ISSN 2663-1563 Vol. 5, Issue 7: 27-36, DOI: 10.25236/AJAGE.2023.050705

Study on Optimization Strategies for Old Industrial Building Sites—Take Shuguang Machinery Factory (Zhaoqing, China) as an Example

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Abstract: *This paper studies the regeneration design of old factory buildings with low production and high consumption which are eliminated under the trend of domestic industrial upgrading, takes the transformation research of old factory buildings under the background of cultural and creative industries as the starting point, combines the relevant information, analyzes the relevant theoretical data on the regeneration design of the old factory buildings concerning the functions, layout, facilities and regeneration forms, etc., and puts forward an optimization strategy suitable for the current trend of regeneration of the old factory buildings based on existing transformation design of the old factory buildings. Regeneration trend optimization strategy. This paper takes Zhaoqing Shuguang Electromechanical Factory as a transformation case, based on adapting to the background of cultural and creative, combining with the demand characteristics of the old factory building transformation, making the optimization design strategy of the old factory building, researching the new scheme suitable for the regeneration design of the old factory building, and solving the problem of the reuse of the old factory building.*

Keywords: *Old Factory Renovation, Zhaoqing Shuguang Electromechanical Factory, Optimized Design Strategies*

1. Introduction

The expansion of commercial and residential areas, etc., as a result of the increased functional needs of cities and rapid urban development, has led to the identification of old factory districts on the fringes of cities that have been given a new lease of life. However, behind the functions and facilities of these old factory districts, there are problems such as high energy consumption and pollution, which are unable to meet the requirements of the development of the modern state and require improvement of the surrounding environment. The problems left behind by the old industrial buildings need to be combined with new-age elements to meet the production and living needs of modern society. People's sense of well-being in life has increased, as have their aesthetic and contextual requirements for architecture, and their concern for the living environment and quality of existence has produced the need for green architectural design concepts. Since the industrial revolution in the 1860s, Western countries have been adhering to the principle of "pollute first, treat later", which has led to serious environmental problems and challenges in global environmental governance. However, before the 1960s, they were consciously aware of the consequences of environmental pollution, and it was not until an environmental pollution incident occurred that they began to pay attention to environmental protection. Over time, the West has reassigned traditional concepts, recognizing that humans are not masters of nature and need to live in harmony with it. Development requires taking the initiative to control pollution rather than taking action. Most companies attach great importance to environmental protection measures in product design, green and healthy packaging products in production, and use, thus influencing consumer awareness of environmental protection. In addition, the country is also pursuing green architecture in construction and interior decoration, green design causes buildings to achieve aesthetic and low energy consumption with ecological and environmental protection effects. Green space design has no fixed pattern and can be applied to places of different scales, making it more unique. This study aims to make full use of the remaining space and give it a new feedback-side policy push to revitalize the dilapidated old factory area and create value to be revitalized in the urban development [1, 2].

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2. Common Problems of Old Factory Renovation in Urban Design

2.1. Difficulties in Cultural Innovation

Since China's reform and opening up the gradual emergence of tertiary industry, the transformation of old factory buildings has become a trend. There are various directions for the transformation of old abandoned factory buildings into empty and flexible spaces, such as cultural and creative industries, tourism industry, leisure and public entertainment space, and comprehensive functional space. Diversified industries are emerging in the transformation of old factory buildings, such as cultural and creative industries, sports, education, and so on. After these renovations, the old industrial heritage is reborn, full of the flavor of the times, and adapted to the needs of contemporary people's lives. Among them, the economic benefits brought by the cultural and creative space are higher than other categories, however, due to the high benefits, it is gradually commercialized by people to transform the old factories, losing the essence of culture and creative, making the cultural innovation stagnant, and not able to bring the interesting experience of cultural and creative to people [3, 4].

2.2. Inappropriate Choice of Greenery

In the urban green space design and environment creation work, the green plant design link is the most important, although it does not have to do green plant ring ring ring, but in the plant how to reasonably collocation can be achieved by the visual effect and aesthetics optimization, but also can make a variety of vegetation healthy growth. These all need relevant professional knowledge, and part of the staff is engaged in the lack of relevant expertise in this regard. Vegetation with unreasonable or ignoring native plants will not only make the green plant with monotonous colors, seasonal changes are not significant, and will even affect the native vegetation ecosystem [5].

2.3. Urban Greening Rate not up to Standard

With the high-speed development of urbanization and the increase in the urban population, people's demand for a living environment is higher and higher, so some of the urban green space cannot meet the requirements of people's living conditions, in accordance with the international standard of greening construction, the urban greening rate is generally not less than 10%, the greening of the residential area is to account for the total construction area of 60%, the corresponding greening is not less than 30%, and most of the corresponding greening in China are not able to meet the standard [6].

3. Optimization Strategy

3.1. Clarifying the Nature of Cultural Innovation

First of all, cultural innovation also needs to have the price value concept in line with the times, which is the thinking on the substance of cultural innovation, but also the significance of cultural innovation, to know the cultural innovation on people's lives, on the society has no impact, whether it deviates from the people-centered development can be the fundamental goal, whether there is a sustainable development of the regularity of the development of [7]. Culture is closely related to human life, so it can not only stay in the surface image of cultural material but also promote the level of cultural values. Cultural innovation is not only the inheritance of cultural achievements, but also the protection of culture, culture can also keep pace with the times to innovate, but also to maintain the correct cultural plant. This is where the charm of cultural innovation lies.

3.2. Clarify Green Space Design Principles

Urban green space has obvious characteristics, it can penetrate every corner of the city, and the growth of green space vegetation, and the ecosystem recovery cycle is an important indicator of urban green space. In the process of creating green space design, there are a few design principles: First, the holistic, native ecological environment needs to be neatly organized, which can be better for the city with each other, second, the ecosystem in the design process must be in the protection of the natural ecological environment at the same time the use of the natural ecological environment to create an independent vertical landscape, third, the sustainable development, the creation of green space, needs to be combined with the environment to achieve complementary sustainable development purposes,

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fourth, humanization, in the design process, the growth of green space vegetation, the recovery cycle of the ecosystem is an important measure of the urban green space indicators. Third, sustainable development, the creation of green space, needs to be combined with the environment to achieve the purpose of complementary and sustainable development, and fourth, humanization, in the design process, we need to pay attention to humanistic care or local folk culture and pay attention to the consideration and care of special populations. In addition to the above principles, the principle of economy can be established in the creation and design of urban green space [8].

3.3. Rationalization of Green Space

When building green spaces, various planning and layouts are needed to ensure their rationality and scientificity. In the process of designing the overall layout of urban green space, it is necessary to consider the unity of the spatial layout and the value of approval, especially focusing on the centralized construction of urban green space. In addition, in the process of urban space green space design, it is necessary to adhere to the principle of adapting to local conditions, strengthen the coordination between the green space and the surrounding environment, and maximize the utilization rate. For example, it is important to focus on green plants and floral decorations in cars when designing sheet plants to improve green and beautiful general green spaces [9].

4. Analysis of the Basic Conditions of Zhaoqing Shuguang Machinery Factory

4.1. Site Context Analysis

With the existing consumer market in Zhaoqing City as a reference basis, to start analyzing the differences and vacancies in the consumer market in Zhaoqing City, and formulate the direction of the transformation of Shuguang Electric Factory. Existing parks in Zhaoqing: Zhilian Dream Factory, Shipai Li, Zhihui Park, and so on, its main are traditional park transformations, presented are more similar, generally have no special commercial subjects, and will lack peer competition advantage. Therefore, the transformation of the motor factory should be transformed into a unique cultural theme park in Zhaoqing, and make a difference with the existing parks in Zhaoqing.

4.2. Location Analysis

Zhaoqing Shuguang Electric Factory is located in Zhaoqing City, Guangdong Province, Zhaoqing City, Duanzhou District, Meian Road No. 17, the terrain is high in the north and low in the south, the northern part of the tectonic denudation of the mountains is dominant, south of the Xijiang River, north of the North Ridge Mountain, east of Dinghu Mountain and Zhaoqing City, Dinghu District, west of the border with the Gao Yao District, Xiaoxiang Town, covering an area of about 14,000,000 square meters. The time of construction is unknown, leaving 13 usable buildings, which are now deserted and can no longer run for production (Figure 1).

Figure 1: Overhead view of The Motor plant

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The northern part of the park is about 60 meters long and 90 meters wide in irregular shape, covering an area of about 5,000 square meters. In the transformation, the area can be used in 6 buildings, which can be used in a house covering an area of about 2,500 square meters, of which the main plant is about 42 meters long and 21 meters wide, with an area of about 900 square meters; the highest point of the roof is 18 meters and the lowest point is 15 meters, and the secondary plant is about 50 meters long and 12 meters wide, with an area of about 600 square meters. The backyard area can be used for about 1000 square meters, and this renovation plan is mainly designed for the main plant and the backyard (Figure 2).

Figure 2: Actual Photo of The Motor Plant

Zhaoqing is one of the birthplaces of the ancient Lingnan ShiYu culture, in the history and culture of Zhaoqing in the Long River, gave birth to China's four great inkstones of the first DuanYan (Figure 3); it is the non-heritage culture of Zhaoqing City, with Shanxi Chengyi ink stone, Gansu TaoYan, Anhui SheYan of China's four great DuanYan. "Duanyan" is an inkstone produced in Duanxi, the eastern suburb of Zhaoqing City, Guangdong Province, with a history of more than 1,300 years. The regeneration design of this project is based on the background of "DuanYan culture", aiming to show the artistic charm of DuanYan culture through the integration of DuanYan's artistic forms and spatial art. In the design, the elements of ink, paper, and inkstone are extracted from the culture of Duan-yan, and a simple and generous design technique is used throughout, combining with the inkstone's form to create a commercial space full of cultural atmosphere. The integration of nature and architecture into the space not only injects new vitality but also allows people to feel the cultural cultivation and artistic charm in the commercial space. This design fully embodies the charm and value of "DuanYan culture", which is of great significance to publicizing and inheriting the culture.

Figure 3: Duan ink Stone

The design site is located in Duazhou District, Zhaoqing City, Guangdong, Hong Kong and Macao Bay Area (Figure 4); Duazhou District has convenient land and water transportation, with National Highway 321, Sanmao Railway and Xijiang River Navigation Channel running through the whole area, and the Pearl River Delta Loop Expressway, Nanguanguang (Nanning-Guangzhou) Railway, Guiyang-Guangzhou (Guiyang-Guangzhou) Railway and Guangzhou-Foshan-Zhaoxing Intercity Light Railway have already been opened to traffic through the territory. The district has initially formed a "one horizontal and five vertical" trunk highway framework with National Highway 321 Duanzhou section as the horizontal line, Provincial Highway 260 Silien section, and County Highways 413, 433,

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434, and the port road as the vertical line, and Duanzhou is a transportation hub in central and western Guangdong.

Figure 4: Project Site Location

5. Research Ideas and Paths

5.1. Design Concept

Mountain flowers fall out of the mountain long in the mountain water flow from the mountain idle. The mountains are so busy that they can see the real mellow, remove all fickleness and splendor, enter the realm of idleness and quietness, and have the open-mindedness of having high aspirations. The world loves and honors mountains and expresses and interprets the meaning of mountains in different forms. The renovation design of Zhaoqing Shuguang Electric Factory will take culture as the theme and the jungle as the conception to develop the design program. It retains the original buildings and plants for remodeling, respecting the site environment, and making full use of the site environment to modify itself.

5.2. Design Principles

(1) Ecological Priority

To protect the city's ecological environment, existing green space must be prioritized during the planning and construction of the site, and efforts should be made to protect the original ecosystem. During the construction process, the intervention of human activities should be minimized and the balance between the functionality of the site and its ecological needs should be ensured to provide a safe and livable habitat for plants and animals. Such an approach can safeguard urban green space and improve ecological quality while also taking into account the functional needs of the site.

(2) Adaptation to Local Conditions

In the process of site design and construction, the natural characteristics should be respected, combined with the actual situation of the site in local conditions, focusing on the comprehensive consideration of the site's multifaceted elements to meet the needs of the local community, the economy, and other needs at the same time, incorporating the regenerative design into the construction concept. This design can realize the harmonious coexistence of man and nature, create a comfortable and healthy environment for the city, and at the same time can also realize the goal of sustainable construction, creating a long-term sustainable site environment

(3) People-oriented

Urban green space is a public space shared by the general public. In the planning of green space, it is necessary to carry out a reasonable regional division design according to the age level of the public, psychological needs, and other factors. In addition, the design of green space also needs to follow the concept of regenerative design to realize the symbiosis of man and nature. This design allows the natural environment to better serve humans and create a more livable and comfortable green space.

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5.3. Extraction and Design of Cultural Elements

By extracting the four precious elements that extend from the inkstone, with the design technique of simplifying the complexity throughout, using variable techniques combined with it, expressed in the language of the old factory building architecture and cultural landscape, to create a renovation design of the old factory building with cultural characteristics. Through the hustle and bustle of urban traffic, in the middle of the busy city, we create a cultural theme park under the cultural cultivation of business, entertainment, and office space, injecting new vitality; nature, and architecture into the fusion of space, not only a place for cultural exchange, but also tourism and leisure shopping, but also the pursuit of nature and serenity of the place.

In the renovation of the old factory building, the culture of Tuan Yan was carried out through the design of the interior space, mainly through the use of Tuan Yan to extend the evolution of the Four Treasures through the interior ceiling; indoor flooring, indoor landscaping to present the DuanYan cultural design, through the simplification of the design techniques to create a public space with cultural inculcation (Figure 5); the culture and the space is the whole of the mutual infiltration, the inheritance of history and culture and spiritual attitude and culture and spiritual attitude.

Figure 5: Brush and Scroll Element extraction

In the landscape renovation design of the old factory building, the pen rests on the extracted four treasures of the renovation design, to create a vibrant landscape art effect; and visually produce the aesthetic interest of the virtual and real, smoke and rain flow. Under the combination and change of light and shadow, it creates one beautiful moving line after another, which brings comfort and relaxation to people, and at the same time, it attracts foreign tourists more, so that more people can recognize and understand the history of the culture of Dao Duan Yan.

5.4. General Layout Design Program

The northern part of the park is about 60 meters long and 90 meters wide, irregularly shaped, and covers an area of about 5000 square meters. 6 buildings can be used in the renovation area, and in this program, the main plant and the back of the hill are mainly designed. The theme of cultural innovation and the concept of the jungle are used to develop the design program (Figure 6). Preserve the original building, reinforce the original building based on the original building, demolish the dangerous building and build a new one, repair the old as the old, and restore the appearance of the old plant; choose green plants according to the characteristics of climate and human conditions, to achieve the combination of architecture and ecology; join the commercial elements, to form a system of harmonious coexistence between human beings and nature; respect the on-site environment, and take full advantage of the modification of the on-site environment itself.

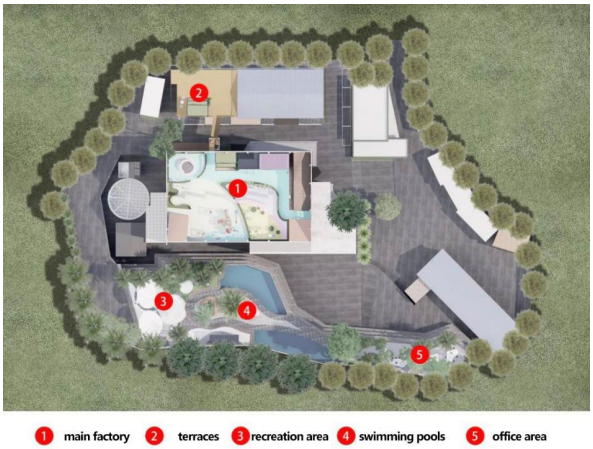

Figure 6: General Plan

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5.5. Project Dismantling Component

In the renovation design of the old factory building, it is necessary to remove part of the unsightly and dangerous building. Under the principle of "repairing the old as the old people-oriented ecological priority", the original side door is moved to the middle of the building for the sake of practical applicability and aesthetics of the site, optimizing the walking line; the original broken roof is demolished (Figure 7); the roof is flattened to form an open-air public space, which increases the light and at the same time, it is a way to bring people closer to ecology so that they can experience ecological beauty; finally, the original wall on the first floor is demolished to open up the connection route with the building inside, forming a large open public space. Finally, the original wall of the ground floor is removed to open up the connection route with the building inside, forming a large open public area, which facilitates more effective communication and contact between people. The old industrial plant is a product of human history, showing the trajectory of the development of industrial technology, in the design of the plant to retain the characteristic columns, but also to retain the industrial culture of the plant, so that people in the ecological integration of the environment can recognize and learn from the local industrial culture, to a certain extent, the inherited industrial culture. This is more conducive to improving the city's image, driving the development of the surrounding areas, the formation of an urban center to achieve the coexistence of old and new buildings co-prosperity and diversified development.

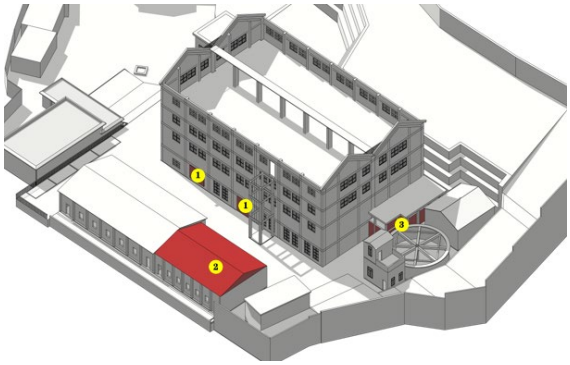

Figure 7: Building Demolition Plans

5.6. New Construction Portion of the Project

Based on the original new shape for the entrance, the use of modeling barriers to connect the indoor and outdoor space, enriching the visual and façade modeling, can also be used as a rain shelter and can provide a place for people to stay. A new rotary staircase is built on the original frame to connect the indoor and outdoor space, which is convenient for people's walking routes, enhances the sense of vertical space level, and increases interest in the area. After removing the original roof and flattening the wall, a new platform is built (Figure 8); it is designed as an open-air commercial space to increase the utilization of space. On the platform, an open-air drinking and snacking area is built, connected to a rotating staircase to construct horizontal and vertical space levels, creating a sense of experience and interest in the regional space.

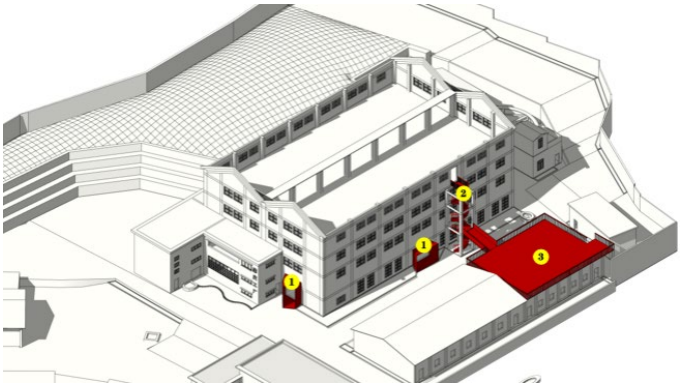

Figure 8: Building New Construction Plans

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5.7. Overall Design Ideas

The main factory building occupies a dominant position as a commercial area, and this commercial space combines indoor landscape design and eco-infrastructure construction to create a pleasant landscape and art environment while meeting the needs of regional environmental optimization. The indoor landscape of the commercial area depends on architectural design, landscape design, and interior design, combining man-made scenery with outdoor natural scenery to form a real landscape so that people can get close to nature in the indoor space. In addition, the eco-infrastructure construction of this commercial space can reduce environmental pollution and provide ecosystem services for the city, providing fresh air, food, safe shelter, recreation, and education. Through a combination of creative and playful design, the commercial space aims to realize the integration of commercial and cultural spaces, contributing to the sustainable and ecologically sound development of the city. The main factory building is divided into three main levels of space: the first level is a space where commerce and culture merge; the second level is an office space; and the third level is a rooftop garden space [10].

To ensure that the interior can have a four-season ornamental effect, plants are often selected as subtropical evergreens, and the office building itself is air-conditioned and ventilated to provide the interior space with a four-season pleasant landscape, as well as humidity and oxygen; the second step is the need to simulate the outdoor lighting: light is a necessary element of the plant growth, the office space of the plant varieties is relatively large, and the plant's relatively high degree of intensity, the absorption of light and supplementation of light are The third is the need for a durable growing environment: plant growth requires "felt-type planting" and "unit planting" two planting methods, as well as "recycled irrigation", "Drainage irrigation" two kinds of irrigation systems; Fourth, but also the most important, from the design to the maintenance of the full cycle of green management: indoor landscape design, construction and maintenance, have sufficient engineering experience, need to indoor green design and construction solutions.

Through the diverse mix of trees, shrubs, and grasses, the combined use of ecological materials to enhance biodiversity, adaptability, multifunctionality, and other aspects of resilience, to achieve "small greening, the big system". The design of the office area fully embodies the harmony and unity of architecture and nature, meets the multifunctional development of the office, and is more in line with the concept of a green office under cultural innovation (Figure 9).

The green color of the plants represents vitality and energy, injecting life into the space. At the same time, the layout of the entertainment space needs to meet reasonable layout and safety requirements. When selecting decorative materials, we choose environmentally friendly materials that meet the basic standards of green materials: non-toxic, non-irritating, non-radioactive, and low carbon dioxide emissions. Applying green materials and plants to the space and combining them with lighting effects help to reduce the production of harmful substances and make people feel comfortable. The setting of the leisure and entertainment space not only adds to the vitality of the space but also brings consumers to the business. The leisure and entertainment area, in realizing the regeneration design of the old factory building, creates a green and biodiverse space.

Figure 9: Recreation Area Rendering

ISSN 2663-1563 Vol. 5, Issue 7: 27-36, DOI: 10.25236/AJAGE.2023.050705

The entrance is made from a Chinese classical vignette: classical vignettes enliven the scenery, complement the space, and make the building integrate with the surrounding ecological environment. Classical vignettes have a positive impact on the environment, and in recent years, classical vignettes have been applied more often. In garden design, the design of landscape vignettes should be consistent with the overall style of the landscape, and classical vignettes are designed with the significance of the times witnessing the development of industry, and have the flavor of inheriting the spirit of traditional Chinese culture [11]. Expanding on the theme of ink and washing, using stone tablets and stones to replace mountains and stones to replace water, simplifying the complexity to create a sense of Zen (Figure 10); in carrying out the design of the landscape for the transformation of the old factory building, the main use of in-situ materials combined with the elements of ink and wash, preserving the original ecosystem. Without destroying the original materials and ecology, it also reduces the cost of renovation and is close to nature in the true sense, retaining the original natural things, and truly integrating with nature.

Figure 10: Landscape Node Plan

6. Conclusion

The use of regenerative design in urban space is still in the early stages of development, however, it is this very premise that has led to its phenomenal success, which speaks volumes about the growing concern for environmental health and green preservation. Urban design still faces a lot of practical needs that cannot be met, and this is also because the field is still immature and undeveloped, but because of this, we can see more development opportunities and provide more directions for spatial design. Therefore, it is essential to use green design in commercial space [12].

This paper analyses the importance of commercial space design in representing the degree of civilization of a city and points out that many commercial space designs are not relevant to the outlook of the city. In the context of cultural innovation, this article discusses the application of realizing green design in urban space and the use of the concept of balance between humans and nature so that developers can apply green design strategies in commercial space design. The article cites the culture of the Duan inkstone as a background for transformation and combines urban space as a design case to provide design ideas for the application of green design in commercial space. We emphasize that in the process of commercial space design, we always adhere to the environmental concept of sustainable development, follow the green law in urban design, and design to meet the needs of people and the environment at the same time, so that the urban space is full of green atmosphere. The article also provides many green design ideas for commercial space, which provides useful reference information for designers. In the design process, we should always adhere to the historical culture and green concept, follow the regenerative design law of urban design, and place the needs of people and the environment at the core of the design, to create a green and sustainable commercial space design, so that the urban space creates a green and environmentally friendly atmosphere. It also emphasizes the design of urban spaces so that people can properly understand green interior design. Creating a cultural and green atmosphere in the commercial space allows people to immerse themselves in a cultural and green environment, to truly understand the importance of cultural innovation and green urban design, and to transform their consciousness, so that they can reshape their new concepts and set up a new consciousness, so that people can experience cultural innovation and green, communicate cultural innovation and green, and disseminate cultural innovation and green in the urban space [13].

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As a whole, the application of regenerative design in space is a very large concept, and its overall application in space is a good idea, commercial space is only a small part of it, the problems and solutions we are dealing with are not all about space, we need to combine our knowledge with other fields to expand the depth of understanding [14]. Innovative and green design of cultural elements in commercial spaces can attract more attention, thus paving the way for their application in urban spaces. To ensure the sustainability of cultural and green design in urban areas, further action needs to be taken to conduct more in-depth analyses and research. Such explorations would not only contribute to the development of cultural innovation and green design but also help to strengthen their application in urban spaces.

Acknowledgements

Guangdong Technology College Science and Technology Project "Landscape Creation of Old Factory Areas Based on Lingnan Culture Replacement Strategy--Taking Zhaoqing as an Example" (2022GKJSK024); 2022 Zhaoqing Philosophy and Social Science Planning Fund Project "Research on the Satisfaction Evaluation of Public Space for Rural Pension in Zhaoqing City under the Strategy of Rural Revitalisation" (22GJ-52).

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