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Research on Self-balance of Funds in Embedded Service Facility Projects

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Abstract: With the accelerated development of urbanization, embedded service facilities projects play an increasingly important role in promoting urban intelligence and improving residents' quality of life. Such projects cover transportation systems, intelligent network facilities, Internet of Things systems and other aspects, and have a significant impact on the construction of urban infrastructure and residents' life services. However, funding issues have become a major obstacle to the development of these projects, including large initial investment, high operating costs and long capital recovery cycles. The purpose of this study is to explore the self-balance scheme of embedded service facility project fund, so as to solve the difficult problem of fund management and promote the sustainable development of the project. Through literature review and case analysis, this paper analyzes the fund flow of embedded service facilities projects, draws on the experience of fund management at home and abroad, and designs a specific fund self-balance scheme. It is hoped that this study can not only provide new ideas of fund management for embedded service facilities projects, but also provide practical reference for urban sustainable development and scientific and technological innovation.

Keywords: Embedded service facility project, Self-balance of funds, Fund management, Sustainable development.

1. Introduction

With the acceleration of the global urbanization process, urban development is facing unprecedented challenges and opportunities. In this context, embedded service facilities projects, such as transportation systems, intelligent network facilities, Internet of Things systems, etc., have become an important force to promote urban intelligence and improve the quality of life of residents. Through close integration with urban infrastructure, these projects provide urban residents with more convenient, efficient and intelligent services, which is an indispensable part of modern cities. However, the construction and operation of these embedded service facilities projects face significant funding challenges. The large initial investment requirements, the ongoing capital consumption in the operational phase, and the uncertainty of capital recovery together constitute important obstacles to the development of the project. The existence of funding problems not only limits the sustainable development of the embedded service facilities project itself, but also affects the process of urban intelligence and the improvement of residents' quality of life. Under the background of the current economic and social development, it is particularly urgent to conduct in-depth research on the self-balancing scheme of embedded service facilities projects. By exploring an effective fund management mechanism, we can not only provide continuous and stable financial support for these projects, ensure the continuity and quality of services, but also promote the sustainable development of the city and scientific and technological innovation.

2. Theoretical Basis

2.1. Urban Community Theory

2.1.1. Relevant research abroad

Studies on urban community governance in foreign countries are earlier than those in China. Britain, as a representative city with a rapid urbanization process in the early stage, encountered many obstacles in its development, such as the emergence of a large number of slums, which caused extensive research by scholars. At the same time, it was found in the study of urban infrastructure that only the architectural form of community transformation had certain limitations [1]. Subsequently, scholars continue to explore in various fields, and research out a lot of governance methods on urban communities. In the aspect of upgrading and improving old urban areas, Henu. E proposed that community transformation should be carried out with the design principle of "people-oriented", which is beneficial to the improvement of residents' neighborhood relations and survival structure [2]. In terms of urban development, scholars from all walks of life have also put forward the research idea of building "livable cities". Lewis Mumford, in the History of Urban Development, expressed his critical view of apathy and unitary modernism, and pointed out that the suitability of the community's public sphere plays a decisive role in urban vitality [3]. William H. White et al. explained their understanding of public space from the perspective of community residents and from their subjective feelings [4]. In terms of improving the economic system, GreenfieldEA and ScharlachAE pointed out that social funds are conducive to the sustainable development of the mutual care community [5].

2.1.2. Relevant research at home

The relevant research on community transformation in our country began in the early 20th century. In terms of the research on participants in urban community governance, Liang Yuzhu believes that in urban governance, grass-roots governments should maintain the concept of collaboration, take it as the guiding ideology to guide urban governance, keep up with the trend of The Times, realize cooperation with multiple social subjects, and jointly promote the modernization process of social governance [6]. In terms of the mode of urban community governance, Wei Na [7], Xia Xiaoli [8], Zhang Kangzhi [9] and other scholars pointed out that the governance of urban communities is mostly

dominated by the government, and other social subjects give little support to it. In terms of embeddings of social work, Xiong Yuegen was the first to apply the meaning of "embeddings" to Chinese social work in China. He proposed the concept of "institutional embeddings" and applied it into practice. He pointed out that this strategy can be a driving force for social work education in China to achieve localized practical development [10]. Wang Sibin later introduced the concept of embeddism into the field of social work, pointing out that the process of Chinese social work is the development of embeddism. He also made a systematic explanation and discrimination of the development of Chinese social work centered on the concept of embeddism, completed the development framework, and explained the development characteristics of Chinese social work [11]. In terms of embedded community governance, Yan Zhen analyzed the embedded governance of a community in Tianjin, summed up experience from social work, got its construction factors and the actual development situation of the community, and came up with the decisive factors of embedded social work [12]. Based on China's national conditions, Yin Miaozhong analyzed the necessity of keeping social work professional and scientific, and pointed out that to achieve good development of social work, it is necessary to organically combine the technical and cultural values of local and non-local social work genes [13]. Xu Yushan analyzed the community governance in Guangzhou and Shenzhen and proposed the research path of "integration - service - incubation" [14]. In the aspect of community embedded elderly care, Tian Yang [15] and Liu Yaqing [16] pointed out that small and micro community elderly care institutions should be embedded into communities to form a large-scale and chaining health operation system. Zhou Yue and Cui Wei analyzed the shortcomings of the institutional-embedded community pension model in terms of service content and personnel management [17]. In terms of embedded community cultural governance, Jia Jingfeng pointed out that the concept of modern cultural governance, which is introduced into urban communities through social work, can promote the growth of community social organizations [18].

2.2. Embeddedness Theory

The concept of embeddedness was first proposed by Karl Polanyi of Hungary in 1944, and embeddedness refers to the interdependence between economic behavior and social system from the perspective of the correlation between economic behavior and social relations in the human market. Mark Granovetter further refined the concept of embeddedness, dividing embeddedness into structural embeddedness and relational embeddedness. Structural embeddedness mainly means that the network composed of multiple agents is embedded into the social structure on a macro level, while relational embeddedness pays more attention to the correlation among agents and emphasizes the reciprocity of agents in the network [19]. The academic circle also divides the forms and functions of embeddedness from different angles and levels, which reflects the value of embeddedness theory in many fields.

China's Embeddedness Theory was introduced by Professor Luo Jiade of Tsinghua University in 2007. In recent years, the research direction has gradually transformed from social networks to the construction of embedded service facilities in urban communities, aiming at bringing services urgently needed by the masses into the community, rationally allocating resources, and revitalizing stock space.

2.3. Analysis of Embedded Service Facility Project

2.3.1. Project size and duration

The embedded service facility project covers a wide range of application fields and technical characteristics, and the project scale and cycle are diverse. Such projects usually involve transportation systems, intelligent connected facilities, Internet of Things systems, etc., which not only require a high degree of technology integration and system compatibility, but also need to be closely integrated with urban infrastructure and residents' daily lives. Due to the complexity of the project, its scale and cycle are affected by a variety of factors, such as technical difficulty, capital investment, policy support and market demand.

2.3.2. Technical requirements and innovation

The technical requirements and innovation of embedded service facility projects are one of its core characteristics, and these projects often rely on the latest technological advances and promote further innovation in technology during the implementation process. Technical requirements are not only related to the feasibility and efficiency of the project, but also directly affect the cost and cycle of the project.

Technological innovation is another significant feature of embedded service facility projects. The implementation of the project is often accompanied by the development and application of new technologies, which not only promotes the progress of the technology itself, but also provides new impetus for the development of the industry. Taking the application of Internet of Things technology in urban infrastructure management as an example, by deploying a large number of sensors and smart devices in the city's water supply, power supply, traffic and other systems, real-time monitoring and intelligent management of urban infrastructure can be achieved, and the efficiency and level of urban management can be significantly improved. The application of this technology not only requires the project team to master the latest technical knowledge, but also needs to keep pace with The Times and constantly explore and apply new technical solutions. Technological innovation has also brought about the improvement of economic and social benefits.

In short, the technical requirements and innovation of embedded service facilities projects are crucial to the success of the project, which not only determines the implementation cost and cycle of the project, but also an important force to promote social progress and sustainable development. Therefore, the project management team needs to constantly pay attention to the technological progress and actively explore and apply new technologies to ensure the successful implementation and long-term benefits of the project.

2.3.3. Project operation context

The capital flow and self-balancing ability of embedded service facility projects are significantly affected by external environment and internal operational factors. The external environment, including policy support, economic conditions, technological advances, and market demand, has a profound impact on the source, use, and recovery of project funds. Internal operation, involving project management efficiency, cost control and revenue generation mechanism, is the key to achieve self-balance of funds.

From the perspective of external environment, government

policies and funding play a decisive role in the capital flow of embedded service facilities projects. At the same time, technological progress and changes in market demand will also affect the flow of project funds. Taking the Internet of Things as an example, with the maturity of the technology and the reduction of costs, the initial investment needs of related projects are correspondingly reduced, but the demand for technological upgrading may increase the capital investment during the operation. The requirement of self-balance of funds in internal operation is reflected in efficient project management and cost control. Good project management can optimize the use of funds, reduce unnecessary expenditures, shorten the project cycle, and thus speed up the return of funds. Cost control involves precise budgeting and strict cost monitoring to avoid budget overruns. The establishment of revenue generation mechanisms is another key to achieving self-balancing of funds, which requires projects to create economic value as well as social value.

When analyzing the operating environment of an embedded service facility project, many factors need to be taken into account, including political, economic, social, technical, legal, and environmental (PESTLE) impacts. These external and internal factors affect the fund flow and self-balancing ability of the project, which determines the success of the project. Political factors include changes in government policies, funding opportunities and the regulatory environment; Economic factors relate to macroeconomic conditions, investment availability and cost-benefit analysis. Global economic uncertainties, such as the COVID-19 pandemic in 2020, have put financial pressure on many embedded services projects, causing some projects to be delayed or scaled back; Social factors include population growth, urbanization process and public demand and acceptance of intelligent services. With the acceleration of urbanization process, urban residents have an increasing demand for more efficient and intelligent urban services, which provides a broad market for embedded service facilities projects. Technical factors relate to the rate of technological progress and the availability of technology on which the project depends; The promotion of 5G technology provides higher speed and lower latency network support for iot facilities, which greatly improves the technical implementation possibility of the project; Legal factors include laws, regulations and standards related to the implementation of the project, which may affect the design, implementation and operation of the project. Environmental factors include the possible impact of the project on the natural environment and its performance in terms of environmental sustainability.

2.4. Theory of Self-Balancing Funds

At present, there are many studies on the fund balance of construction projects, including urban construction projects [20], urban village reconstruction projects [21], real estate development projects, urban water management projects [22] and other basic service facilities. At present, the research on financing of development projects is mainly divided into two aspects: one is to discuss the way to obtain project start-up funds from the perspective of developers; the other is to consider the overall income and expenditure from a macro perspective to measure whether the project balance [23]. In addition, the theoretical support for the self-balance of funds of construction projects is divided into the following aspects: the theoretical basis of project fund balance, basic supply and demand theory [24]; System theory and cybernetics, also known as system planning, were first applied to urban planning in Britain in 1960 [25]. The development threshold theory is also known as the threshold theory [26], which holds that urban resources are limited in a certain period of time, so the intensity of urban development is also limited. After the domestic regulation theory of floor area ratio [27] was applied to the reform and opening up, with the rise of China's real estate development industry, it began to learn from the controllable mode of urban development in the United States. "Floor area ratio" refers to the ratio of the total floor area of a plot to the land area.

2.5. Analysis of Self-Balancing Funds

The basic theory of supply and demand in economics provides the theoretical basis for the balance of project funds. From the macroscopic point of view, construction projects can be regarded as a kind of public goods. The supply and demand of capital in the market determine the price of the product through the interaction. However, when the government takes the lead in a project, the transaction of such a project is not a simple market behavior, so the characteristics of the project itself can usually be reflected by the balance of funds. The development of the project needs to match the supply of funds with the demand for funds, so the government can intervene in both the supply and demand of funds, so as to achieve the balance of funds for construction projects. From the perspective of developers, the self-balance of funds of construction projects needs to be considered from three aspects: the source of funds, the use of funds and the withdrawal of funds.

3. Case Analysis of Embedded Service Facility Project

Based on the characteristics and theoretical analysis of embedded service facility projects and fund self-balance, this chapter takes Beijing community embedded elderly care service project and the empirical exploration of funds management of typical embedded services at home and abroad as examples, and chooses Beijing A senior care service Station, Singapore Smart Country project, Hangzhou City Brain project and other typical cases for in-depth analysis. Beijing, as one of the first cities to respond to the call of the state to carry out community embedded service facility projects and support for the elderly, began to explore the practice of community elderly care service stations in 2016. The operation status and operation mechanism of Beijing A senior care service Station in the process of project construction are of typical significance to this study. Overseas cases such as Singapore's Smart Country Project show innovative fund raising and operation strategies, and domestic cases such as Hangzhou's "City Brain" project are of great significance in promoting urban construction through the combination of government guidance and market drive. The above cases have strong typicality and demonstration, which plays an important role in the research of the self-balance of funds of embedded service facilities.

3.1. Beijing Community Embedded Elderly Service Project

As the capital city, Beijing has unique geographical conditions and a solid economic foundation for the elderly care industry. After exploration, it finally decided to provide

"embedded" elderly care services in the form of community elderly care service stations. The pilot construction began in 2016, and the post service has been rapidly promoted since then.

In November 2015, the Beijing Special Plan for Elderly Care Service Facilities proposed to invest the elderly care resources of all social parties into the construction of community elderly care facilities. At the end of 2015, some representative elderly care service stations entered the construction stage and were constantly equipped with more perfect service facilities in practice. In 2016, the Beijing Municipal government issued an explicit policy on elderly care service stations and proposed the construction standards of elderly care service stations. At the same time, the six major urban areas began the pilot work of elderly care service stations, and the perfect community elderly care service has taken shape. In April 2017, the Beijing Municipal Government issued the Construction Plan of Beijing Community Elderly Care Service Station (2016-2020), which clearly pointed out that by 2020, Beijing plans to fully build 1,000 elderly care service stations. In addition to ensuring the construction of elderly care service in urban communities, rural communities also need to cover a large area [28]. Since then, Beijing has issued a series of management regulations and policies to regulate and support the sustainable development of community elderly care service stations.

3.1.1. Introduction of An elderly service station in Beijing

Beijing A pension service Station is A project managed by Beijing A pension Service Company. During Beijing's "13th Five-Year Plan" period, community elderly care service is the strategic focus of elderly care, so Beijing A elderly care Service Station company came into being in September 2016. The company is committed to the field of elderly care services, to create chain institutions, to achieve branding and professional management. At present, Beijing A retirement service station has become one of the most successful retirement service station brands in China. There are 130 Beijing A senior care service stations in Beijing, which cover 47 townships and more than 300 communities, serving more than 150,000 elderly people. The station works closely with communities in various urban areas of Beijing.

The way of operation of Yi Station company is unique, and it designs exclusive service plans for the characteristics of each community to highlight the characteristics of each elderly care service. In addition, the company works with the government and the community to expand its scale through corporate acquisitions and affiliate strategies. However, according to the survey records of 2020, in terms of operation, the station is currently in a state of loss. Most of the funds of the station come from government purchase and subsidies. In addition, the station also strives to expand its market. 35% of the funds come from government purchase, 35% from government subsidies for elderly services, 25% from suppliers' cooperation, and 5% from selling products. According to the data, it mainly relies on the government and market operations, and some funding sources are extremely unstable. It can be seen that because the marketization of this industry is limited by its special nature, it still mainly relies on government support.

3.1.2. Operation mechanism of An elderly service station in Beijing

Through institutional embedment, the legal status is determined. The field of elderly care services involves the effectiveness of social public services. As the biggest supporter of community elderly care service stations, the government supports the development and operation of elderly care service stations through various institutional policies and financial subsidies, empowers elderly care service stations to provide elderly care services, and establishes the external environment and legal status of elderly care service stations with a targeted system.

Through structural embedding, the organization status is determined. As a practical carrier of community embedded elderly care service, Beijing Community elderly care Service Station is in the basic position of Beijing's four-level elderly care service system. At the same time, it is integrated into the service system as a new organizational form. Elderly care service stations can continue to sink on the basis of services provided by elderly care institutions, embed themselves into corresponding communities, provide closer and more detailed services, and expand the space for different types of elderly care services. On the other hand, nursing homes and housekeeping services are common forms of elderly care services. The construction of Beijing A elderly care service Station is a manifestation of structural optimization, which provides an opportunity for relevant practitioners and is conducive to the development of the elderly care industry.

Empower organizational development through resource embedding. The government, the market and the block provide financial support to the community elderly care service stations and give them the ability to integrate resources to achieve the healthy operation of the organization. The Beijing Ministry of Civil Affairs provides subsidies for various elderly care service projects, and the water and electricity bills of the station enjoy the preferential policy of charging residents at the same price. The Group headquarters receives funds from other pension businesses to help maintain daily operations. At the same time, the community provides software and hardware support. On the site selection issue, the community jointly planned at the street level, and provided free sites and houses in the community, including some necessary hardware facilities. On the other hand, the community cooperates with the station in the form of project contracting, so as to achieve the promotion of elderly care services.

3.2. Fund Management Case of Embedded Service Facility Project

3.2.1. Related cases abroad

In exploring the fund management and self-balancing mechanism of embedded service facilities projects, there are many successful cases in the world worth learning. These cases not only demonstrate innovative ways to raise and use funds, but also provide effective strategies for fund recovery, which has important reference value for guiding the implementation of similar projects in China.

A case in point is Singapore's Smart Nation Initiative. As a global pioneer in the construction of smart cities, the Singapore government has attracted a large number of private funds to invest in smart transportation, smart healthcare and other fields through the public-private partnership (PPP) model. For example, in the Intelligent Transportation System project, the Singapore government not only provided initial financial support, but also brought in a number of private enterprises as partners to share the cost of project development and operation. This model not only reduces the financial burden of the government, but also improves the efficiency and innovation of the project. Another noteworthy

case is the urban fiber network project in Europe. In Stockholm, Sweden, the government and private investors jointly funded the construction of an urban fiber optic network through the establishment of the Stockholm City Network Company (Stokab). Using an open access model, the project has attracted a number of telecom operators to use the network to provide services and recoup funds in this way. After years of operation, the network has not only greatly improved the city's information and communication infrastructure, but also achieved good economic returns, becoming an international model of urban optical fiber network construction. In the United States, the smart street light upgrade project in Los Angeles is an example of how to achieve the return of funds through the economic benefits of energy conservation and emission reduction. The project significantly reduced energy consumption and maintenance costs by replacing traditional street lights with LED street lights. The savings not only cover the initial investment in the project, but also bring ongoing financial benefits to the city. In addition, the project also generates additional revenue from the sale of carbon emission rights, further enhancing the project's financial sustainability.

3.2.2. Related cases at home

In China, the implementation and funding management of embedded service facilities projects also demonstrate diversity and innovation. Through a combination of government-guided and market-driven models, these projects have played an important role in promoting the construction of smart cities. The following case studies show the successful experience in raising, using and withdrawing funds in China.

Hangzhou's "City Brain" project is one of the benchmarks of domestic smart city construction. The project relies on Alibaba's cloud computing and artificial intelligence technology to optimize urban services such as traffic management and public safety by integrating urban operation data. In terms of funding sources, the project has received strong support from the Hangzhou government and attracted investment from companies such as Alibaba. Through the public-private partnership (PPP) model, the project successfully integrated government resources and the technological advantages of private enterprises to achieve efficient capital utilization and technological innovation. In terms of capital recovery, in addition to improving the efficiency of city management and reducing public expenditure, the project also creates revenue for partners by providing cloud services, data analysis and other commercial services, forming a self-sustaining financial model.

The Shenzhen Smart Light Pole Project is an example of how funds can be effectively used through technological innovation and multi-faceted cooperation. The goal of the project is to upgrade the traditional street light pole into a smart light pole that integrates multiple functions such as 5G base stations, video surveillance, and environmental monitoring to support the construction of smart cities. In terms of funds, the project has taken the way of joint investment by the government and a number of enterprises, and at the same time, funds are collected by renting advertising space and communication facilities on the lamp pole. According to preliminary estimates, through these business models, the project will be able to recover most of the investment cost in the first three years, and will continue to generate stable earnings after that.

The Suzhou Industrial Park Intelligent Transportation System is another example that demonstrates the effectiveness of innovative money management strategies. The project aims to improve traffic efficiency and reduce congestion by introducing an intelligent traffic management system. In terms of funding, in addition to government investment, the project is also funded and operated through the BOT (Build-operate-transfer) model in cooperation with domestic and foreign technology suppliers and financial institutions. In addition, the project also set up a revenue model based on fine income and service fees to ensure the effective return of funds and long-term operation of the project. These cases show that domestic embedded service facility projects have adopted diversified strategies in fund management, not only effectively utilizing government and private capital resources, but also realizing sustainable recovery of funds through innovative business models and operational mechanisms. These experiences provide a valuable reference for other cities and projects, demonstrating the possibilities of advancing smart city construction through flexible and diverse capital management strategies in a complex economic and technological environment.

4. Fund Self-balancing Design

4.1. Principle of Self-Balance of Funds for Embedded Service Facilities Projects

It is very important to follow the clear principles of financial management, investment decision and fund allocation when designing the self-balancing scheme of embedded service facility project. These principles not only ensure the effective use of project funds, but also provide a solid foundation for the long-term sustainability of the project.

Principles of financial management. Emphasize the precise monitoring and strict control of the project's financial situation. Taking the smart light pole project in Shenzhen as an example, the project adopts a dynamic budget management and cost control system, which adjusts the allocation of funds in time to ensure that the project does not overspend by monitoring the difference between the project expenditure and the budget in real time. In addition, regular financial audits are conducted to assess the financial position and ensure transparency and compliance in the use of funds.

Investment decision principles. Focus on project investment effectiveness and risk management. The Suzhou Industrial Park Intelligent Transportation System project has carried out detailed feasibility study and cost-benefit analysis in the early stage to ensure that the investment decision of the project is based on sufficient market and technology research to maximize the investment benefit. At the same time, the project adopts a phased implementation strategy, starting modules with high returns and low risks first, and gradually achieving full coverage, effectively reducing project risks.

Principles of allocation of funds. Look at funding needs and priorities for the different phases of the project. Hangzhou's "City Brain" project has adopted a flexible strategy in funding allocation, prioritizing the funding needs of key technology research and development and core system construction, while establishing emergency funds to deal with unforeseen expenditures. Through scientific fund allocation, the project not only ensures the smooth progress of the key stage, but also improves the efficiency of the entire project fund use. In the concrete implementation, these principles support and interact with each other, forming a comprehensive fund self-balance management framework. For example, through

detailed financial management, project managers can timely understand the use of funds and the financial health of the project, and provide reliable data support for investment decisions. Wise investment decisions can ensure that funds are invested in areas that maximize returns and improve the efficiency of capital use. The reasonable allocation of funds ensures that the project has sufficient financial support at different stages, and avoids the situation of fund shortage or waste.

4.2. Details of the Design

Designing an efficient self-balancing scheme is critical to the success of an embedded service facility project. This plan needs to include specific measures for financial management, investment decisions and capital allocation to ensure that projects are in sound financial health from inception to completion and achieve long-term sustainable development.

4.2.1. Financial management

The primary task of financial management is to ensure transparency and accountability. Implement an electronic financial management system to achieve automatic recording and real-time monitoring of all financial transactions. For example, cloud account services are used to record every expenditure and income of the project, and big data analysis tools are used to conduct in-depth analysis of financial data, timely detection of abnormal situations and prevention of fund abuse. Second, implement a strict budget control mechanism. At the beginning of the project, a scientifically rigorous budget plan is developed based on detailed market and technical research. Budget allocation should take into account the various stages and potential risks of the project to ensure that there is sufficient funding for each link. At the same time, the budget adjustment mechanism is set, so that when unforeseen challenges are encountered during the implementation of the project, it can quickly respond and adjust the allocation of funds to avoid greater financial losses. Finally, establish a comprehensive risk management framework. Through the continuous monitoring of external factors such as market, technology and policy, we can identify the risks that the project may face and formulate corresponding countermeasures. For example, through the purchase of insurance, the establishment of emergency funds, etc., to reduce the impact of potential risks on the project's financial status.

4.2.2. Investment decision

The core of investment decision is to maximize investment benefit and minimize risk. First, project investment decisions should be based on thorough market research and technical evaluation. SWOT analysis (strengths, weaknesses, opportunities, threats) is used to determine the core competitiveness and potential market of the project, and to ensure that the direction and strategy of the project investment match the market demand and technology development trend. Secondly, the dynamic evaluation mechanism is adopted to continuously evaluate the investment benefit of the project. Use financial models, such as net present value (NPV) and internal rate of return (IRR), to regularly evaluate the financial performance and return on investment of the project, and adjust the project strategy based on the evaluation results to ensure that the capital investment is producing maximum benefit. Finally, implement the phased investment strategy. The project is broken down into multiple stages or modules, and funds are gradually released according to the performance of each stage and market feedback, which can not only effectively control risks, but also ensure that the project receives financial support as needed.

4.2.3. Funds allocation

The key to the allocation of funds is to ensure that the funding needs of all stages of the project are met, while optimizing the efficiency of the use of funds. First, a flexible fund allocation plan should be developed to dynamically adjust the fund allocation according to the project progress and actual situation. For example, more financial support may be needed in the technology research and development phase, while more funds may be needed in the operation phase for marketing and maintenance. Second, optimize the flow of funds to ensure adequate funding for key links and value creation points. This requires project managers to have a deep understanding of the value chain of the project, identify which links are key to generating revenue, such as technological innovation, market development, etc., and then prioritize the funding needs of these links. For example, in an intelligent transportation system project, it may be necessary to prioritize investment in high-performance data processing centers to support real-time traffic management and data analysis to quickly achieve traffic efficiency and revenue increases.

In addition, the establishment of diversified sources of capital, reduce the risk of capital supply. In addition to traditional government funding and bank loans, various financing channels such as private investment, crowdfunding and project financing can also be explored to ensure that the project can obtain stable financial support at different stages. At the same time, through the establishment of partnership, sharing resources and risks, it can also effectively improve the efficiency of the use of funds and the overall stability of the project. Finally, implement the strategy of cost control and income maximization to improve the efficiency of capital use. Through the use of advanced project management tools and methods, such as lean management, value engineering, etc., continuously optimize the project design and implementation process to reduce unnecessary costs. At the same time, through the development of new business models and revenue channels, such as data services, value-added services, etc., to increase the revenue potential of the project and accelerate the return of funds.

To sum up, the self-balancing scheme design of embedded service facility projects needs to comprehensively consider financial management, investment decision and fund allocation, and adopt specific and effective measures to ensure the financial health and long-term sustainability of the project from start-up to operation. This not only requires the project manager to have forward-looking planning ability and flexible management strategy, but also needs to constantly innovate and adapt to the rapidly changing market and technology environment to achieve the goal of project success and sustainable development.

5. Program Implementation Evaluation

5.1. Preparatory Work Before Implementation

The preparatory work before implementing the embedded service facility project is the key to the success of the project, especially the establishment of organizational structure, personnel training and the construction of data collection and analysis system. Organizational structure and talent training are essential to ensure the effective operation of the project team. Taking the "City Brain" project in Hangzhou as an example, the successful implementation of the project

benefited from a clear organizational structure and the support of a professional team. At the beginning of the project, a joint working group consisting of relevant government departments, technology supplier Alibaba, and other partners was established to define the responsibilities and functions of each party. At the same time, according to the characteristics of the project, a series of talent training plans have been organized, especially for the training of key technologies such as cloud computing and big data analysis, to ensure that team members can master the latest technologies. The project reportedly upgraded the technical capabilities of more than 100 team members through training at its initial launch. The construction of data collection and analysis system is the basis of realizing intelligent project management. In the Shenzhen Smart light pole project, the project team has established a comprehensive data collection system, which not only includes real-time monitoring of the working status of street lights, but also involves the collection of multi-dimensional data such as environmental monitoring and traffic flow. In order to effectively process and analyze these data, the project also built a data analysis system based on the cloud platform, using artificial intelligence algorithms for data processing and analysis, to provide decision support for urban management. It is reported that the data collection and analysis system of the project successfully processed more than 1TB of data per day, which greatly improved the efficiency and intelligence level of urban management.

5.2. Problems and Solutions During Implementation

In the implementation process of embedded service facility projects, teams often face a variety of expected and external difficulties, these challenges need to be solved by flexible strategies and timely adjustments. Here are some examples of typical problems and their solutions.

Difficulties in moving a project forward often include technical difficulties, funding shortages, partner coordination, and policy and regulatory changes. For example, in the Shenzhen Smart light Pole project, the initial technical challenges included high-density 5G network coverage and the integration of multi-functional devices. In addition, in the early stage of the project implementation, the unreasonable allocation of funds also led to the delay of some key links.

Adjustments and improvements to the problem are essential to ensure the success of the project. In the face of technical difficulties, the Shenzhen Smart light Pole project team introduced the latest 5G technology and smart equipment by strengthening cooperation with technology suppliers, and organized multiple rounds of technical training to enhance the team's technical implementation capabilities. For the shortage of funds, the project manager timely adjusted the fund use plan, gave priority to the funding needs of key technology research and development and equipment procurement, and actively sought government subsidies and external financing support, effectively alleviating the financial pressure. Another example is the Suzhou Industrial Park Intelligent Transportation System project, which encountered coordination difficulties during the implementation process, and the different goals and expectations of different partners affected the speed of the project. To this end, the project management team has taken the initiative to establish a multi-stakeholder coordination mechanism, holding regular project coordination meetings to ensure that the interests and concerns of all partners are properly addressed and balanced. At the same time, the project team also optimized the work flow, simplified the decision-making process, and improved the efficiency of project promotion. Project teams need to maintain a high degree of vigilance and flexibility when it comes to policy and regulatory changes. For example, if the government has updated the safety standards for smart facilities, the project team should adjust the project design and implementation plan in a timely manner to ensure that the project meets the latest regulatory requirements. In addition, the project team can actively participate in the discussion and formulation process of relevant policies through close cooperation with government departments to create a more favorable policy environment for the project.

5.3. Evaluation Criteria

The evaluation of the implementation effect of embedded service facility project is an important link to ensure the achievement of project objectives and continuous optimization. The effective evaluation system includes two important dimensions, economic benefit evaluation and social benefit evaluation, and carries out quantitative analysis through specific indicators and data.

Economic benefit evaluation focuses on return on investment (ROI), cost savings, revenue increase and other indicators. For example, in the Shenzhen Smart light Pole project, the economic benefit evaluation index includes the total cost of the project (including initial investment and operation and maintenance costs), the total revenue generated through advertising and data services, and the direct and indirect economic benefits brought by the implementation of the project. According to the project report, the total investment of the smart light pole project is 120 million yuan, and it is expected that the cumulative revenue through advertising and intelligent services will reach 180 million yuan in 5 years, and the ROI will reach 50%. In addition, the project has also reduced electricity bills by about 30% through energy conservation, saving the city's energy expenditure of more than 20 million yuan.

Social benefit assessment pays more attention to the positive impact of the project on urban management, residents' quality of life, environmental protection and other aspects. Taking the "City Brain" project in Hangzhou as an example, the indicators of social benefit assessment include the degree of improvement in traffic flow, the proportion of reduction in response time to public safety incidents, and the improvement of environmental quality. According to statistics, the implementation of the project has effectively shortened the average traffic jam time by 20% and improved the traffic efficiency; Through the intelligent monitoring system, the average response time of public security incidents has been reduced from 15 minutes to 5 minutes, improving the efficiency of urban management and residents' sense of security; At the same time, the application of intelligent environmental monitoring system also helps the city to monitor and manage air quality more effectively, and promotes the continuous improvement of the environment. These evaluation indicators not only provide quantitative analysis basis for project managers, but also show the value and results of the project for government departments and the public. Through the comprehensive evaluation of economic and social benefits, the implementation effect of the project can be fully understood, and data support and experience reference can be provided for the planning and optimization

of subsequent projects. In addition, effective effectiveness evaluation can also attract more investment and social support for the project, and promote the sustainable development of the project.

Table 1. Evaluation criteria

	Criteria	Example
Economic benefit	Return on investment (ROI)	The cost of community embedded service facility project is returned on the basis of balance by increasing the property operation cost and parking fee
	Cost saving	Reduce electricity costs through energy saving during project operation
	Income increases	Commercial property rental and sales income, community parenting and trusteeship, commercial sales of elderly care services
Social benefit	City management	Improve traffic flow and reduce traffic congestion time
	Life quality of resident	Use intelligent monitoring system to shorten the response time of public safety incidents
	Environmental protection	Promote environmental improvement through continuous monitoring and management of air quality

5.4. Analysis of Implementation Effect

In the post-implementation effect analysis of an embedded service facility project, it is crucial to evaluate the improvement of the project's financial position and the improvement of its sustainability. Through specific indicators and data, the economic and social impact of project implementation can be fully understood, thus providing valuable experience for future project planning and implementation.

Financial improvement can be assessed by comparing key financial metrics such as return on investment (ROI), operating income, and cost savings before and after project implementation. Taking the Suzhou Industrial Park Intelligent Transportation System project as an example, before the implementation of the project, traffic congestion in the region led to high economic losses, estimated to be about 100 million yuan per year. After the implementation of the project, by optimizing traffic flow, traffic congestion time has been reduced by approximately 30%, directly improving economic efficiency. According to preliminary statistics, in the first two years of the implementation of the project, the efficiency of the transportation system has saved about 30 million yuan of direct economic losses for the industrial park, and the ROI has reached 20%. At the same time, the project also provides data services and advertising and other ways to increase the annual revenue of about 5 million yuan. The increased sustainability of the project is reflected in the long-term positive impact of the project on society, the environment and other aspects. Continuing with the example of the intelligent transportation system above, in addition to the direct economic benefits, the project has significantly improved the safety and reliability of urban transportation, reduced the incidence of traffic accidents, and improved the quality of life of residents. In addition, by reducing vehicle stagnation and congestion, the project also effectively reduces vehicle exhaust emissions, which has a positive impact on improving air quality and promoting environmental sustainability. It is estimated that one year after the implementation of the project, the carbon emissions in the region have been reduced by about 5% compared with before the implementation of the project, contributing to the green development of the city.

6. Conclusion

In this study, the self-balance of funds of embedded service facilities projects is deeply discussed, and through the analysis of successful cases at home and abroad, effective fund management strategies are revealed, and a series of financial management principles, investment decision principles and fund allocation principles are put forward. Studies have shown that through precise financial monitoring, wise investment choices and scientific allocation of funds, projects can achieve effective use of funds, improve economic and social benefits, and ensure long-term sustainability of projects.

From domestic and international case studies, it can be seen that whether it is the smart light pole project in Shenzhen, the "urban brain" project in Hangzhou, or the international fiber optic network project in European cities, successful embedded service facilities projects rely on innovative financing methods, effective fund use strategies and diversified fund return paths. These projects have not only been a financial success, but have also produced significant social benefits by increasing the efficiency of urban management, improving the quality of life of residents and promoting environmental protection. The preparatory work before implementation, such as the establishment of a reasonable organizational structure, personnel training and the construction of data collection and analysis system, laid the foundation for the smooth implementation of the project. In the process of implementation, problems such as technical challenges, shortage of funds, coordination of partners and policy changes faced by the project were effectively solved through timely adjustment and improvement. In addition, by setting specific evaluation indicators of economic and social benefits, the implementation effect of the project has been quantitatively analyzed, which confirms that the financial status of the project has been significantly improved and the sustainability of the project has been enhanced. To sum up, this study emphasizes the importance of self-balancing project funds for embedded service facilities, and puts forward a set of practical management principles and strategies. These results not only provide theoretical guidance and practical reference for related projects, but also contribute valuable insights to promoting urban intelligent construction and sustainable development. Future research can further explore the fund management models of different types and sizes of projects, as well as the application of emerging technologies in optimizing project fund management, to provide more support for the successful implementation of embedded service facilities projects.

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