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Research on the Path of Realising the Value of Public Works under the Perspective of Value Co-creation Theory

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Abstract

As the foundation of China's economic construction and social development, due to its public welfare nature, the realisation of the value of public works is closely related to every member of society, i.e. there are multiple stakeholders. How to realise the value proposition of each stakeholder has become a measure of the success of public works. This paper analyses the connotation of the value realization of public works stakeholders and the characteristics of public works in China, takes the theory of value co-creation as the theoretical basis, and finally puts forward the path of public works value realization.

Keywords

Value co-creation; Public works; Palue realisation; Stakeholders.

1. Introduction

Engineering is the pillar of modern society, and public works, as a special category of engineering, are constructed to meet the public needs of society. In the past, the measurement of the value realisation of public works was based on the "Iron Triangle" objectives, i.e. time, finance and quality. However, some subsequent studies have shown that these public works are not successful when the "Iron Triangle" objectives are achieved.0 Public works are not as successful as private works. Compared with general private projects, public projects not only need to consider the realisation of economic value, but also need to care about their social and ecological value, etc. The realisation of these values needs to be realised in the use phase of the project, i.e. product success, whereas the "Iron Triangle" objectives can only measure the success of inputs and outputs in the construction phase of the project, i.e. project management success. Success. Zwikael & Smyrk added the use phase to the "Iron Triangle" objectives, focusing on the realisation of value in the use phase. Zwikael & Smyrk added the use phase to the "Iron Triangle" objectives, focusing on value realisation in the use phase, but lacking in the pre-decision phase and planning. As a public product serving all members of the society, public works are important to understand the value propositions of all stakeholders in the decision-making and planning phases, and the joint efforts of all stakeholders provide an important guarantee for the realisation of value in the subsequent use phase.

Based on the theory of value co-creation, this paper analyses the pairs of value subjects, value claims, resource elements and environmental elements, etc., and draws on the definition of value connotation of public works related stakeholders and the characteristics of public works by Liu Xiaoxiao, et al.'s definition of the connotation of value for public works stakeholders and the characteristics of public works, and constructs a framework for public works value co-creation realisation. Then, under this framework, we analyse the path of public works value co-creation in the whole life cycle.

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2. Public works value realisation

2.1. Characteristics of public works

The Government Investment Regulation (State Order No. 712) states that public works refers to works constructed within the territory of China using funds arranged in the budget for investment in fixed assets (e.g., direct investment mode, capital injection mode of investment) as government investment works. It is an effective tool for government intervention in the economy, but also an important carrier to achieve people's well-being. As a special kind of project, it aims to meet the needs of the public and improve social welfare. It has the following characteristics:

2.1.1. Public welfare

The primary characteristic of public works is their public interest nature. The purpose of these projects is usually to promote social development, improve people's lives, protect the environment and other public interests. For example, infrastructure development, public transport systems, environmental protection projects and so on all fall into the category of public works.

2.1.2. Stakeholder plurality

The stakeholders involved in public works are numerous and diverse. Apart from the government and the builder, they also include residents, enterprises, environmental organisations, relevant industries and interest groups. These stakeholders may hold different positions and interests due to the impacts brought about by the project, so it is necessary to balance and co-ordinate the interests of all parties in the process of project planning and implementation to ensure the smooth progress and sustainable development of the project.

2.1.3. Long-term

The impacts of public works are usually long-term and may last for decades or more. For example, the construction of a dam not only affects the use of local water resources and the ecological environment, but may also have long-term impacts on agriculture, industry and the livelihood of residents in downstream areas. Therefore, when planning and designing public works, it is important to give due consideration to future social, economic and environmental impacts, and to take appropriate measures to manage and regulate them.

2.1.4. Complex sources of funding

Public works are usually financed from a variety of sources, including government budgets, international assistance and social investment. These funds not only involve different financial systems and policy regulations, but may also be affected by the macroeconomic situation and political factors. Therefore, the financing and management of public works projects need to be carefully planned and effectively implemented to ensure that the supply and use of funds for the projects are in line with the relevant regulations and requirements.

2.1.5. Broad social impact

The construction and operation of public works have a wide range of impacts on social life and the environment, which may trigger concerns and discussions in all sectors of society. For example, the construction of urban infrastructure may change the appearance and spatial structure of the city, affecting the travelling and lifestyle of residents; and environmental protection works may affect the ecological balance and biodiversity of the surrounding areas.

2.1.6. Strict policy regulation

The construction of public works is subject to strict government supervision and laws and regulations. Government departments usually formulate relevant policies and regulations to regulate and manage the establishment, approval, implementation and supervision of public works projects. These policies and regulations cover a wide range of aspects such as land use,

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environmental protection, production safety, quality supervision, etc., which need to be complied with and implemented in practice by builders and managers to ensure that the projects are legally compliant.

2.2. Value realisation

Value is a relatively subjective concept, usually used to describe the degree of importance or significance that people attach to things. Value reflects the extent to which the object meets the needs of the subject. The value objectives of public works are all public in nature, and their value is to satisfy public needs such as national policies, people's needs, and economic development. Generally speaking, construction projects contain many levels of value, such as social value, use value, cultural value, environmental value, economic value, tourism value and so on. The main purpose of public works construction is for the use of the public, i.e. the realisation of use value.

The realisation of value depends on the satisfaction of stakeholders' needs, however, for the same public works project, the value proposition of each stakeholder is different, i.e. the needs are different. In order to better satisfy the needs of each stakeholder, on the one hand, it is necessary to clarify the stakeholders in public works. Usually, a project contains investors, owners, constructors, users, other peripheral organisations, etc. Haddadi et al. summarise the main stakeholders as owners, contractors and users. On the other hand, the value connotation of each stakeholder needs to be analysed.

Most of the studies on value realisation take the "Iron Triangle" goal as the dimension of value realisation and the means of value realisation of engineering management, ignoring the impact of "before" and "after" engineering construction on value realisation. The influence of "before" and "after" on value realisation is ignored. With the development of stakeholder theory, TFV production theory, etc., scholars slowly began to add dimensions to measure the realisation of engineering value, such as customer satisfaction, environmental performance, etc., indicating that scholars began to realise that the engineering value realisation with the goal of "Iron Triangle" could not satisfy the needs of all stakeholders.

3. Definition of stakeholder value

3.1. Definition of stakeholders

The Guide to the Project Management Body of Knowledge (PMBoK) states that individuals, groups or organisations that may have an impact on, and be affected by, the decisions, activities or outcomes of an engineering project are known as stakeholders.

Stakeholders exist in the "before" and "after" of a project. Stakeholders exist in the "before", "during" and "after" phases of a project, so stakeholder participation in the design, construction and other values of public works has a key role to play. Therefore, the participation of stakeholders in the design and construction of public works and the realisation of other values is crucial. Different stakeholders have different ways of influencing the realisation of the value of public works.

3.2. Public Works Stakeholders

Only when the stakeholders of public works are identified can their value connotation be analysed. Existing studies divide the stakeholders of public works according to the characteristics of the subjects related to the works and the previous value claims. Yuan Qian, et al. divided the stakeholders of public works into government, investors, financial institutions, environmental protection departments, surrounding communities, media, and society at large.Haddadi et al. summarised the main stakeholders as owners, contractors, and users . Liu Xiaoxiao et al. classified the stakeholders of primary and secondary school projects as

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government, owners, construction task bearers, users, and other surrounding organisations. All of the above divisions are more or less in the situation that the division of stakeholders is too general or incomplete. Considering the existing PPP model of public works construction and the commonality and difference of the stakeholders in public works defined by the above scholars in their previous value claims, this paper considers that the stakeholders of public works are the government, other investors, the construction task bearers (suppliers, design units, construction units, and acceptance units, etc.), users, financial institutions, the environment, and the public.

3.3. Stakeholder value realisation connotations

Based on the stakeholders in public works identified in the appeal, the value realisation of these subjects is defined below.

3.3.1. Governments

The Government, as the main investor in public works, is the main provider of funds for public works. Through the construction of public works to achieve the purpose of its investment. For the government side, public works construction is mainly to serve the society. The government can influence the construction of the project through a series of project management activities in accordance with laws and regulations. Public works generally involve specific government departments such as financial departments, development and reform departments, planning departments, environmental protection departments, fire departments, public security departments and so on. The connotation of the value realisation of these government departments in public works is shown in Table 1.

Table 1: Connotations of value realisation in government

serial number	Value realisation
1	Promoting regional economic development
2	Increase in fiscal revenue
3	Increasing employment rates
4	Cultural heritage and preservation
5	Enhancing the image of the Government
6	Enhancing the quality of urban planning and the quality of the environment
7	improve people's livelihood
8	Promoting technological progress and scientific and technological development

3.3.2. Other investors

Other investors refer to subjects other than the Government that co-operate with the Government in investing in public works. They usually include investors, developers, construction companies, operators, etc., and are responsible for capital investment, engineering and construction, and facility operation, etc., and usually obtain projects through competitive bidding and other means. It mainly influences the realisation of value in public works through technological innovation and efficiency improvement, project management and operation capability, investment and financing channels, risk management and sharing, and optimisation of project costs and benefits. The connotations of value realisation in public works by other investors are shown in Table 2.

Table 2: Connotations of value realisation for other investors

serial number	Value realisation
1	Higher return on investment

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2	Rationalising the cost of counterfeiting
3	Good relations with the Government
4	Enhancement of corporate image
5	Reducing investment risk
6	Long-term stable source of income

3.3.3. Engineering and construction task bearers

Public works are generally entrusted to units such as infrastructure or urban investment. It mainly includes suppliers, design units, construction units and acceptance units, etc., which can have an impact on the various stages of public works, such as the procurement stage, the engineering construction unit can ensure that the quality and performance of the purchased materials and equipment meet the project requirements through reasonable procurement strategies and supplier selection, and can guarantee the quality of the project while controlling the cost. Its value realisation connotation is shown in Table 3.

Table 3: Connotations of value realisation for engineering and construction task bearers

serial number	Value realisation
1	Construction was in accordance with contractual requirements
2	Satisfy acceptance requirements
3	Raise standards as needed
4	Effective integration of resources
5	Higher return on investment
6	Safe, green production

3.3.4. User

The user is the unit of use after the construction of public works is completed. Such as the school project is the use of teachers and students. The realisation of the value of the user is an important symbol for evaluating the success of public works, which is a concern for the "after" of the construction. The connotation of the value realisation of users is shown in Table 4.

Table 4: Connotations of user value realisation

serial number	Value realisation
1	Good practicality and functionality
2	Safe and reliable in use
3	Good user experience
4	More inclusive
5	Valuable for culture

3.3.5. Financial institution

Financial institutions provide financial support and financing services to provide the necessary funds for public works projects, including loans, financing, the issuance of bonds and other forms, to help the Government and construction units to raise the funds needed for the projects. Financial institutions help public works projects manage and reduce risks through risk management and financial engineering tools, including assessing the risk level of the project, designing a reasonable financing structure, and providing financial derivatives. The connotations of financial institutions' value realisation in public works are shown in Table 5.

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3.3.6. Evironment

With the introduction of high-quality development strategies, countries and enterprises are paying more and more attention to the impact of development on the environment. Taking the environment as a stakeholder in public works can promote harmony between public works and the environment from design to end-of-life. Public works have multiple impacts on the environment, such as the impacts of land resources, water resources, air quality, and noise and vibration. In this paper, the value propositions of environmental protection organisations or interest representatives are selected to replace the connotation of value realisation of the environment in public works. As shown in Table 6.

Table 5:Connotations of value realisation in financial institutions

serial number	Value realisation
1	Robust investment returns
2	Good liquidity
3	Lowest possible investment risk
4	Long-term stable partnerships
5	Convenient Financial Services

Table 6:Connotations of environmental value realisation

serial number	Value realisation
1	Rational use of land resources
2	Lowest possible industrial waste
3	Less noise and vibration
4	ecological balance
5	Less consumption of resources
6	Avoiding, as far as possible, impacts on natural features and ecological patterns

3.3.7. The masses

In the construction of public works, the public usually refers to the general population affected by the project, including residents around the project, people who do not live in the neighbourhood but whose interests and lives will be affected by the project, and representatives of public opinion and opinions concerned about the project. The construction of public works can not be separated from the support of the social public, and will also have an impact on people's production and life as well as social consciousness. The connotation of value realisation of the social public is shown in Table 7.

Table 7:Connotations of value fulfilment for social populations

serial number	Value realisation
1	Increased wages, social benefits
2	increase employment opportunities
3	cultural inheritance
4	Reduction of environmental and noise pollution
5	Improved quality of life
6	Project Information Disclosure

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4. Value Co-Creation Framework

The co-creation of value theory was developed by economists Prahalad and Ramaswamy in 2004 to explain how value is co-created by firms and consumers in the modern business environment. The traditional view is that firms unilaterally provide products or services and consumers are seen as passive recipients of these products or services and pay for them. However, the co-creation of value theory suggests that value is co-created through interaction and co-operation between firms and consumers, and that consumers are not only recipients of value, but also one of the creators of value. The Service Ecosystem Theory further extends the dichotomous perspective of "customer-firm" to a multidimensional dynamic network system formed by the interaction of all economic and social agents. In addition to suppliers and consumers, other partners are also included in the value co-creation context. The co-creation of value is also included in the context of suppliers and consumers, and is gradually applied to other fields. According to their own value demands, each subject creates value through service exchange and resource integration under the influence of political and economic environments, which provides a new way of thinking for the realisation of value co-creation in public works.

Value co-creation in the engineering field can be expressed as "the practice of different participants integrating and consolidating resources to create value through cooperation". Based on the theory of value co-creation, this paper constructs a value realisation framework according to the logic of "value proposition → value creation and transfer → value acquisition". As shown in Figure 1:

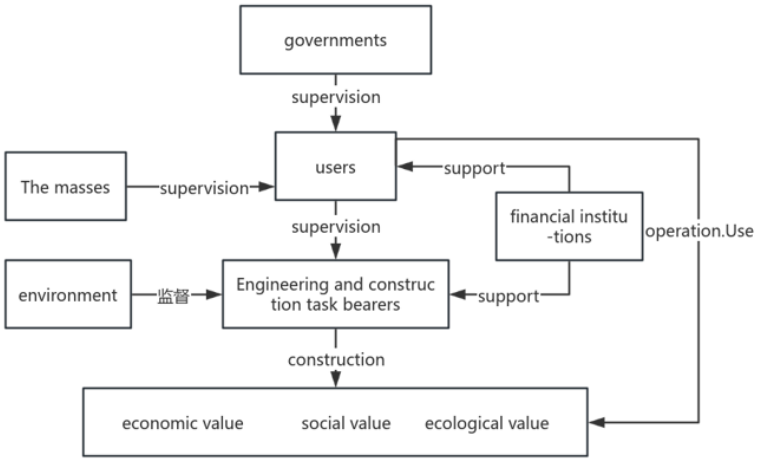

Fig. 1:Public works value realisation framework based on co-creation theory

5. Pathways to Public Works Value Realisation

Under the perspective of value co-creation, stakeholders are included in the process of value realisation, and the logic of "value proposition → value creation and delivery → value acquisition" is used to realise the interaction of all parties and the integration of resources. The extended value beyond the goal of the "iron triangle" of public works is realised in the process.

5.1. Planning stage

Understand the needs and expectations of governments, stakeholders and the public through communication with them. Involves the need to address infrastructure deficiencies, improve public services, promote economic growth, enhance environmental sustainability, etc.; conducts feasibility studies, including technical, economic, environmental and social assessments, to determine the feasibility and prioritisation of projects. To help decision-makers understand the return on investment, risks and impacts of the project to provide a basis for

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decision-making; to define the objectives of the project and develop performance indicators corresponding to them for subsequent evaluation of the effectiveness and efficiency of the project. These objectives and indicators should be measurable, specific and consistent with the goals of socially, economically and environmentally sustainable development; and establish a mechanism for multi-party cooperation, including the government, the private sector, non-profit organisations and community organisations, etc., in order to promote cross-sectoral and cross-disciplinary cooperation and to jointly realise the value of the project.

5.2. Design phase

Based on the project objectives and the results of the feasibility study, develop a design programme that meets technical, economic, environmental and social requirements. The design programme should take full account of the principles of sustainable development, including considerations of resource efficiency, environmental protection and social equity; introduce innovative technologies and methods to improve the efficiency, quality and sustainability of the project. Innovations involving the use of new materials, the adoption of advanced engineering technologies, the introduction of digital design and modelling, etc.; and the involvement of stakeholders in the design process through participatory design to ensure that the design solutions can fully take into account their needs and expectations. This can be achieved through workshops, symposiums and public hearings; and risk assessment of design solutions to identify possible technical, economic, environmental and social risks, and to take appropriate measures to manage and control them.

5.3. Construction phase

Ensure that the construction process is effectively managed and supervised in accordance with the design programme, so as to ensure the quality, progress and cost control of construction. This mainly includes work on reasonable resource allocation, construction progress tracking and quality inspection; actively fulfilling corporate social responsibility during the construction process, including responsibility for protecting the environment, safeguarding labour rights and interests, and promoting community development; and actively promoting innovative practices to improve construction efficiency and quality. This includes innovations in adopting advanced construction technologies, introducing intelligent equipment and tools, and implementing digital management; continuously supervising the construction process and assessing construction quality, progress and safety. Timely identification and resolution of problems will ensure that the project can be successfully completed according to plan.

5.4. Operational phase

To conduct regular monitoring and assessment of the operational conditions of public works, including indicators such as the utilisation rate of facilities, resource utilisation efficiency and service quality, etc., so as to ensure that their performance meets expectations; to listen to the views of members of the public to ensure that public works can continuously meet the needs of various sectors of the community, including the provision of basic services, improvement of the quality of life and promotion of social equity, etc.; to ensure that the operational costs of public works are controlled within a reasonable range, and that operational costs are reduced through optimisation of resource allocation and improvement of efficiency, etc., so as to ensure the sustainability and long-term sustainability of projects. costs are controlled within reasonable limits, operating costs are reduced through optimising resource allocation and improving efficiency, etc. The economic benefits of public works are regularly assessed, including indicators such as return on investment and financial break-even, so as to ensure the sustainability and long-term development of the projects; new technologies and management methods are continuously introduced to improve the management level and operational efficiency of public works, and to promote technological innovation and application. To make

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use of information technology and intelligent equipment to achieve digital management and intelligent control of public works, and to improve operational efficiency and service quality.

6. Conclusion

This paper, based on the characteristics of multiple stakeholders involved in public projects, firstly identifies the key stakeholders who have an impact on and are affected by public projects, including the government, other investors, project implementation entities (suppliers, design institutes, construction companies, and acceptance units), users, financial institutions, environment, and the general public. Then, the value connotations of each stakeholder are defined. Subsequently, a framework for realizing stakeholder value in public projects is constructed based on the theory of value co-creation. Finally, implementation pathways are proposed for the planning, design, construction, and operation stages.

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