

## Research on the Urban Environmental Construction Index

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**Abstract:** This study describes the status quo of domestic and international environments index, proposes the purpose and significance of the capital city environment construction index. On the basis of studying the basic theory and the index system of the environment index theory, put forward the concept of capital city environment construction index, its content and analyzes the principles and construction methods of environmental index's three most commonly used indicators system, namely, the DPSIR model, Life Cycle Assessment (LCA) model and basic index system.

**Keywords:** Concept, content, design methods, environmental index

### INTRODUCTION

The urban environment is an important aspect of urban soft competitiveness, the base, source and the target of urban development, directly related to the public interest, related to the life quality of the masses and the sustainable development of urban society and economy; the construction of the urban environment includes construction and management of urban public utility, municipal facilities, public environment and urban order. Urban environmental construction standards should be the Interco ordination between people and the environment, high degree of harmony between economic development, social progress and environmental protection in urban construction, improve the natural and social environment, enhance urban functions and values, so that the city enjoy stable, coordinated and sustainable development.

The construction of the urban environment requires not only improve coordination and command working mechanism, need to create a complete set of scientific and operational running state comprehensive analysis methods and prediction models, so as to conduct real-time dynamic monitoring of the data of all kinds of signs in the capital urban environment running, diagnose the operational status and development trend of the capital city environment timely and accurately to measure the capacity of the urban environment whole operation. The construction of the urban environment covers wide range and many departments are involved, requires a strong institution and effective ways and means to co-ordinate. Ronchi *et al.* (2002) analyze a system oriented integrated indicator for sustainable development in Italy. Peter and Ron (2000) have a study of the sustainability assessment of development scenarios: methodology and application to Thailand.

Christoph and Patrick (2007) have a research of the measuring the immeasurable-a survey of sustainability indices. Manal *et al.* (2008) study the environment and sustainable development indicators in Lebanon: a practical municipal level approach. Bohringer and Patriek (2007) have a research of the measuring the immeasurable: a survey of sustainability indices. Hezri (2004) study the sustainability indicator system and policy processes in Malaysia: a framework for utilization and learning. Nader *et al.* (2008) have a research of the environment and sustainable development indicators in Lebanon: a practical municipal level approach. Nourry (2008) study the measuring sustainable development: some empirical evidence for France from eight alternative indicators. Xu (2004) have a research of the statistical index theory and its applications.

Therefore, it is necessary to study the concept, content and design methods of urban environmental construction index. Provides a way to rationally measure the pros and cons of the urban environment construction, plays a role of macro-guidance, feedback and testing in guiding the next level of planning. However, environmental construction index shall not blindly copy advanced standards of foreign city, but proceed from the reality of national and city conditions, closely combine socio-economic development and urban form planning, pay attention to handling the relationship between the layout and planning standards in different regions of a city, between socio-economic indicators and site layout vector elements, between urban planning indicators selection and the world cities standard.

Currently, urban environment construction has not formed a complete, true evaluation methods system.

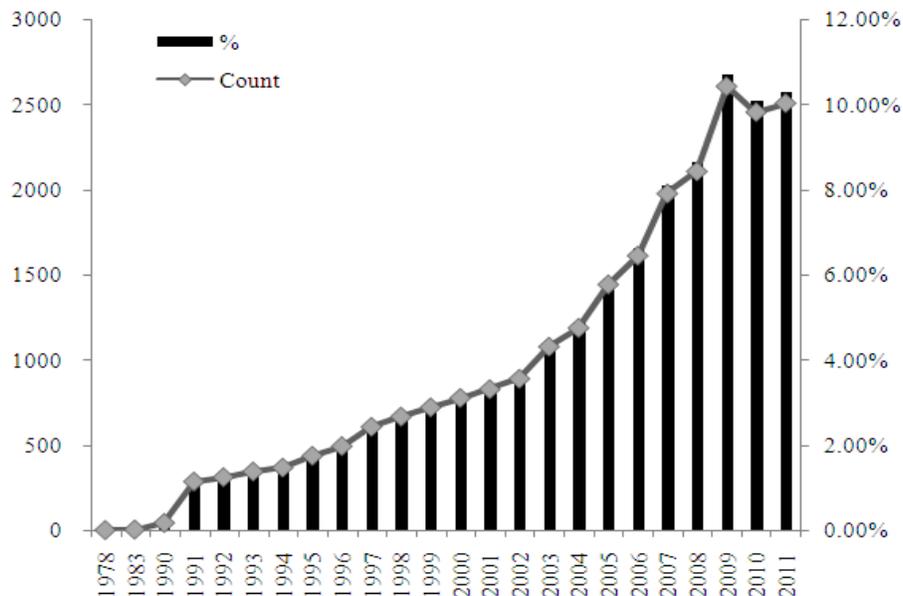


Fig. 1: The number of year in the retrieved documents (1978-2011)

Therefore, it is of great significance to develop and improve the urban environment construction index, gradually form a set of macro, meso and micro-level evaluation of the object-oriented environment construction evaluation system, promote in-depth research and practice of the construction of urban environmental evaluation, to improve the quality of urban environmental construction evaluation.

There are research results presented in the related fields of environmental index concept, connotation and design methods, which are closely related to the accumulation studies of the environmental index and study conducted in this article has highly scientific value for the research on the concept, content and design methods of environmental construction index.

**Research status:** The research on the environmental index is very wide in China and many scholars have studied it from different perspectives, which thereby aroused varied corresponding words and phrases. Based on the theoretical analysis, the thesis conducted the researching on the environmental index in the database from Science Citation Index (SCI Expanded, SSCI, CPCI-S, CPCI-SSH, IC, CCR-EXPANDED). The results are as follows.

The study about environmental index in database has 24388 as Fig. 1. Science focus continued to increase, the average growth rate of nearly 5% years, in recent years has been more than 10% of the rate of growth. Environmental index has become a research hotspot of great scientific value.

In the retrieved documents as Fig. 2, environmental index involve many research field. Environmental science (3621, 14.85%), engineering (3610, 14.80%), computer science (2507, 10.28%) and others outstanding performance. Many researchers in the basic theory and method of measuring have a lot of groundbreaking research.

Environmental index related concept, content and design method of correlation analysis in Fig. 3

In the environmental index is related to the field of concept, content and design method are related to the research results and environmental index research accumulation is closely related to and based on the concept, connotation and construction of environment index design method research of great scientific value.

Among them, the indicator system provides a ruler to measure the state of economic, environmental and social development among States, includes index systems with great influence in the world. These evaluation methods have their respective strengths and weaknesses in the selection of indicators, weight set and the applicable ranges, the use of different methods to measure the degree of sustainable development in the same region may also show difference in results (Bohringer and Patriek, 2007). Of course, the selection of indicators of sustainable development must also consider the spatial and temporal scales in different regions, as well as policy makers' intent. This study develops a complete set of sustainable development evaluation system based on characteristics of social, economic, environmental and resource system in Italy

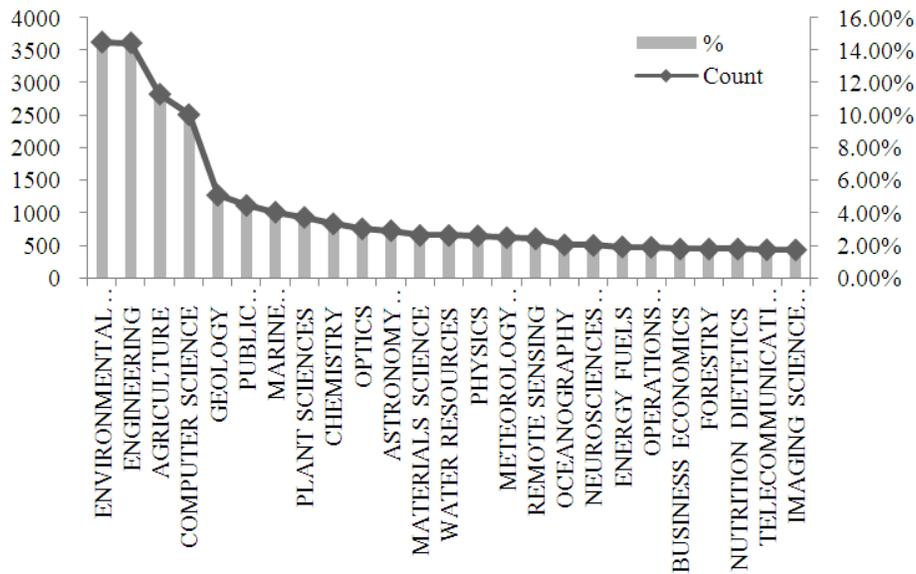


Fig. 2: Research field in the retrieved documents

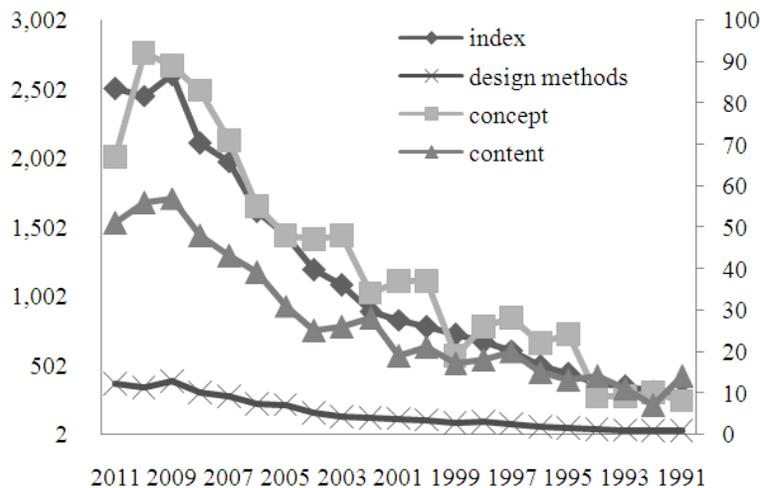


Fig. 3: The correlation analysis in the retrieved documents

(Ronchi *et al.*, 2002) and through measuring the gap between target value and actual value of the relevant indicators to quantitatively estimates the sustainable development state of Italy; propose relevant measures on the basis of regional system analysis, use "critical threshold" and "tricolor model" to quantitatively and vividly reflect the state of sustainable development in Thailand; the establishment of Lebanon municipal system of sustainable development indicators was formulated by the local broad participation of government officials, research institutes and non-government sector organizations, through theoretical discussions, finally screened 110 evaluation indicators

covering four categories, namely: population and social economy, economic activity, the environment, sustainable development activities and policies (Nader, 2008). Scholars have pointed out that the study of indicators of sustainable development ignored the intrinsic relationship between indicators and policies, its cause lies in the policy issues, technical issues, communication problems and policymakers inherent theatrical defects and so on Hezri (2004).

Our environment index has a strong potential for development, started from the discussion of the demand for environmental index in 1958, evolved into the full range and multi-level study of concept, content,

technology and methods, becoming a hot and difficult issue in the field of sustainable development. According to China Resources Environmental and Economic Accounting System Framework developed by the State Environmental Protection Administration in 2004, "the environmental pollution is divided into two parts based on environment pollution cost: cost of pollution control and environmental degradation cost, due to the polluting process is complex and difficult to measure, environmental degradation cost caused by pollutant emissions is the most crucial part in the price valuation of the environmental pollution. In addition, by setting the evaluation index system, adopts some evaluation methods to conduct quantitative measure of the level of sustainable development is also commonly used in China's evaluation methods and means. Since 1995, China gradually launched creating ecological provinces (municipalities and counties) and environment-friendly enterprises and other "green creation" activities and proposed acceptance standard of evaluation index system of ecological provinces (municipalities and counties). The system encompasses three aspects of economic development, environmental protection, social progress; from January 1, 2007, the State Environmental Protection Administration (SEPA) conducted rating assessment according to the newly developed indicator system of the "National Environmental Protection Model City", the new index system includes economic and social, environmental quality, environmental construction, environmental management of 30 compulsory indicators of four categories and two reference indicators; learn the evaluation system of sustainable development at home and abroad, trying to establish a county sustainable Development Evaluation Model to replace the existing GDP assessment system.

It can be seen from the above literature reviews that, the existing environmental impact assessment modeling approach in econometrics has been more mature and the international community has developed a dozen environmental cost estimation models, some models have been widely used in developed countries, but subject to the special data statistical structure, economic development level and other factors in China, some models do not necessarily apply to the specific situation in our country, need to be improved and reconstructed. Many Chinese scholars have explored in the field and achieved certain results, which provides a good idea, direction and theoretical basis for this study.

**Concept definition and analysis of connotation:** Some scholars have studied from different angles, mainly including the description of a few aspects (Xu, 2004):

Most simple form of the index is the weighted average of a number of interrelated values.

The index is a reflection, which cannot be added, cannot directly contrast the relative number of phenomenon comprehensive changes.

**Index is a dynamic relative number:** The meaning of index has both broad and narrow. The broad index refers to all relative number explaining the changes in the number of Socio-Economic phenomenon or the °C of difference. The narrow index is a special relative number that refers specifically to the relative number of complex socio-economic phenomenon changes cannot be directly added.

The statistical indicator refers to the relative number to show the quantity comparison relations of socio-economic phenomena at different times. The index is a relative number that can be used for the comparison of the economic phenomena in time and space. The index is usually a comparison of the level of phenomenon at different times; in addition, it can also be a comparison of the level of phenomenon at different times, or the comparison of the actual level of the phenomenon and program objectives. The index refers to the relative number of a variable in the degree of change in time or space.

The index system must have the following three conditions, namely, describe and characterize the status of all aspects of development at some point; able to describe and reflect the trend of all aspects during a period; able to describe and characterize the degree of coordination of all aspects. Accordingly, the capital city environment construction index should have features including a description function, which reflects the current social, economic and environmental basic conditions; explaining function, which provides objective phenomena of analysis system and the causes of logical clues and the relevant data; evaluation function, which can make an objective evaluation of the actual development status and policies and measures; prediction function, which predicts the development trend, provides services for the development of policies and preventive measures; monitoring functions, it monitors the development of the problem and its extent.

Through the above analysis of the index, combined with the actual needs of the urban environment construction, the author proposes that urban environmental construction index is a quantitative indicators to measure the urban environment construction; contains the city environment, ecological environment, facilities environment and order environment; reflect the dynamic changes of city environmental construction at different time points; measure the distance between the actual level and the

planning objectives of urban environment construction; compare the degree of development of environmental construction in different regions, clarify the dominant direction of environmental construction within an area.

**Design method:** From the functional point of view, Environmental Construction Index is to analyze and interpret impact of environmental construction on the development of municipal affairs and urban appearance, a system integrates various indicators according to a certain structure. It helps to understand the different relationships between city environment, ecological environment, facilities environment and order environment are interlinked and interact. Therefore, to build the urban environment construction index can be created in accordance with the framework of sustainable development. Here are the main analysis of LCA, DPSIR and basic indicators.

The advantage of LCA is to take the good time, clear in chronological order, describe the specific content of each period in details, especially in measuring gains and losses with economic units, with strong intuitive sense. The disadvantage is that requires a lot of economic theory and economic feasibility studies to support, such information is not readily available, resulting in the high index cost; and the index system is not perfect compared with the DPSIR model, the development is not as mature as DPSIR model; it has some limitations to describe the environmental impact only from the point of process.

The advantage of DPSIR is it can more comprehensively reflect the main impact of EIA planning, focus to reflect the ecological, socio-economic, environmental quality, resource utilization; carefully select indicators; reflect diversified levels, draw a clear distinction between the primary and the secondary; more quantitative indicator, leaving a strong intuitive sense, easy to understand. The disadvantage is that too many and complex indicators; difficult to analyze and determine the weight; although fully reflect the environmental impacts, confusion and fuzzy on the concept of time; some quantitative indicators cannot be reflect, need more manpower and time to confirm.

The advantages of basic indicators lie in simple and quick reflect the impact of planning; a collection of some basic indicators in DPSIR model and LCA models, learn from strong points to offset weakness; basic indicator system has high accuracy; fewer qualitative indicators and more quantitative indicators and has high degree of standardization in many country's laws. The drawback is that not detail enough, it can meet requirements in the low-level assessment, but fails to be up to a comprehensive and detailed description, needs to further improve and supplement.

From above analysis, it can be seen that when detailed investigation and time and effort are satisfied

and requirements are clear, the best index system to select is based on the DPSIR model; if to emphasize economic aspects and chronological order, it is better to select the LCA model; If the evaluation is at a lower level, select the basic indicator system. This study believes that it is more appropriate to select the design method of urban environment construction index based on DPSIR framework.

## CONCLUSION

In this study, through the study of the status quo of Environment Impact Assessment index system at home and abroad for Planning, we come to know some about the principles of building index system and indicators to select and how to conduct a comprehensive evaluation of index system, which provides method theory for the establishment of the urban environment construction index and the index system comprehensive evaluation.

Through the study of the basic theory of the environmental impact assessment on planning and basic theory of indicators, we come to know some about the theoretical basis of the urban environment construction index, which lays theoretical foundation for the establishment of the urban environment construction index.

By studying principles of DPSIR model, LCA model and the basic indicator system, indicators construction as well as comparative analysis of the advantages and disadvantages of the three index systems, combined with the focus and purpose of the urban environment construction, the author selects the design method of the urban environment construction index.

## REFERENCES

- Bohringer, C. and J.E.P. Patriek, 2007. Measuring the immeasurable: A survey of sustainability indices. *Ecol. Econ.*, 63: 1-8.
- Christoph, B. and E.P.J. Patrick, 2007. Measuring the immeasurable-A survey of sustainability indices. *Ecol. Econ.*, 63: 1-8.
- Hezri, A.A., 2004. Sustainability indicator system and policy processes in Malaysia: A framework for utilization and learning. *J. Environ. Manage.*, 73: 357-371.
- Manal, R.N., B.A. Salloum and N. Karam, 2008. Environment and sustainable development indicators in Lebanon: A practical municipal level approach. *Ecol. Indicat.*, 8(5): 771-777.
- Nader, R.M., A.B. Salloum and N. Karam, 2008. Environment and sustainable development indicators in Lebanon: A practical municipal level approach. *Ecol. Indicat.*, 8: 771-777.

- Nourry, M., 2008. Measuring sustainable development: Some empirical evidence for France from eight alternative indicators. *Ecol. Econ.*, 67: 441-456.
- Peter, N. and V. Ron, 2000. Sustainability assessment of development scenarios: Methodology and application to Thailand. *Ecol. Econ.*, 33: 7-27.
- Ronchi, E., A. Federico and F. Musmeci, 2002. A system oriented integrated indicator for sustainable development in Italy. *Ecol. Indicat.*, 2: 197-210.
- Xu, G.X., 2004. *Statistical Index Theory and its Applications*. China Statistics Press, China.