

Integrated development strategy of industrial buildings and farming communities in Hong Kong

Kaining Tian

School of Architecture, Shandong Jianzhu University, Qingdao, Shandong Province, China, 100084

kenyteen2021@gmail.com

Abstract. Insufficient agricultural land and a high vacancy rate in industrial buildings are important problems facing Hong Kong. Therefore, this study aims to determine whether industrial buildings are suitable as agricultural spaces and to formulate corresponding utilization strategies to promote agricultural production and food supply in Hong Kong. Research objects include industrial building space and hydroponic agricultural space. This paper used literature research and field research as the main research tools to collect relevant information on the utilization potential of industrial buildings and hydroponic agriculture. In addition, research data are derived from literature studies and surveying data, which provide detailed information about the industrial building structure and surrounding environment to better assess its suitability and feasibility. This research concludes that industrial buildings are potentially suitable for use in agricultural spaces, especially hydroponic agriculture. Its internal structure and environmental conditions can support agricultural production and effectively use vacant industrial building space to expand the scale of agricultural production. Regarding utilization strategies, this study recommends using recycling systems and related technologies, such as hydroponic systems and LED lighting, to transform industrial buildings internally to create farming communities. This will help make agricultural production more efficient and sustainable while providing cities with a fresh supply of produce.

Keywords: Hydroponic Agriculture, Industrial Buildings, Hong Kong, Utilization.

1. Introduction

The agricultural challenges facing Hong Kong include insufficient land, insufficient productivity to meet urban demand, farmland encroachment due to urbanization, waste of green space, and rising food prices due to the economic downturn. Therefore, it is crucial to find alternative, affordable ways of producing food. At the same time, there are a large number of vacant industrial buildings in Hong Kong, but it is difficult to revitalize industrial buildings[1]. As shown in Figure 1, the results of industrial building revitalization do not reflect the upgrading of industries.

This macro-scenario raises several key questions: Why do revitalized industrial buildings in similar contexts differ in their space utilization? Are vegetables produced in cities more popular? Are urban residents interested in agricultural activities?

The theme of this study is to explore the feasibility and strategies of integrating industrial buildings with rural communities. Specific questions include: Is the presence of agriculture more conducive to

improving the utilization rate of industrial buildings? Are vegetables produced in cities more popular because of their quality and price? Are urban residents interested in agricultural experience activities and promoting urban vertical farming?

This research has profound implications for practice. Using industrial buildings for agricultural space can improve resource utilization efficiency and promote urban vertical agriculture. Through the construction of agricultural communities, resource recycling such as water recycling and waste recycling can enhance the sustainability of agriculture. The use of advanced agricultural technology can improve production efficiency, reduce space occupation, and increase economic benefits. This helps reduce Hong Kong's dependence on imported vegetables, provides local food, and creates opportunities for sustainable development [2].



Figure 1. Statistics on revitalization uses of industrial buildings.

2. User groups and needs

Surrounding migrant workers and residents in the community: convenient shopping for vegetables, resting space close to nature, and space to experience rural life

Due to port development, there are more tourists: experience the characteristic industrial building food (street food), understand the industrial building culture and its transformation (cultural tourism), and get a space to rest [3].

Farm staff: production space (planting, distribution, bagging), rest space.

Users who rent makerspaces: convenient commuting, low land rent, undisturbed environment, and good environmental quality.

Couriers and other external transportation personnel: the shortest route to obtain goods, convenient transportation entrance.

Usage: Lucky Industrial Building is located within other designated land use areas in Kwun Tong District, which is planning land that allows industrial land to be converted into commercial buildings to simplify the revitalization process of industrial buildings. There are currently 111 commercial and trade companies, 33 retail companies, and 34 wholesale manufacturing companies. From a management point of view, there are multiple owners and property rights are complex, but 91% of users believe that industrial buildings should be upgraded, and more than 90% of owners are willing to sell their use rights.

3. Spatial structure

Building type characteristics - space

The plan space layout, vertical transportation and floor load of the factory building with the maximum number of floors and maximum height allowed by the law should be adapted to the requirements of various production processes as much as possible. The layout of unit partitions,

passages and toilets should meet the needs of small and medium-sized units. Of course, in addition to these types of factories, there are also a considerable number of large units in Hong Kong, that is, factories occupying a thousand floors for one manufacturer and high-rise factories specializing in production. The architecture and structural design of these factories are similar to those of small and medium-sized commodity factories [4].

High-rise industrial factories in Hong Kong are generally planned or approved by the Hong Kong authorities, and are invested in and constructed by real estate developers. In other words, buying a piece of land to build a building or a group of buildings does not occupy a large area. In terms of the standard floor building area, the minimum area of each floor is only about 200 square meters, usually about 1,000 square meters. If each floor reaches 3,000 square meters, such as in Taikoo Industrial and Commercial Center), it is considered a large industrial building. It is conceivable that as an industrial building with large depth requirements, if the building area of each floor is only about 1,000 square meters, it can only be arranged in the form of a tower. Therefore, high-rise industrial plants in Hong Kong are dominated by towers and slab buildings with a small aspect ratio similar to towers [5].

Industrial buildings are mainly composed of pedestrian passages, cargo passages, units, auxiliary facilities and service cores. Pedestrian passages include entrances and exits, lobbies, elevator halls, passenger elevators, walkways and evacuation stairs. Cargo passages include truck entrances and exits, loading and unloading docks, freight elevator halls, freight elevators and freight walkways. Each unit consists of production rooms, offices, bathrooms and beverage rooms. Auxiliary facilities include guard rooms, parking lots, staff canteens, canteens, transformer rooms, air conditioning rooms and automatic control systems. The service core is a centralized arrangement of service facilities located in the middle or end of the standard floor of the factory building, including elevator halls, freight elevator halls, passenger elevators, freight elevators, evacuation stairs and some toilets.

4. Agricultural Technology

In Hong Kong's vertical farms, a series of advanced agricultural technologies are used to achieve efficient agricultural production and resource recycling. These agricultural technologies include:

Vertical growing system: By growing vegetables on vertical vegetable poles, you can maximize space savings and increase crop yields.

Water circulation system: Realize the aquaponics cycle of the farm, using the waste from farmed fish as plant nutrients. At the same time, the growth of plants also provides oxygen to the fish. This system of recycling water resources helps reduce water usage and improve resource utilization efficiency.

Computer-controlled spectrum technology: In the vertical farm of the Tuen Mun Industrial Building, computer-controlled optimal spectrum is used to provide appropriate light according to the needs of different plant parts to promote the growth and development of plants.

Cultivation of high-value crops: Vertical farms mainly plant high-value crops, such as strawberries, basil leaves, Taiwanese vegetables, cherry tomatoes, etc., to improve the economic benefits of agriculture.

Container farm technology: Expand vertical farms into export-oriented container farms, using the convenience and flexibility of containers to conduct agricultural production in a limited space and increase agricultural output.

These advanced agricultural technologies make vertical farms a new and scalable production model in industrial buildings, and also provide the foundation and core for the design and development of farming communities. Through the continuous integration of innovative technologies, this paper can further promote the development of Hong Kong's agriculture, promote the organic integration of urban and agricultural areas, and achieve more sustainable and efficient agricultural production.

5. Conclusion

This paper repositions industrial buildings as agricultural spaces by building farming communities, which not only provides new opportunities for Hong Kong's agricultural development, but also helps promote the city's economic diversification and sustainable development. This strategy is expected to

improve the efficiency of agricultural production, reduce dependence on exotic vegetables, and alleviate the waste of urban resources, making a positive contribution to the future sustainable development of Hong Kong. Repurposing industrial buildings as agricultural spaces is a promising solution when faced with the challenges of urbanization and limited resources.

The construction of agricultural communities is a key part of realizing the agricultural utilization of industrial buildings. This community structure allows for the recycling of resources, including water reuse and waste recycling. For example, the use of advanced water circulation systems can minimize the waste of water resources and ensure the irrigation and growth of crops. At the same time, the application of waste recycling technology, such as composting organic waste, helps reduce the adverse impact of waste on the environment and achieve sustainable agricultural production.

In addition, advanced agricultural technology plays a key role in industrial agriculture. Vertical farming technology allows for multi-level vertical cultivation within a limited space, thereby maximizing land utilization. With the help of LED lighting and automated control systems, precise environmental control can be achieved to increase the growth rate and yield of crops. This not only improves the efficiency of agricultural production, but is also expected to reduce the need for pesticides and fertilizers and mitigate negative impacts on the environment.

The development of vertical farms in Hong Kong has successfully proven the feasibility of industrial agriculture. Located inside high-rise buildings, these farms achieve high-yield vegetable production through innovative growing techniques. This provides practical feasibility and success stories for repurposing industrial buildings into agricultural spaces.

Although this study provides important insights into the use of industrial buildings for agricultural spaces, there are some shortcomings. First, the study does not discuss in detail the influence of social, cultural and policy factors on the feasibility of integrating agriculture with industrial buildings, which may play an important role in actual implementation. Second, there is insufficient in-depth analysis of sustainability and environmental impacts, and considerations such as ecosystems and ecological balance have not yet been covered. Finally, research may require more field surveys and case studies to further verify the feasibility and actual benefits of industrial building agriculture.

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