

Urban Landscape Innovative Design and Its Evaluation

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Abstract

Innovation is the soul of landscape design, and studying the innovative design methods of landscape and evaluating it have significant meanings. This research classifies landscape design innovation into 9 types: cultural art innovation, functional position innovation, technological and scientific application innovation, space usage innovation, environmental protection innovation, service object innovation, economic efficiency innovation, social development innovation and industry chain innovation. Landscape design innovation is aimed at creating a landscape environment, which can be more in line with the long-term interests of the public. Landscape design innovation can be evaluated from 8 aspects: visual art evaluation, physiological comfort level evaluation, convenience evaluation, resource and environment evaluation, psychological satisfaction degree evaluation, POE evaluation, input-output evaluation, social integration evaluation and life cycle evaluation. The evaluation of innovation aims to ensure that the creative landscape design works could be carried out to provide the public with service and experiences of higher quality.

Keywords: Landscape, Innovation, Design, Evaluation

1. Introduction

With the rapid development of Chinese economy and the growth in people's living standards, the landscape environment requirement of the society is also becoming higher and higher [1]. From the city to the community and then to the garden, the landscape design continues to improve the quality of the environment on different scales, and increases the urban livability index and the public's happiness index. The flourish of the landscape design industry pushes the boom of the education. At present, about 200 universities and colleges set up landscape and relative majors. Each year, thousands of graduates enter the landscape design industry. On one hand, it adds new employees to the landscape design industry, but on the other hand, these designers are in varying levels because of the lack of systematic professional training. Research and investigations suggest that copying and plagiarism problems are serious in the landscape design market [2]. A large amount of copied and plagiarized works have completely neglected the specific requirements of the site, and only copied the form. As for the solutions to these problems, strengthening innovation and perfecting the evaluation methods are the most effective solutions.

Innovation refers to the acts of improving or creating new things with the existing knowledge and materials, and get some rewarding effects in a particular environment [3]. Innovation is a process of conceptualization which is characterized by new thought, new invention and new description. The essence of innovation is the breakthrough, which means to break through old patterns of thinking and old conventional rules. The core of

innovative activities is "new", that is, it is the transformation of the structure, performance and external features of products, or the creation of appearance design, manifestation of contents and means, or the enrichment and perfection of contents. Innovation plays an important guiding role in all the fields of natural sciences and social sciences [4-7]. The constant innovation and revolution in these fields continuously promote the progress and development of the society.

Innovation is the soul of landscape design [8]. Only by combining innovation can landscape design create a high quality environment to meet the diversified, multi-view and multi-dimensional requirements. Landscape design has very strong subject integrity, which makes it relatively complex to look for innovative points: on one hand, there are quite abundant potential innovative sources; on the other hand, they are too broad to be found. Therefore, it is necessary to classify the modes of innovation, so as to make them convenient to be chosen. After the innovation behavior occurs, how to identify the innovativeness will become a problem in front of people. The aim of this article is to classify the innovation modes of landscape design and to summarize the landscape innovation evaluation methods of high feasibility.

2. Methods of Landscape Innovative Design

The Chinese landscape is comparatively wider, which is not only based on the inheritance and development of traditional cultural characteristics but also takes in the landscape thoughts of western developed countries. After the social development comes into a new stage, the landscape design is much more diversified. The final purposes of Landscape Innovative Design are: to save resources and energy, to save lands, to strengthen the aesthetic perception of the city, to meet the demands of multiple functions, to enhance the biodiversity, to improve the humanization, to raise the input-output ratio and so on. The innovative design can be started from the following 9 aspects (Figure 1).

2.1 Cultural Art Innovation

Objects of the landscape design are elements existing in physical forms. They have tangibility and are figurative. While culture is a reflection of people's spirit and thought, which is not tangible, but abstract. The topicality of landscape design often reflects the culture in the form of material, and the changing process from the invisible to the visible is the very process that needs innovation and is also exactly a difficult problem which is the biggest test to designers' innovativeness. The materialization of culture can be embodied by modes of description, narrative, metaphor and so on. After condensation, processing, extraction and abstraction of culture art, the quintessence and main vein of it can be grasped, and the processes of developing something from nothing can be accomplished, which is called Cultural Art Innovation [9].

2.2 Technological and Scientific Application Innovation

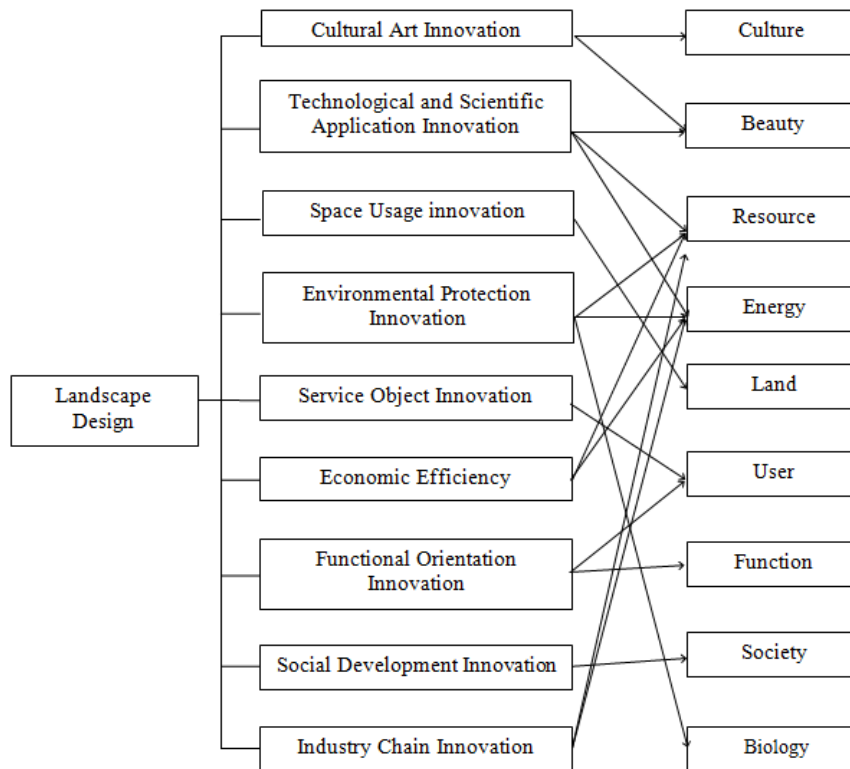


Figure 1. Diagrammatic Sketch of Landscape Design Innovation

With the continuous development and progress of science and technology, the design of landscape more and more depends on Technological and Scientific Application Innovation. Technology innovation includes many aspects: The application of intellectual technology, through applying the intellectual technology which integrates information technologies, such as the Internet of Things, the Internet and the communication network, as a whole to the landscape design, will improve the scientificity of the landscape planning and design; based on GIS, the application of geographic design provides support for the design through geographic data [10]; the application of new engineering technology achieves the complex scenes creation through the application of engineering technology; the application of new environmental protection technology, which extends the breadth and depth of the landscape design through the combination with the environmental protection technology.

2.3 Space Usage innovation

Landscape design is about the design of land. Under the increasing tension of city land resources, landscape design should consider more cautiously on man-land relationship. Through the Space Usage innovation, contradictions between men and land can be mollified. Environmental space's use can be extended from ground to air and underground: constructing a hanging garden, establishing a recreational area of view between the floors and the top floors in the building, increasing the amount and viewing rate of green in the city, at the meantime, promoting the livability of architectures; vertical greening is to carry out vegetation cover on the vertical surfaces of buildings and structures, and achieve construction of vertical landscape depending on a new type of wall green plant technology; making high altitude park is to make environmental construction by using places like viaducts, abandoned railways and so on; To use underground spaces such as tunnels, air-raid shelters for virescence rationally.

2.4 Environmental Protection Innovation

The city environment is faced with increasingly severe pressure with the depletion of natural resources and the growth of energy consumption. The various industries in the city are all advocating "low carbon and saving" [11]. Equally, the landscape design also ought to have a broader horizon, and the design innovation needs to be carried out from the perspective of caring about the environment: low-carbon landscape design, which reduces the consumption of energy and decreases carbon emissions by means of the rational selection of location and material; ecological cycle, which forms an ecological circle system in the field to reduce the consumption of resources and energy with the landscape design; low-effected development with methods as building up water-saving style green spaces, drawing on rain resources, reusing the sewage and so on can realize an effective utilization of water resources; protection of animal resources, changing from increasing the plant diversity to increasing the animal diversity, enriches the landscape through increasing the diversity of urban insects, aquatic animals, small mammals and birds, as well as amphibians.

2.5 Service Object Innovation

Besides special activity venues, homogenization treatment of the users of venues is used in the most of the current landscape designs, namely to satisfy the most users' needs. With the progress of society and the improvement of the level of civilization, the rights and interests of using landscape environment by physiologically disadvantaged groups should be guaranteed. Landscape design should be started from the perspective of humanity concerning, and one should deeply understand the landscape needs of physiologically disadvantaged groups, then conscientiously strengthen the pertinence of design in the designing process. Service Object Innovation can effectively promote the humanization level of landscape environment.

2.6 Economic Efficiency Innovation

The phenomenon of extravagance and waste exists in current landscape designs. Although the large amount of hard landscape construction and high-density plants cover meet the requirement of landscape quality and stereo allocation, it is often expensive and uneconomical. Through the Economic Efficiency Innovation, if a small amount of input can have the same or even better effect on the landscape design, there is no doubt that it's more suitable for build requirements of ground field.

2.7 Functional Orientation Innovation

In landscape design, it is easy to control the display of a single function. However, the landscape environment usually has requirements in many aspects. Therefore, through the function innovation, the use efficiency of the landscape environment can often be improved. The functions of landscapes include ecology, production, recreation, education, environment protection, and society promotion and so on. If landscape design can accurately position its own function, make clear priorities and cover all aspects, then it will make the environment more sustainable.

2.8 Social Development Innovation

Landscape design should not only pay attention to the requirement of the ground field itself, instead, should pay more attention to the innovation from social development angle. Integrating the landscape design into the society, community and so on will more accord with the long-term development requirement of the ground field. The interpenetration and mutual promotion between the landscape design and society can make the landscape

evolution and the society evolution become consistent, which is benefit to achieve the goal of sustainable development.

2.9 Industry Chain Innovation

Landscape industry is a complete industry chain formed by phases including planning, design, construction, management and update. Landscape design shouldn't just consider the requirement of a single phase, it should also promote the coordination of different phases through the industry chain. For example, the initial landscape design should consider the influence on construction, management and updating stage.

3. The Evaluation Method of Landscape Design Innovation

The innovation evaluation is an important reference for preferred landscape design works. Innovation evaluation could be judged from the following aspects: resource, energy, investment and output, public perception, society, health, sense of beauty and so on. Generally, innovation evaluation of landscape design could be studied further from the following eight aspects (Figure 2).

3.1 Visual Art Evaluation

Vision is an important part of five senses of the human body. Researches show: human eyes take in over 70% of the external information. Therefore, the evaluation of visual arts, which is served as the main stimulation source of landscape environment, is feasible. Visual Art Evaluation could adopt the qualitative or quantitative methods: qualitative evaluation is mainly carried out by ways of handing out the investigation questionnaire or scene picture enjoyment; while quantitative evaluation needs to be done by specialized instruments. For example, the development of the eye tracking technology has realized the scientific measurement of the eye movement [12]. By means of recording all the characteristics of the eye movement, and combining with questionnaires, the stimulus features of the landscape environment and the aesthetic preferences of the public can be judged.

3.2 Physiological Comfort Level Evaluation

Physiological comfort, concretely, means that most users reach a state where they are satisfied with the objective environment in terms of physiology. And the factors and conditions that affect physiological comfort are very complicated. Physiological comfort of landscape environment can be measured from several aspects: indicators in climate like temperature, humidity, ventilation, oxygen content, anion and so on; the change of environmental elevation, distance between the resting nodes; walking comfort of the roads; the temperature, coarseness and so on of the device material. Through experiment or research, the range of users' acceptable comfort degree can be grasped, so as to provide instruction for the landscape design.

3.3 Availability Evaluation

Evaluation of availability is the evaluation of the landscape environment from the angle of user experience. Availability is the measurement for users to experience the quality, including many aspects: design, function, structure, beauty, moulding, smell, sound, lighting, etc. [13]. The availability evaluation is subjective, but according to the availability evaluation scale table developed, we can make relatively scientific evaluation of the service quality of the landscape environment.

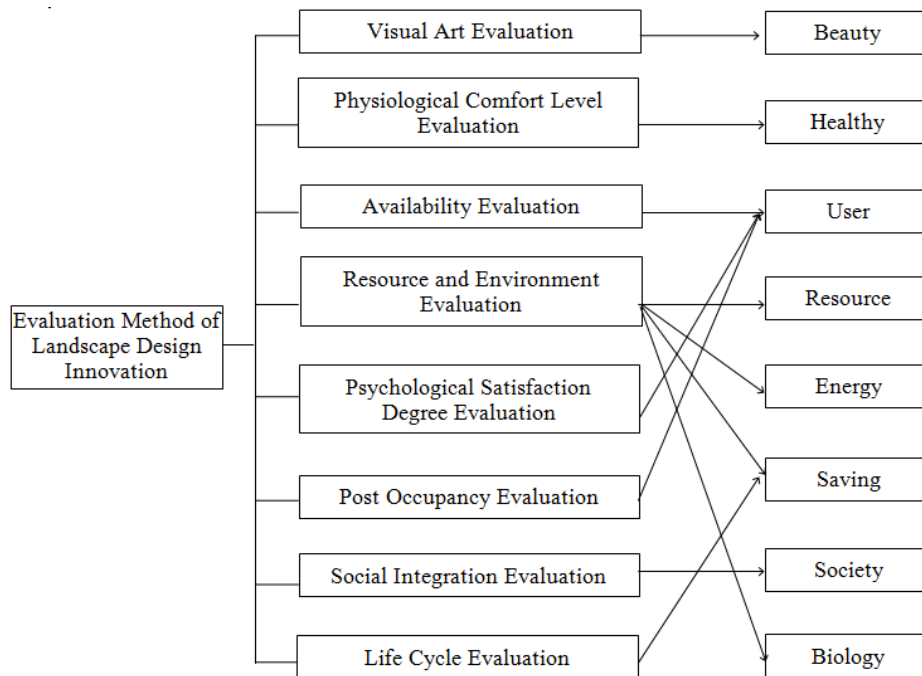


Figure 2. Diagrammatic Sketch of Evaluation Method of Landscape Design Innovation

3.4 Resource and Environment Evaluation

Resource and Environment Evaluation is mainly the calculation of carbon footprint and energy [14, 15]. Carbon dioxide is the main contributor to global warming. The product supply chain of landscape environment generally includes purchasing, production, storage and transportation, among which the storage and transportation processes will produce a large amount of carbon dioxide. Through the calculation of carbon emission, "consumption of carbon" can be obtained. There into, "carbon" refers to the natural resource constituted by carbon elements such as petroleum, coal and wood. The higher the carbon consumption, the higher the carbon dioxide is produced. With the help of the calculation of carbon emission, we can measure the degree of the interference which the landscape design makes on the environment, then make adjustments and improvements.

The energy calculation can transform various forms of energy into a unified unit (solar energy joule), which can provide a new scale for the analysis and the evaluation of environment, resources, human labor, information and development decision. Energy analysis considers the energy as the common reference, comprehensively analyzes and evaluates the landscape environment system's energy flow, currency flow, population flow and information flow, and gives a series of the energy indices reflecting the system structure, functional features and ecological economic benefits which can be used to and evaluates the landscape environment system's sustainable development, and to assist the landscape designer to make decisions.

3.5 Psychological Satisfaction Degree Evaluation

Psychological activity is one of the functions of the human brain. It is a process in which the human brain reflects the outside world. Satisfaction is a psychological state. It is a sense of pleasure caused by the user's demands being satisfied; it is also the relative relationship between the user's prior expectation of the environmental service and the user's actual feelings generated after actually using it. As user satisfaction is the basic condition of user loyalty, carrying out Psychological Satisfaction Degree Evaluation on

the landscape environment can measure the innovative design level of the landscape environment.

3.6 Post Occupancy Evaluation

Post Occupancy Evaluation refers to a set of systematic evaluation program and method to the landscape environment after a while of construction and use [16]. POE cares about the actual service situations and the comments and requirements of users of the landscape environment. Through the comparison between the desired purpose of environmental design and actual service condition, and the collection of feedback, it can provide the future environmental planning and design as well as construction of the same type with reliable objective basis. The result of POE can directly reflect the designer's innovation ability, because any innovations should be under the premise of satisfying the users' demand.

3.7 Social Integration Evaluation

Integration can be classified into psychological integration, cultural integration, social relationship integration and so on, among which social relationship integration is mainly measured from the angle of social interaction. Social Integration Evaluation is a multi-dimensional evaluation, which is a process of acceptance and approval between the landscape environment and the society. For example, as one of the important functions of landscape environment, social interaction shall be paid attention to in the landscape design. This demands the landscape designer to know the communicative will and psychology of different crowds and organize the communication space reasonably in landscape design. Therefore, whether the public strengthen the social interaction through landscape environment or not can also be the assessment of on Landscape Design Innovation.

3.8 Life Cycle Evaluation

Life Cycle Evaluation is the compilation and assessment of inputs, outputs and potential environmental effects in the life cycle [17]. Life Cycle Evaluation focuses on the research of system's environmental effects on territories of ecological health, human health and resource consumption. Through the energy and material consumption and environmental release in the construction and maintenance stages of the landscape environment, these consumptions and release's influences on the environment can be evaluated and eventually the chances of reducing these influences can be recognized and evaluated. Through LCA, the use of materials that may result in the environmental pollution and links that may lead to the increase of energy consumption can be reduced in the landscape design stage.

4. Conclusion

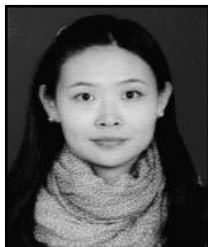
Innovation is the core content of the landscape design. The Landscape Innovative Design needs not only perceptual knowledge but also scientific and rational analysis. The landscape design is finally implemented in the material level, but the paths and methods of the implementation are in endless variety. Innovative design can not only highlight some factor but also make overall consideration on various factors, in order to create the landscape that further conforms to the long-term public interests.

There are many innovation evaluation methods of landscape design. For specific usage, the proper evaluation method should be selected according to the type and other aspects of the project. The goal of innovative evaluation is to ensure that innovative landscape design works could be implemented to provide the public with services and experiences of higher quality.

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