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Innovative Thinking on the Renovation Design of Old Industrial Building Space

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Abstract: The current study investigated the value and significance of the existence of the old industrial buildings, as well as the necessity and difficulty to renovate the design. Combined with successful cases, this study analyzed and showed that one should not only deal with the relationship between the original architectural style and construction of modern cities in the process of renovation design of the old industrial building space. More attention should also be paid to create new space to meet the functional requirements of the modern features, and then complete substantial renovation of old industrial building space through the innovative design. In the use of aesthetic innovative design for the renovation of the old industrial building space, people must respect the space of old industrial buildings as the prerequisite of the renovation design. It is needed to expound the local space reconstruction methods and design principles respectively on the basis of respect. And then one should grasp the whole space and make the structured design and reasonable use according to the new space functional requirements of different functional areas. This paper attempted to learn from environmental art study on the renovation of old industrial buildings space and in terms of innovative design. The authors explored the innovative thinking on the renovation design of old industrial building space through the analysis of the reality.

Key words: Old industrial building space, renovation design, innovative thinking, reality.

1. Introduction

With the rapid development of global economy, the urbanization process is further accelerated. The chain of industrial structure in many countries has undergone earth-shaking changes. In order to meet the demand of the continuous development of city planning, there have been many old industrial buildings in the city. The old industrial buildings mainly refer to the buildings as an industrial production place built since the rise of modern industrial [1]. They have already lost production function due to various reasons such as time, space, society and so on but still have use value. They can meet the new function just through the renovation [2]. Although these old industrial buildings have lost its original function, but they still have whole structure, excellent geographical location, and some even bear the weight of the dream of a generation. They are witnesses of the history and culture.

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Now there are many old industrial building space facing with the choice of being demolished or upgrading to further be used. Some western developed countries have experienced such choice [3]. These countries have reformed the renovation design of old industrial building space into national development planning and have made deep theoretical researches and practical cases. China is also active in the research and development. How can we use these old industrial building space effectively and strongly? The biggest problem of the current practice research is that how to make use of the old industrial buildings and maximize the local economic development and social benefits. Innovative thinking is undoubtedly the top priority of solving the problems.

1.1 Economic Significance of the Innovative Thinking on the Renovation Design of Old Industrial Building Space

First of all, this paper discussed the economic value

of old industrial building space itself. Industrial buildings are mostly distributed as collections of building community and their construction scales are always very large. Considerable capital will be needed if they are chosen to be dismantled. It can effectively save a large part of the money after the innovative renovation design of old industrial building space. It is not hard to see that the saving money after the innovative renovation design equals to the total of demolition of old industrial buildings and construction of new buildings and then minus the funds used in the reconstruction. According to figures from the western developed countries in 1987, compared with constructing the same size of buildings, the cost of old building reconstruction can save a quarter to half cost [4].

Then the economic value of old industrial building space produced in the region was discussed. With the continuous development of economy, the populous degree is higher and higher. The urbanization is vigorously proceeding and the land prices around the cities are soaring. At the same time, the center of the city has began to shift to a new development zone of the old industrial buildings because of the development of economy and industrial structure adjustment. It makes the local economic value of the old industrial buildings rise continually. It can not only increase the local economic income, but also adjust the industry chain of the region if the lowest cost was used to take advantage of the old industrial buildings. It can further enrich people's daily life and reduce the cycle of the new infrastructure for people using new installations as soon as possible. Thus people's living environment can be improved, and also more employment opportunities to local residents can be provided.

1.2 Ecological Environment Significance of the Innovative Thinking on the Renovation Design of Old Industrial Building Space

The characteristics of the distribution of old industrial buildings are cluster and scale of distribution. So, it is bound to an enormous range of dust particle pollution in the process of demolition reconstruction. The building material waste of demolition is extremely large area. At the same time, construction waste in the process of transportation will bring incalculable impact and pressure to the region (traffic, environment, noise and so on) [5].

The renovation design of old industrial building space is the recycling of existing resources on its own. The innovative renovation design of old industrial building space further uses the resources of the old factory for its own existence, such as the original plant, the original building, the original equipment, etc. According to statistics, 35% of the world's solid waste is from construction projects, including the construction process and the production process of various kinds of building materials [6]. It is obvious that the protection of the ecological environment in the innovative thinking is significant on the renovation design of old industrial building space.

1.3 Historical and Cultural Significance of the Innovative Thinking on the Renovation Design of Old Industrial Building Space

Industrial buildings are the witness of history and time, they can witness struggles and woes of generation. The old industrial buildings not only witness the progress of the society and the development of the city, but also the social important historical and cultural landscape. Old industrial buildings are valuable and non-renewable resources, which witness the history of the city's industrial development and spatial structure evolution [2]. Old industrial buildings may be not adapted to the functional requirement of the modernization in a certain extent, but it records a history including the original environment and formation of the workplace culture which can evoke people's memories and visions for the future. The old industrial building space can communicate with people and make people

feel the common experience of identity and belonging. Therefore, the protection and recycling of the old industrial buildings are helpful to save the cultural identity and sense of belonging for people [5].

1.4 Significance of the Response to National Policy of the Innovative Thinking on the Renovation Design of Old Industrial Building Space

With the rapid development of global economy, the chain of many countries has earth-shaking changes in industrial structure. The process of urbanization is further accelerated in modern society. In order to further meet the demand of the growing urban planning, each country has its own rules and regulations and related laws. Most countries encourage transformational reuse of old industrial building space. It is in response to China's national policy under the premise of building such as the 798 Art District of Beijing, China. The renovation design of old industrial building space can further enhance the national pride and strengthen the identity of national culture and history. It conforms to the policy of cultural power for national construction. It is in accordance with national development strategy of sustainable development for the use of non-renewable resources and protection. As the saying goes, nothing can be accomplished without norms or standards. The renovation and reuse of the old industrial buildings develop vigorously under the aegis of the government policies.

2. Analysis of the Situation of the Innovative Thinking on the Renovation Design of Old Industrial Building Space in Different Countries

2.1 The Theoretical Study of the Innovative Thinking on the Renovation Design of Old Industrial Building Space in Different Countries

The first to enter the upgrade of industrial structure is the western developed countries and regions, which began to renovate and design the old industrial buildings effectively as early as in the 50s and 60s of the last century. American garden master Lawrence Halprin put forward the recycle theory of construction as early as 1965. "Recycle" was not simple repair but the change of function. It adjusted the internal demand function of the construction to meet people's new functional requirements [7]. The renovation design of old industrial building space in western countries was widely carried out in the last century. During the period, there were many books with guiding effect, such as *Nairobi Advice* in 1976, *Machu Picchu Chapter* in 1977 and *Washington Charter* in 1987, etc. [8].

According to their own national conditions and cultural background, Australia first put forward the concept of "renovation and recycle" in 1979. Renovation and recycle meant to rethink the buildings' new function definition on the basis of their original function. According to the culture of the region and residents living conditions, one needed to make the creative design for the most suitable space in order to meet the needs of people's different life. *Burra Charter* pointed out that, in the process of renovation of old industrial buildings the main structure of the original old buildings should be fully retained. This transformation can be returned.

The renovation design of old industrial building space in China came to prominence in the 1980s, many cases were based on the above study on the basis of practical experience. Although now the research depth and breadth are constantly improving and deepening in China, the thought of "forced demolition and reconstruction" still prevailed in the city influenced by many factors such as economy, construction conditions, the development of science and technology, and people's recognition degree, etc. The innovative thinking on the renovation design of old industrial building space in other countries is limitedly accepted for Chinese. The practical projects in China are still not enough and construction designs are not perfect, so that the ideas are still inadequate.

2.2 The Case Study of the Innovative Thinking on the Renovation Design of Old Industrial Building Space in Different Countries

The most typical instance of the recycle theory of construction was the comprehensive program modification in Gillard Square in San Francisco (Fig. 1), such as the chocolate factories, the woolen mills were perfectly converted into shops, restaurants, etc. It had far-reaching significance for the local industrial structure upgrade. The success of the case became the strong foundation of renovation of old industrial buildings.

Japan became involved in renovation of old industrial buildings in 1970s. The designing work of Kurashiki Square (Fig. 2) in 1974 was also a successful case. Large textile factory building was designed into tourist hotel. It cleverly retained the mechanism of the surface structure of the old industrial buildings and gave the original lost function of old industrial buildings new function.

Fig. 1 Gillard Square in San Francisco.

Fig. 2 Kurashiki Square.

The renovation design of old industrial building space in China is relatively concentrated with general type distribution. It can be seen that the renovation design of old industrial building space in China pays more attention to the collective economic benefits. The first renovation of old industrial buildings in China was “ShuangAn Square” located in Beijing’s third ring road. It was transformed by the building of Beijing Watch Factory. Designers made the factory building novel and chic and let visitors shine at the moment. In addition, 798 Art District in Beijing (Fig. 3) became Chinese art and culture creative park. And Tsingtao Brewery Industrial Park was creatively designed into the museum.

Zurich Power Plants in Switzerland (Fig. 4) transformed the original power plant as the landmark of the city.

Fig. 3 798 Art District in Beijing.

Fig. 4 Zurich Power Plants in Switzerland.

3. Innovative Thinking and Method on the Renovation Design of Old Industrial Building Space

3.1 The Organic Combination of Keep and Remove on the Renovation Design of Old Industrial Building Space

Old industrial buildings are the symbol of history, and they bear the weight of history and witness. The old industrial buildings in reserved for local wall were respected for history.

The design elements and original elements of the old industrial buildings should be perfect combined together in the process of innovative renovation design. People should perfectly combine the point of innovation and design and the function of the old industrial building space, then find the symbiosis of them. And one must fully respect the original space and maximumly retain the original space structure in the process of innovative renovation design. Different spatial structure has different uses. For example, full consideration should be given to the layer structure relations of the big workshop structures, and then one should make full use of the large span of the factory building structures and design the creative points with coordination. As well, different old industrial buildings have different characteristics, coordinating interior space should be designed according to the different features of the space.

3.2 Innovative Renovation Design of the Overall Environment

3.2.1 Local Reconstruction Function

In the process of the renovation design of old industrial building space, reconstruction means for its internal functional partition space integration and the process of redecorating on the basis of respect for the old industrial building space. It can make the whole space have feeling of administrative levels and make the space to achieve the greatest degree of application. Innovative renovation design should notice the following:

- be sure to determine the after transforming practicality;
- must be connected to the local residents' living custom and living environment, and be in conformity with the local residents' life;
- should diligently make the old industrial buildings into the local landmark buildings.

3.2.2 Increase or Decrease of Local Function

It is bound to appear new function in the process of the renovation design of old industrial building space. Accordingly, one will put forward new requirements to the old industrial buildings. One should increase or decrease the original space to ensure that the modified spatial layout is perfect in this way. In the face of the old industrial buildings, the new elements one adds contain functional stairs, corridor of stream of people, some new partition function, etc. Facing the change of the function for the old industrial buildings, some of the stress points of the buildings also need to adjust. This is a quite important part of new space.

In order to further improve the renovation design of old industrial buildings' function space, one has to make the reasonable dismantled for the function layout of obstruction of the part of the whole space. The authors use this way to guarantee the improvement and perfect of the space function of the layout after transforming.

3.2.3 Segmentation of the Space—Vertical and Horizontal Segmentation

Vertical Space—Increase. The internal space of the old industrial buildings has a very important advantage is the height advantage. The current old machinery factories in Chinese city can reach 13 m high. The focus of our research is how to fully use the vertical distance. Vertical segmentation is crucial, because it can make full use of the height of vertical space. Effective segmentation can extend the old industrial buildings' interior space. It can increase the actual use area after transforming the function of the space and play a crucial role in the improvement of

the functional areas of the transforming old industrial buildings (Fig. 5).

Vertical Space—Decrease. Although there are advantages in height for some internal vertical space of the old industrial buildings, there are all kinds of placement machine platforms in the prophase of plant functional space. For the vertical space transformation, some can be consistent with the late transformation space, some needs to be dismantled, so as to get the further integrity of the whole space (Fig. 5).

Horizontal Space. The vast majority of the old industrial buildings are the opening workshop space in addition to a small number of office space. Different function space will have different requirements in the process of the renovation design of old industrial building space. For instance, one needs to split the original old industrial buildings' interior space when the old industrial buildings are asked to transform into workshop space as the office spaces have more privacy compared with other spaces. Again for instance, if one wants to transform the old industrial buildings into hotel space, it requires a completely private split in the horizontal space. In the process of segmentation, the whole new workshop space function was divided in order to better meet the needs of different space. It plays a crucial role in the improvement of the functional needs of the transforming old industrial buildings (Fig. 6).

3.2.4 The Combination of the Old Industrial Buildings and New Buildings

The old industrial buildings should meet the functional layout of the modified partition. There are some specific functional areas needed for new in the process of the renovation design of old industrial building space, so as to further meet the space requirements after transforming. The combination of the old industrial buildings and new buildings can make the function of the old buildings further perfect. It further made up for the inadequacy of some old buildings. Whether the whole building facade or internal material, or the façade of integral feeling, all

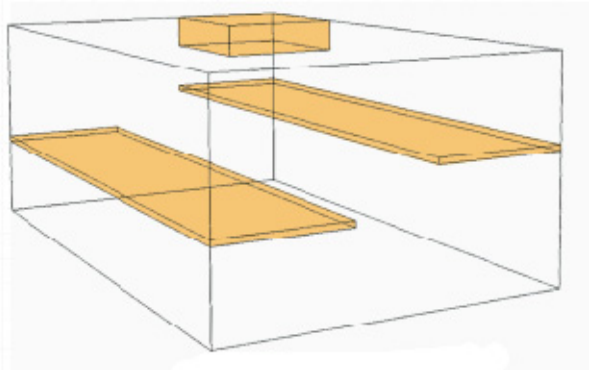

Fig. 5 Vertical space increase or decrease.

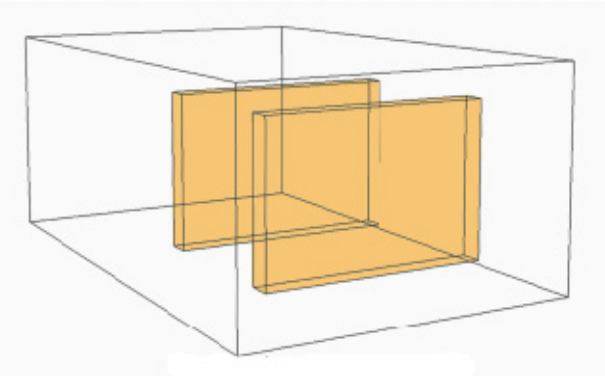

Fig. 6 Horizontal space and increase or decrease of the sketch map.

give people a kind of feeling that one can find everything new and fresh.

The coexistence of old and new is an important bridge of the entire renovation of the old industrial buildings. The innovative design makes the architectural elements of two eras have mutual confluence and coexists with time.

3.3 Extraction and Utilization of Innovative Elements of Space

As part of the cells of city, the old industrial buildings reflect the city's historical process of industrialization with high value of multiple. At the same time, as the material carrier of urban industrial civilization, the renovation design of the old industrial buildings in the city meets the objective law of the development of city history, and also conforms to the objective requirement of buildings' own development.

Internal space of the old industrial buildings has retained an important point of building structure, as

the important metope elements of mechanism, for example, massive rusty bearing column and the huge number of chemical plants to stay huge pipe, etc. These old elements are quite important for the late renovation design. These elements of reuse are very important in the renovation of the old industrial buildings, confirming to the sustainable development strategy.

In pursuit of the existence of the old industrial building design, one will be deliberate to retain and use the elements having feelings of time in the whole interior space in the process of the renovation design of old industrial building space. The extraction and utilization of the indoor creative elements can well reflect the age feeling and the time stamp of the buildings themselves will be remembered forever.

4 Conclusions

In conclusion, the innovative thinking plays a vital role in the process of the renovation design of old industrial building space. On the one hand, one should make the innovative renovation design on the basis of the original style of the old industrial building space as far as possible. On the other hand, one should make the old industrial building space into the new logo using the innovative renovation design and keep up the trend of times with the view of development. And furthermore, one should keep the economic significance, ecological environment significance, historical and cultural significance and other significance of the innovative thinking on the renovation design of old industrial building space as far as possible. People should pay attention to the reasonable, suitable and feasible approach of the innovation.

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