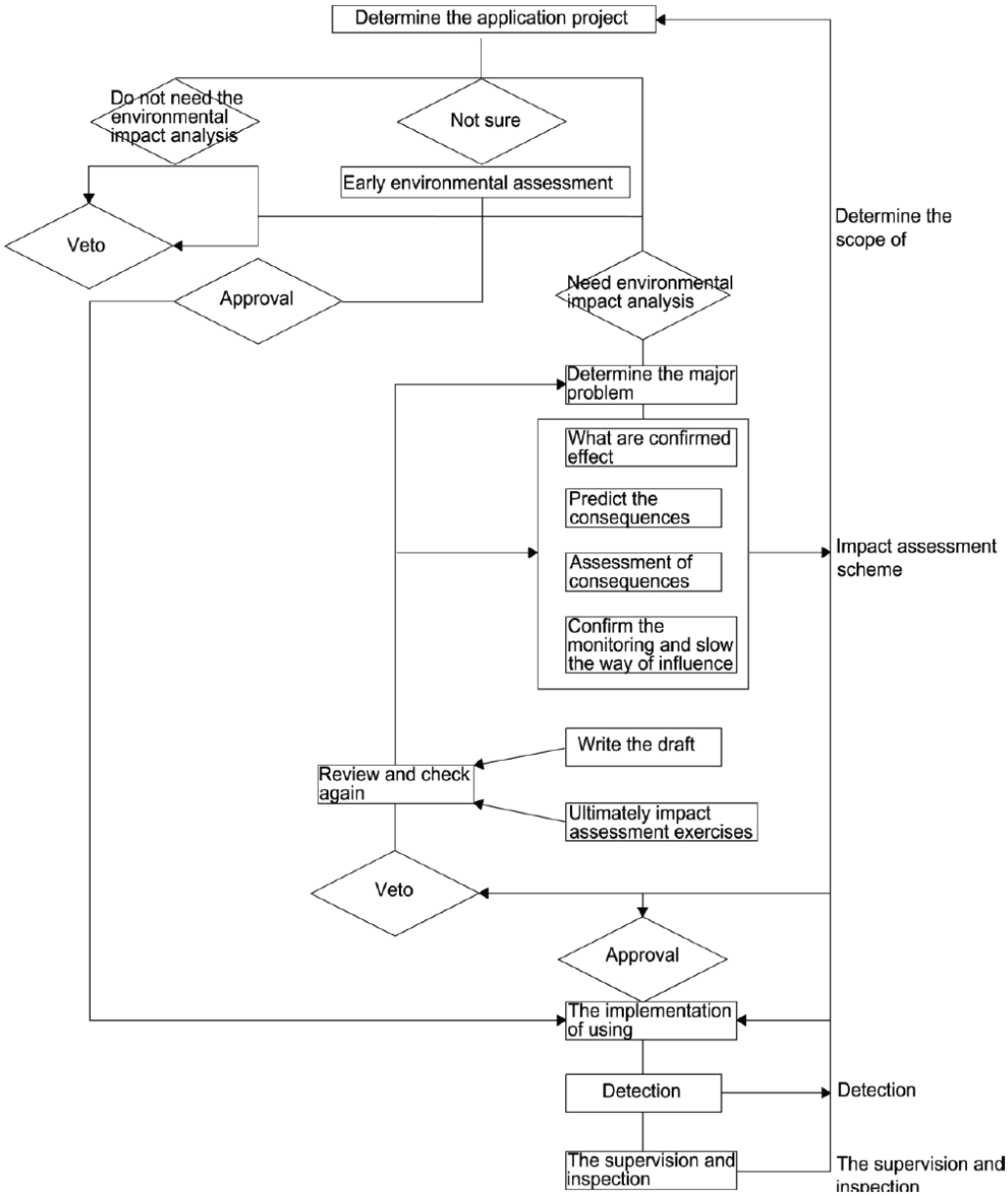

Fig. (3). Social impact assessment process framework [21].

results of the analysis of the matrix can be accepted depends on the opinions of policy makers and interest groups given the target.

Cost-benefit analysis is an important method for evaluating the planning in many developed countries. But the cost-benefit analysis does not apply to all areas, especially for environmental protection and other aspects of the maintenance of public interest.

In case, when all costs and benefits cannot be monetized you can use the "cost-effect analytical method" as it can take the “form of incomplete." When go on “cost-effect" analysis, first of all, make sure all the important achieved policy objectives and other main indexes are present, then put forward a series of alternative offers, compare the alternatives, and then select the minimum cost plan. When planning can achieve a number of different beneficial "effects", for it may involve many aspects of comparison, you can use the quantitative evaluation method, to distribute different weights to different "effects", scores according to the alternative effect, ultimately determine the high score and low cost solution.

3.5. Cumulative Effect Method

The cumulative impact assessment focuses on the long time monitoring information, and supply and demand comparison of each scheme, rather than the influence of isolated, or individual scheme. Specific to the environmental impact assessment, cumulative environmental impact assessment process is not as intuitive and concise as independent scheme evaluation; the main difficulty is the lack of the environmental impact parameters of previous projects (Fig. **4**). If you want to monitor the environmental systems, you must establish a series of datum, so you can obtain a time series

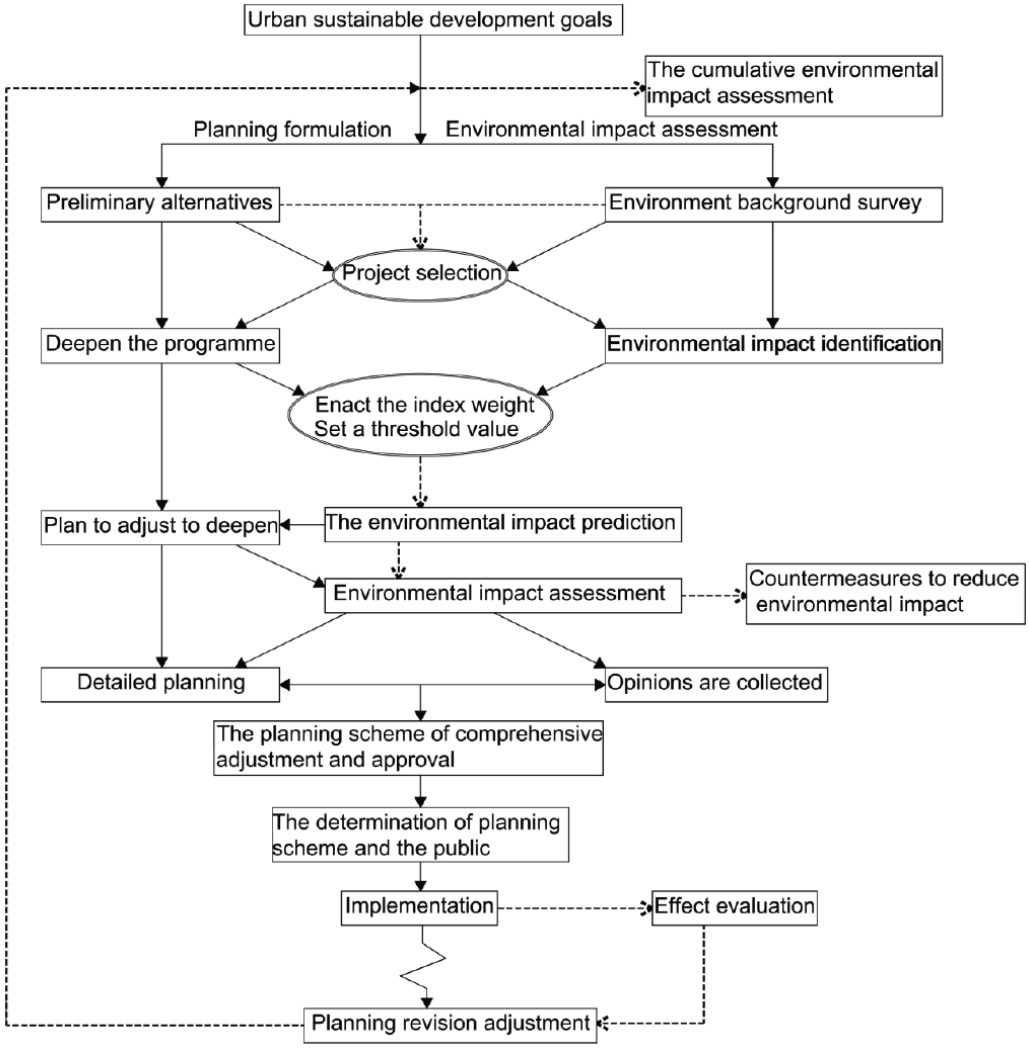

Fig. (4). The pre-adoption evaluation method for environmental protection.

data to determine the type and degree of environmental changes [22]. These models focus on the impact of natural ecological system on "gathering", these effects will happen before the new effects will occur. A series of "fragmentary" influence gathering themselves together in a very close time and space, can cause the ecosystem recovery delay before the new effects occur. Through these models, it can be found that the influence of unpredictable effects is bigger than that of early influence or beyond the system capacity or natural boundary. At present, the development of the cumulative effect analysis is not perfect, and so it still needs a lot of basic research work. But this kind of method is performed most close to the real situation, and objectivity for the environment problems, which may appear in the process, accumulated over a long period.

4. BASIC THOUGHTS OF "PRE-ADOPTION EVALUATION" OF URBAN PLANNING ACCORDANCE WITH ENVIRONMENTAL ASSESSMENT

4.1. Integration and Synchronicity (Fig. 4)

Integration. First is the fusion of starting point. Urban planning is to achieve the sustainable development of city, environmental protection and improve as the primary standard of rationality assessment plan is necessary. And evaluation is to ensure that planning is moving in that direction. Only goal unification can achieve the organic integration of planning and evaluation. The second is the fusion of process. The pre-adoption evaluation is carried out before the plan stage, especially to perform full analysis of environmental impact assessment, and formulate measures for reducing environmental impact.

Synchronic. In the past, urban planning, evaluation and examination according to the time sequence, make a longitudinal phase, *i.e.* occurring one after another. If the evaluation results suggest to modify planning scheme and the duration of the process will be longer, carrying out planning and evaluation together can reduce the time of the planning and evaluation, improving the efficiency. Thus, the problem that environmental impact assessment cannot intervene planning early in the past is solved.

4.2. The Basic Evaluation Objects and Contents

Table 2. Basic evaluation objects and contents.

	The evaluation factors	In view of the object	Environmental objectives
The environment Impact assessment	The natural environment	The water environment	● control of regional water environmental pollution, ● to maintain and improve the surface water and groundwater water quality and aquatic environment, ● Guide the effective utilization of water resources
		Air quality	● control the urban air quality index, index of PM2.5 and PM10 ● control city smoke control area coverage Began in automobile exhaust success rate
		Natural characteristic protection	● respect for the area existing natural features and combination ● Reduce earthwork, vertical
		greening	● Urbanization area green coverage rate, the per capita green space and the per capita public green area
		The open space	● reduce the building density, increase the urban open space ● Cluster development and effective space such as model
	Artificial environment	Noise environment	● control the regional environmental noise level ● control near the city traffic trunk line noise level ● Ensure residential noise sensitive acoustic environment, *etc*
		Solid waste	● living garbage classification collection and resource utilization ● industrial solid waste comprehensive utilization ● Municipal solid waste landfills and incinerators and residential areas, the proximity of ecological sensitive area
		The local climate to improve	● Planning and construction of the possible impact of including sunshine, air, wind
		Light environment	● Light reflex, architectural lighting effect on the public environment
	Resources and environment	The land use efficiency	● intensive use of land resources ● increase the old change and use in brown ● Control the spread of city
		Wildlife protection	● The diversity index
		Wetland protection	● The coastal zone and to protect the wetland system is given

4.3. How to Use "Pre-adoption Evaluation" Method

Table 3. The basic evaluation method and suggested using stage.

	Evaluation method	The characteristics and effects of	It is recommended to use links
1	Scheme comparison method	● simple and intuitive ● scheme comparison, in the early design stage to determine the main difference and trade-offs ● Simplify subsequent evaluation work	● Planning scheme selection
2	Tabulation method	● a comprehensive list of environmental background elements ● preliminary identification of the environmental impact ● weight comprehensive evaluation results can be introduced ● Can be combined with threshold to control the decisive factor	● Planning scheme selection ● Environment background survey ● Environmental impact identification
3	Elements overlap method	● establish the superposition of a connection between environmental impact factors ● Can judge the preliminary intuitive superposition environmental impact	● Environmental impact identification ● Preliminary forecast planning environmental impact
4	Cost-benefit method	● the quantitative analysis of the environmental impact ● Quantify the results reflecting the environmental impact assessment	● Planning environmental impact assessment
5	Cumulative effect method	● a comprehensive analysis of space over a period of time, the cumulative effects of factors such as changes ● System is complex, need support planning implementation evaluation data	● The cumulative environmental impact assessment

CONCLUSION

In the process of dealing with global climate change, especially in the process of the urban environmental improvement, the planning ability of the government is important. Its institutional framework of the urban planning is especially worth exploring. In urban planning, it needs: to pay attention to the urban elements overall, to emphasize the synergy between the government, enterprise and personal; to respect the foundation of the city development, instead of implementing the same planning concept in different cities [23]. The criteria for evaluating the environmental awareness is called "people-oriented" which will gradually detail evaluation targets that will extend from the space environment to social justice, eco-friendly and sustainable economic *etc.*

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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