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Meeting investors' demands in PPP project to improve enthusiasm for participating in green and low-carbon

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ABSTRACT

The use of PPP scheme to guide private investors to actively participate in green and low-carbon development is conducive to filling the funding gap of domestic green and low-carbon transformation. It is important to meet the demands of investors to ensure that investors can permanently participate in PPP low-carbon projects. Due to the high financing leverage, wide coverage, and government's right to initiate in PPP project, the investors' demands also include the enhancement of social reputation, and the acquisition of future project market resources besides investment income. To fully understand the purpose of the investors' participation in PPP projects and provide guidance for further analysis of behavioural influence path, the study systematically analyzes the demands of investors and develops a demand measurement scale. Firstly, based on the characteristics of PPP scheme, six investor's demands were identified. Secondly, through theoretical analysis, the measurement items of investors' demand were constructed, and 269 valid data were collected through questionnaire. Finally, carrying out factor analysis, reliability and validity test, the items were revised to get the formal investor demand scale. The research provides guidance for improving the demand satisfaction of investors, which is conducive to attracting private capital to participate in the green low-carbon development strategy of PPP projects, and provides financial guarantee for achieving the 'double carbon' goal.

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1. Introduction

To achieve the goal of carbon neutrality, climate neutrality or global net zero carbon emissions by 2050, China has set carbon neutralisation targets. On 22 September 2020, China's goal is to reach the peak of carbon dioxide emissions by 2030 and achieve carbon neutrality by 2060 (Liang et al., 2022). To achieve the 'double carbon' goal, reducing carbon emissions through technological innovation and the development of green and clean energy strategies is important (Wan & Sheng, 2022; Xu

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et al., 2022). However, the high cost reduces the development and application of carbon emission reduction technologies and the development of low-carbon projects. According to estimates, China needs RMB 150–300 trillion to achieve green and low-carbon transformation, with an annual investment of RMB 3.75–7.5 trillion. The huge capital demand is an urgent problem to be solved in realising the ‘double carbon’ goal. PPP (public–private partnership) scheme has unique advantages in attracting private capital and relieving financial pressure and has been applied in more than 19 industries. Attracting investors to participate in green and low-carbon development projects through PPP scheme can effectively fill the huge funding gap and promote the development of green infrastructure. Therefore, it is important to maintain the enthusiasm of investors to participate in PPP projects continuously.

According to the field dynamics theory of Kurt Lewin, demand is the internal driving force of behaviour and an important reason for behaviour (Burnes & Bargal, 2017). The demand theory of Maslow also shows the driving role of demands on behaviour (McLeod, 2014). Accordingly, it is necessary to meet the demands of investors to participate in the project, so as to maintain the enthusiasm of investors to participate in the PPP project, then provide adequate sources of funds for low-carbon development.

The demands of investors in PPP projects are diversified. Identifying and understanding the demands of investors is of great significance for improving the demand satisfaction of investors. PPP scheme’s advantages such as the high financing leverage, the dispersion of risk, and relatively stable income, are an important reason why PPP are widely used. The expansion of the PPP project field provides high-quality investment channels for investors to realise capital appreciation. At the same time, the Real Estate Investment Trust (REITs) in the field of infrastructure launched in China in 2020 also further guarantees the investment channels and stable project income for small and medium-sized enterprises, which can alleviate the financing difficulties of green and low-carbon development of PPP. However, due to the long payback period and high level of publicity of the PPP project, it is still difficult to realise the short-term project income. In addition, under the situation that the rights such as the initiation, supervision and disposal of preferential policies of PPP projects are concentrated with the government departments. The goal of investors in decision-making is not limited to the current investment income, but to establish a good cooperative relationship with the government through participating in the investment activities of the project, so as to lay a foundation for obtaining long-term project resources and government welfare. In the highly competitive PPP project procurement process, local governments may prefer investors with strong qualifications and set restrictive terms in the bidding documents, or directly invite private capital ranking in the industry through invitation to bid. Therefore, some investors also expect to enrich the practical experience of enterprises through participating in PPP projects, so as to improve the industrial competitiveness. PPP projects are generally quasi-public or pure-public. The people are the direct beneficiaries of the project. It is an important platform for enterprises to obtain public support and attention. Therefore, there are also investors who hope to provide public services for the people through cooperation with the government to win better social reputation and social recognition for the enterprise.

To sum up, in addition to the investment income demand, investors also expect to obtain future project resources, improve enterprise strength and social image or reputation by participating in PPP projects. Yuan (2004) believed that in project management, understanding the demands of all stakeholders is the basis for seeking the best combination of the team and realising the best decision-making choice, and also the guarantee of project results. According to the stakeholder theory, the purpose of stakeholder management activities is to comprehensively balance the interests of all stakeholders. The identification of stakeholder's demands is conducive to the targeted management of subject objectives (Freeman & McVea, 2001). Accordingly, to achieve the goal of attracting investors to participate actively in the PPP, the study identifies the demands of investors in PPP projects, and develops a measurement scale of each demand variable for analysing the influence path of investor behaviour.

2. Literature review

2.1. Current research on demand and PPP

Currently, research on the way of carbon neutralisation and carbon peaking focuses on the methods and technologies of realisation, as well as the research on carbon tax and carbon trading market. For example, in terms of technological innovation, low carbon emissions can be achieved through the development of new energy, green materials, carbon sink absorption and carbon removal technologies (Dong et al., 2018; Li et al., 2022). Carbon tax and carbon trading are important ways of carbon pricing, and most of them are based on CGE (Computable general equilibrium) model. For example, Yang et al. (2016) investigated seven carbon trading pilots in China and determined the positive impact of government regulations and policies, public relations management and estimated economic benefits on the national carbon trading plan. Lin and Jia (2018) further discussed the influence of economic benefits and carbon emissions on the carbon tax rate through CGE model. Wibert et al. (2020) found that carbon tax can effectively reduce national greenhouse gas emissions, and the economy caused by carbon tax policies for different fuels is different through the CGE model in Indonesia. These studies ignore the cost of carbon reduction objects or implemented projects (such as green infrastructure, new energy technology, green roads, etc.), and lack of attention to the importance of the advantages of PPP projects in attracting investors to green and low-carbon development. This study takes this gap as a breakthrough to analyse the demands that investors need to meet for providing guidance on how to attract investors to participate in low-carbon PPP projects.

The concept of demand is widely used in the financial market. Many managers or scholar analyse the demand of consumers for a commodity or the market and change trend of a product (including oil, food, housing, etc.). For example, Gong et al. (2017) discussed that online social networking can significantly promote consumers' demand for video programs under the development of the information network video industry. Liu et al. (2019) discussed the influence of random market demand in a supply chain system composed of suppliers and retailers. Liang (2007) used the concept of market demand to analysis the elasticity of nonresident students' enrolment demand from the national, state and institutional levels of education.

In management and sociology, Maslow emphasises that human demands should be given priority in demand analysis (Mcleod, 2014). Demand is the natural of people when discussing the behaviour motivation, the driving role of internal demand should be focussed (Anderson, 2014). Larrick (1993) believed that the demand motivation for personal image protection is a factor that is easily ignored in risk decision-making. Hung et al. (2011) paid attention to the influence of external environment on demands and found that the influence of internal incentives (altruism) and external incentives (economic rewards, reputation feedback and reciprocity) on knowledge sharing is critical. Therefore, the analysis and measurement of the demands of stakeholders can lay a foundation for further research on the behaviour mechanism, which is of great significance to the subject behaviour management.

However, in the PPP project management, there is still a lack of comprehensive research on the demands of the people on the premise of taking the project stakeholders as the main object. Especially for investors who are the core subjects of investment and financing decisions, identifying them demands is conducive to the optimisation of investors' decisions (Yuan, 2004). Currently, risk management, the allocation of equity and control rights, performance management, and concession period decision-making in PPP are still hot topics. In these studies, the demands or objectives of the project are the focus such as the risk type and risk allocation of the project, the allocation of project equity, project performance evaluation, and the decision model of project concession period (Cai et al., 2021; Jokar et al., 2021; Lomoro et al., 2020; Xiong & Han, 2021). However, the above research ignores the demands of the executors who takes risks and implement project decisions. In the process of achieving project goals, the inability of stakeholders to meet their own demands is an important reason for the failure of project decision-making. In project performance management, the target expectations of the stakeholders should be noticed, and meeting the demands of stakeholders is a key link to the success of PPP (Mladenovic et al., 2013). In the existing research, Ju et al. (2004) showed that enterprises have basic investment income demand for participating in PPP projects; Walker and Dyck (2014) and Esen (2013) showed that good corporate reputation is an important requirement for enterprises to obtain social recognition and public support. The above highlights a lack of a systematic analysis of the investor's and analysis on the measurement scales of demand indicators in PPP projects. Therefore, this study further improves the discussion on the demands of stakeholders in PPP projects.

This study mainly includes into two parts: Identifying the demands of investors in PPP projects through theoretical analysis and group discussion; According to the literature analysis and data validation determine the measurement items and evaluation scales of investor demand.

2.2. Identification of the investor's demands

In the economy or commodity trading market, demand represents the desire and ability to buy goods or services (see *Xinhua Dictionary*). According to the above literature review, in management and sociology, demand refers to the purpose that people want to achieve in social activities, which are related to specific activity scenarios or

behaviours (Mcleod, 2014). Whether in the economy or management, demand has the meaning of expectation, which is to meet the subject's desire and purpose. Accordingly, in this paper, the demand of the stakeholders in the PPP project is defined as the purpose that the stakeholders expect to achieve by participating in the PPP project to obtain certain demand satisfaction. In definition, specific activities refer to the participation of investors in PPP projects through investment and financing.

The study identifies the demands of investors according to the characteristics of the PPP scheme including huge financing scale, centralised launching right, long payback period and wide range of fields as shown in Table 1.

Investment income is the main demand for investors when they participate in the project (Lisa, 2012). The diversified financing structure and high financing leverage of PPP scheme are the reasons for attracting more private capital to participate in the project, which provides a better platform for enterprises to realise capital appreciation.

However, due to the long payback period, a high-level publicity of PPP projects, and the benefits of public projects, such as carbon reduction, emission reduction and environmental governance are lagging behind, the short-term income is still difficult to achieve for investors. At the same time, the government has the right to initiate, supervise and dispose of preferential policies for PPP projects. The goal of investors is not limited to the current investment income, but to obtain long-term benefits by participating in the project investment such as establishing a good cooperative relationship with the government and obtaining future project resources (Fan, 2003; Kwon et al., 2017).

Industry competitiveness is the basis for enterprises to obtain project participation rights (Zhang & Wang, 2012). PPP scheme has covered more than 19 industries. In the market environment where PPP is widely used, only a small number of private projects may not adopt this scheme in the future. Investors have to participate in the investment and construction of PPP projects to ensure their competitiveness and position in the industry (Reng & Liang, 2005; Sharkey, 2014). In the process of PPP project procurement, local government may prefer the investors with strong qualifications and ability or invite the investors who rank at the top of the industry.

Table 1. Investor demands and operational description.

Demands	Operational description	References
Investment income (II)	Enterprises increase investment income through project investment and financing process	Lisa (2012)
Industry competitiveness (IC)	Enterprises cultivate resources and capabilities through PPP projects	Zhang and Wang (2012)
Future project market (FPM)	Enterprises win project resources and occupy a position in PPP industry in the future by participating in PPP projects	Kwon et al. (2017)
Cooperative relationship with government (CR)	Enterprises establish good cooperation with the government by participating in PPP projects	Fan (2003)
Social reputation (SR)	Enterprises win social and public recognition and approval by participating in PPP projects	Walker and Dyck (2014) and Esen (2013)
Industry status (IS)	Enterprises improve industry ranking, brand value and market share by participating in PPP projects	Sharkey (2014) and Reng and Liang (2005)

Source: data analysis results of the study.

A good reputation is a unique resource owned by an enterprise. It is an important demand for obtaining social recognition, development opportunities, and public support, so as to complete the value creation ability (Esen, 2013; Walker & Dyck, 2014). PPP projects with quasi-public or pure-public provide an important platform for investors to obtain public praise. Especially in the environmental governance project, the public's life health and safety are closely related to the project output. A good PPP project can improve public satisfaction and enable investors to gain trust and appreciation from partners, thus improving the reputation of enterprises.

To sum up, 6 demands of investors are identified (Table 1). Combined with the group discussion, the operational descriptions of each demand are given in the PPP project environment to reduce the perceived bias of the subjects and the social desirability bias of the participants (Podsakoff & Organ, 1986).

3. Measurement of demand

The procedure of scale development by Wu (2000) is referred (Figure 1). Figure 1 shows that the scale development mainly includes into two stages: Determination of measurement items to build the initial scale; Selecting the participants to collect data, and conduct factor analysis on the data to form the formal scale.

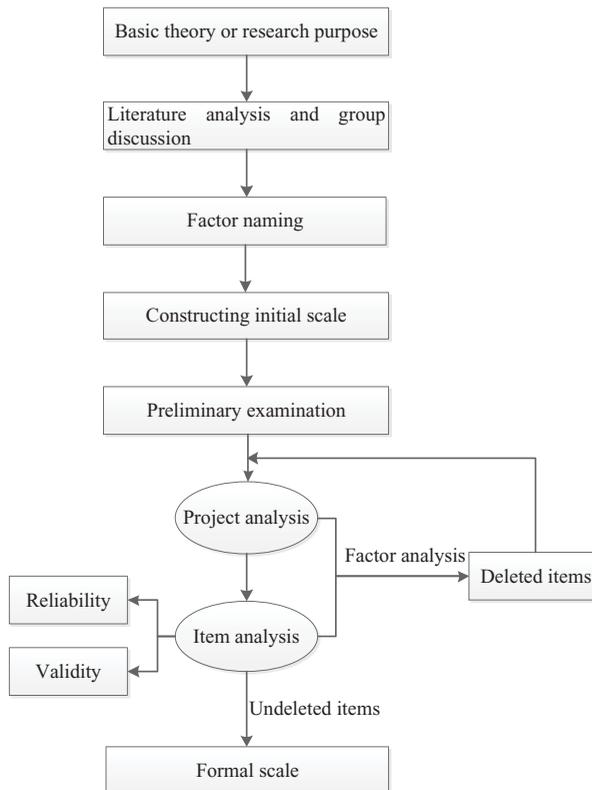


Figure 1. Scale development procedure referenced the scale preparation process by Wu (2000).

3.1. Demand measurement items

3.1.1. Investment income

In the PPP project, investors participate in the investment, financing and construction activities of the project with a certain amount of equity, and their investment income directly comes from the dividends of the project operation income. Therefore, the operating income of the project can directly reflect investor's investment income. As a part of the project operation income, the government's operation subsidy can directly reduce the investor's expenditure on the project operation cost. Many investors expect to win higher government operating subsidies, so as to ensure sufficient income of the project, and then obtain the excess income dividend of the project (Wu et al., 2013).

Because most PPP projects are quasi-public or pure public, the project income is low and the payback period is long. In order to attract investors, many local governments may provide preferential policies such as tax relief and legal and regulatory support for enterprises (Yang et al., 2018). These preferential policies enable investors to enjoy the reduction or exemption of value-added tax or enterprise income tax, indirectly reduce the cost of enterprise investment and financing, and improve the income of investors. For example, Enterprise income tax law pointed out that 'income from investment and operation of public infrastructure projects supported by the state or income from eligible environmental protection, energy saving and water saving projects' can be exempted or reduced from enterprise income tax. In addition to relying on preferential policies to attract investors to participate in PPP projects, in many public projects, the government will allocate private products or resource development for private capital to supplement the project income. For example, transfer the development right of the fixed resources around the project (environmental governance, roads, tracks, etc.) to the project company, plan the by-products with business nature for the project, and authorise the project company to operate the supporting products and services with income (advertising, catering, etc.) (Du & Yin, 2015). These resource compensations improve the overall income of the project and ensure the reasonable return of investors, which is one of the guarantee conditions for the enthusiasm and income of investors to participate in the PPP project. Therefore, the government's preferential policies and additional private products and resource allocation are the indirect income sources for investors to participate in PPP projects.

To sum up, this study measures the investment income that investors expect to achieve through participating in PPP projects from operating income, government preferential policies and government private products and resource allocation.

3.1.2. Industry competitiveness

The competitiveness of an enterprise reflects its value and comprehensive ability. In the highly competitive industry, enterprises improve their hard and soft strength by cultivating their own resources and capabilities to obtain strong resources and technical (Wang & Meng, 2004). Enterprises need to improve their competitiveness in the PPP field through the experience of participating in the project, and obtain the right to participate in the project activities and the right to income with the competitive advantage. This is the premise for enterprises to obtain income. Many enterprises participate in PPP projects, in addition to obtaining certain benefits, they also hope

to accumulate various experiences and social relations through participation in activities, so as to improve their competitiveness in the PPP industry.

Human resources are one of the important indicators of enterprise core competitiveness. The implementation of 'double carbon' started late in China, and there is still a lack of technical personnel for carbon neutralisation and carbon peak. This increases the difficulty of green development of PPP. In this environment, enterprises that give priority to reserving human resources can often take the lead in PPP project participation (Juang et al., 2007; Li, 2005) such as having excellent PPP consulting team, investment and financing structure design team, construction and operation team, etc. Therefore, both human resources and technical capabilities can reflect the competitiveness of an enterprise in an industry (Tian, 2005). At the same time, the cultivation of talents by enterprises also needs to be based on certain professional knowledge and rich practical experience. Therefore, this study will mainly measure investors' demand for industry competitiveness from their expectations and requirements for PPP professional talent resources, PPP professional technical capabilities and theoretical knowledge.

3.1.3. Future project market

The development trend of PPP scheme industrialisation is an important link of domestic economic development, gradual improvement of social public facilities and services, and environmental governance. Continuously introducing private capital into the construction of PPP projects is not only an important requirement for national development but also a need for social development and local government financial pressure. In the future, PPP projects will occupy a core position in the infrastructure and public service industries and the national 'double carbon' development strategy. Participating in various social activities in these industries is the foundation of enterprise development and the key to enterprise survival (O'Regan, 2002). Projects are the source of enterprise development. The enterprise obtains project income by participating in the investment and financing, construction, operation and maintenance of the project, and maintains the daily capital operation and expanded development of the enterprise. With the continuous maturity and expansion of the PPP and the funding needs of low-carbon development, most infrastructure projects and social public goods and services will be based on the PPP scheme. Enterprises need to continuously participate in similar projects to accumulate experience and prove their existence in the PPP field in order to take the initiative. At the same time, enterprises also need to establish cooperative relations with other stakeholders through participating in PPP projects, so as to obtain the channels of project cooperation and further prepare for acquiring and occupying the market share of future PPP projects (Xie et al., 2018). Therefore, ensuring the resources and cooperation channels of PPP projects and taking the initiative in the projects can reflect the development prospects of enterprises in the future industry market.

3.1.4. Cooperative relationship with government

In addition to improving internal knowledge, technology and resource capacity, the development of enterprises also needs the support of external environment and social network (Ruan & Jiang, 2009).

PPP is a financing scheme based on the cooperation of stakeholders. All stakeholders establish a good cooperative relationship under the constraint of contract and work together for the successful implementation of the project. Among them, the government, as a special subject (mainly as the initiator, supervisor and investor of the project), has established relations with various private capital to provide project resources for social enterprises. At the same time, the government expects to use the power of private capital to provide better public goods and services for the society. Therefore, building a good cooperative relationship with the government has become an important strategic idea in the process of enterprise development. Especially in the PPP projects initiated by the government, without the support of the local government, enterprises may face the dilemma of having no projects to do in the future.

Cooperative relationship is the foundation of enterprise resource. Many scholars have discussed the indicators to measure the cooperative relationship from the results of the cooperative relationship. In the supply chain system, trust is the basis of cooperation and the result of benign cooperation (Fynes et al., 2005; Rauyruen & Miller, 2007). Crosby et al. (1990) believed that trust and subject satisfaction are important indicators affecting the quality of the relationship between partners in the process of cooperation. In PPP projects, a good cooperative relationship between enterprises and the government can increase the government's trust in enterprises of the government (Ren et al., 2016). To win future cooperation opportunities and the continuous support of the government, enterprises also need to maintain close contact and benign interaction with local governments through practice to leave a good impression on the government and make the government feel satisfied with the cooperation process (Crosby et al., 1990). A good atmosphere is the condition for establishing cooperative relations. A bad relationship atmosphere affect the mood of the partners, and then lead to the dissatisfaction of the partners and the collapse of cooperation. Therefore, the study will measure the demand of enterprises for pursuing cooperation with the government from trust, close contact and benign interaction, and good relationship atmosphere.

3.1.5. Social reputation

Reputation is the characteristic of an individual, and it is the view of others on their own behaviour. Enterprise reputation represents the excellent characteristics of enterprises. Raub and Weesie (1990) linked reputation with prosocial behaviour, that is, prosocial reputation. Pfeiffer et al. (2012) believed that the subject's perception of reputation generated by other people's prosocial behaviour represents the subject's prosocial reputation. Prosocial behaviour is a kind of altruistic behaviour, whose main purpose is to bring benefits to others, and has no obvious benefits to oneself. For the investors of PPP project, their participation in the project is self-interest. It can be seen that investors' participation in the investment activities of the project does not belong to prosocial behaviour. The corresponding social reputation does not belong to prosocial reputation.

The essence of PPP projects is mostly pure public projects or quasi-public projects, and its output is conducive to social public welfare. The success of the project brings good public praise to all participants of the project. Therefore, the social reputation

of the investors in the PPP project mainly comes from the praise of the beneficiaries for their investment participation behaviour and the trust of the enterprise brand after the success of the public project. As the marginal participants of PPP projects, the public not only has a great influence on government policies but also has a restraining effect on the development of enterprises. Moreover, as the largest group in society, the public's behaviour is often uncertain, and the public opinion effect is an important factor influencing political decision-making and enterprise development. Therefore, obtaining social reputation through public projects is one of the most important demands of enterprises and one of the basic conditions for enterprises to base themselves on society.

From the perspective of social participation, a good enterprise also needs to be recognised by its partners, industry recognition and positive reports from social media on its participation activities. Although enterprises do not have social publicity, in the business environment, the social responsibility of enterprises has gradually become the concern of every stakeholder. Corporate social responsibility activities will not only affect the reputation of other organisations but also affect their own corporate reputation (Esen, 2013). In the process of cooperation, if the enterprise leaves a bad impression on other participants, such as weak technical ability, poor reliability and lack of responsibility, they will not be recognised by its partners for its ability, value and trust. Similarly, in the competition, high-quality enterprises will be appreciated and favoured by peers, and even become industry sample, so as to improve their own reputation. With the rapid development of the electronic information, social media (including websites) is often the promoter of a certain behaviour event and an important channel for information dissemination. Once the irrational behaviour of the enterprise is exposed by media, the enterprise often faces the condemnation and blame from various social groups, which leads to the dishonour of the reputation. Especially after the establishment of the PPP information platform, the activities of enterprises participating in the PPP will be disclosed to the whole society through the internet (such as the dishonesty and speculation of enterprises in the clearing and returning projects; the praise reports of enterprises in the successful projects, etc.). Therefore, the positive information disclosure of social media is also an important factor for enterprises to maintain their reputation and healthy development. Based on the above analysis, the study measure investors' demand for social reputation from five aspects: public praise, public trust, industry identification, partner identification and positive media disclosure.

3.1.6. Industry status

Status refers to the level of individuals or organisations in the social system relative to other organisations and groups. Status has a social hierarchy or hierarchical system, also known as social status (Washington & Zajac, 2005). Another kind of status is called network status, which reflects the position of an individual in the relationship network formed by its cooperative stakeholders (including enterprises, organisations and governments) (Lin et al., 2009). For the same industry or field, the relative position of individuals or enterprises in the industry is the industry position (Mai et al., 2016). Industry status is an important indicator for enterprises to base

themselves on the market, improve their innovation ability and obtain resources and development opportunities. For example, in the bidding process of PPP projects, the government prefers private capital with strong qualifications, sets restrictive terms in the bidding documents, or invites private capital directly ranking in the industry through invitation to bid. For enterprises, the higher the industry status, the more employees have a sense of honour and security, and the lower the corresponding employee turnover rate. Therefore, improving the industry status is also an important part of the talent strategy of enterprises.

The industry status of an enterprise can be measured by its share in the market. The higher the market share of an enterprise, the higher the profit (Wang et al., 2001). Reng and Liang (2005) used the market position, company image and reputation, sales performance, popularity, enterprise growth rate, enterprise profit rate and popularity in the hearts of major customers to measure the industry status of an enterprise. However, we believe that some of the indicators are unreasonable. First of all, according to the research of Reng and Liang (2005), we believe that the concepts of enterprise market position and industry position are contradictory. There are contradictions because the industry is the same industry and field, and the market includes many industries and fields in the social market economy. Secondly, the image or reputation of an enterprise represents the 'reputation' of the enterprise. The reputation of an enterprise is high, but its ranking in the industry may be low. For this study, the indicator 'enterprise image and reputation' has been studied as an independent variable. Finally, the popularity of the enterprise is wide. In addition to the popularity in the industry and the public, it should also include the 'popularity in the hearts of major customers'. Therefore, according to the definition of the demand for industry status in this study: 'enterprises expect to improve the industry ranking, brand value and market share through participation in PPP projects', combined with the research of Mai et al. (2016), Wang et al. (2001), and Reng and Liang (2005), in this paper, the industry status of enterprises is preliminarily measured by six indicators: market share of PPP investment, enterprise industry ranking, brand popularity, PPP performance, enterprise growth rate and enterprise profit rate.

3.2. Participants in the questionnaire

The questionnaire is not intended to test the degree of investors' demand. Therefore, the participants selected only need to have some experiences on PPP research or practice. The government, investors and PPP researchers can all be the effective objects of this study.

The questionnaire was made through professional websites and pushed to different PPP academic groups through *WeChat* and *QQ* (a chat software). The group includes *The Fourth China PPP Academic Summit Forum* and *China PPP Lecture Hall*. In these groups, the members mainly include private capital (investors, contractors, operators, etc.), researchers and some government representatives. They have some experience in PPP meetings or training and have good professional knowledge and project operation experience. Therefore, the participants can effectively give feedback to the questionnaires. Members fill in the questionnaire under the situation of small rewards. At the

same time, snowball sampling is also used to collect data (Such as in the research of Walumweya & Phiri, 2022). Members of the team invited familiar scholars and relevant PPP personnel to fill in this questionnaire, and asked the respondents to push the questionnaire to other subjects. In order to ensure the quality of the answers, the IP (Intellectual property) address of each user can only be answered once. 291 data were recovered. After eliminating invalid data, 269 valid data were retained. Stevens (2010) thought that the effective data should be at least 5 times larger than the total item when performing factor analysis, There are 38 items in this study, and the number of samples exceeds 7 times the number of items. Therefore, 269 samples are acceptable and can meet the requirements of study. Table 2 shows the background information of the participants.

3.3. Data analysis

Reliability: SPSS (Statistical Product and Service Solutions) 22.0 was used to analysis data (Table 3). The internal consistency reliability coefficient (Cronbach α) was adopted for the reliability of the scale. The reliability of the scale is 0.768, which was greater than the acceptable standard of 0.7. Content validity refers to whether the measured content is suitable for the measurement goal. Background information in Table 2 shows that more than 80% of the participants have more than 2 years of PPP research or practical experience; Most of them have a good understanding on PPP; And the invalid cases has been excluded. Therefore, the subjects can give better feedback to the questionnaire content, so as to ensure that the data can better reflect the research objectives, that is, the research data have good content validity.

Factor analysis: KMO (Kaiser-Meyer-Olkin) test and Bartlett test show that the investor's demand items is suitable for factor analysis (KMO = 0.776, $p < 0.001$). A

Table 2. Background of the participants.

Characteristics	Category	Frequency	%
Stakeholders	Government	34	12.6
	Investors (financial institutions such as banks or strategic investors: including professional service companies such as contractors and operators)	77	28.6
	PPP researchers	158	58.7
	Others	0	0.0
Project experience (Research and Practice)	≤ 2 years	51	19.0
	2–5 years	167	62.1
	5–10 years	47	17.5
	>10 years	4	1.5
	Never heard	0	0.0
Understanding on PPP	Basic	33	12.3
	Very	161	59.9
	Master	67	24.9
	Expert	8	3.0
The degree of concern about the government's decision-making in PPP projects	No	0	0.0
	Occasional	49	18.2
	Sometimes	116	43.1
	Often always	87 17	32.3 6.3

Note: '0' indicates that the corresponding case has been excluded.

Source: data analysis results of the study.

Table 3. Reliability, validity and factor analysis of data.

Scale	Latent variable	Observation items	Factor loading	Percentage of variance	Cumulative variance percentage	α	KMO and Bartlett
Investor demand	IS	IS3	0.840	16.623	16.623	0.768	0.776***
		IS5	0.824				
		IS2	0.823				
		IS1	0.822				
		IS4	0.783				
		IS6	0.630				
	SR	SR3	0.855	14.909	31.532		
		SR4	0.824				
		SR1	0.821				
		SR2	0.820				
		SR5	0.754				
	CR	CR2	0.908	10.734	42.266		
		CR3	0.894				
		CR1	0.878				
	IC	IC2	0.914	10.607	52.873		
		IC3	0.892				
		IC1	0.856				
	II	II2	0.870	9.816	62.690		
		II3	0.856				
		II1	0.838				
	FPM	FPM3	0.852	9.247	71.937		
		FPM2	0.840				
		FPM1	0.790				

Note: ***Significance of Bartlett test ($p < 0.001$).

Source: data analysis results of the study.

total of 6 group factors (eigenvalue > 1) are extracted from the 23 demand items, which is consistent with the number of latent variables in the original questionnaire. The cumulative variance contribution rate was 71.937% greater than the acceptance level of 0.60 (Greene & Krcmar, 2005), and the factor load of each indicator on the group factor is greater than 0.5. Moreover, the intra group correlation of each observed variable is greater than the correlation between groups. Above results show that the research data have good convergence validity. The method of Harmon single factor test proposed by Podsakoff et al. (2003) is applied to conduct non-rotating factor analysis. The results show that the maximum variance of the extraction factors is 18.642% (less than 40%), which indicated that no single group factor accounts for the majority of the total variance interpretation, that is, the common method deviation of the questionnaire is not a problem.

Confirmatory factor analysis (CFA) is used to test the convergence validity and discrimination validity of the scale through the latent variable measurement model of investor demand built by AMOS (Analysis of Moment Structure). Running measurement model and establishing the correlation of error between the *IS4* and *IS5* based on the modification indexes (M.I. >10) of the model. Fitting index is CMIN/DF (the ratio of chi-square to the degree of freedom) = 1.485 < 3 ; RMSEA (root mean square error of approximation) = 0.043 < 0.08 ; CFI (comparative fit index) = 0.966 > 0.9 ; GFI (Goodness of Fit Index) = 0.911 > 0.9 ; TLI (Tacker-Lewis index) = 0.960 > 0.9 ; IFI (incremental fit index) = 0.966 > 0.9 , which show that the measurement model has good fitting degree (Seyal et al., 2002). On the premise of better fitting of the

Table 4. Standardised factor load of CFA.

Measurement model	Latent variables	Observation items	Standardized factor load
Investor demand	IS	IS1	0.83
		IS2	0.86
		IS3	0.84
		IS4	0.67
		IS5	0.68
		IS6	0.50
	SR	SR1	0.77
		SR2	0.79
		SR3	0.83
		SR4	0.79
		SR5	0.68
	CR	CR1	0.79
		CR2	0.89
		CR3	0.86
	IC	IC1	0.78
		IC2	0.89
		IC3	0.86
	II	II1	0.71
		II2	0.84
		II3	0.81
	FPM	FPM1	0.67
FPM2		0.76	
FPM3		0.80	

Source: data analysis results of the study.

measurement model, [Table 4](#) summarises the standardised factor loads of each observation variable on the latent variable.

Due to the load of standardisation factor is required to be greater than 0.7 in the measurement model (Fornell & Larcker, 1981), the *IS6* does not meet the requirements. *IS6*: ‘investors expect to improve the profit rate of enterprises by participating in PPP projects’ is the measurement item of investors’ demand for industry status. In PPP project, the project investment cost is huge, the investment payback period is long, and it is difficult to realise the benefits of public projects. There are also many investment losses of investment enterprises. Therefore, it is difficult to achieve the goal of achieving enterprise profit growth in the short term through PPP projects. This leads enterprises to focus on long-term market resources, cooperation and brand effect. Therefore, under the PPP project environment of this study, the item *IS6* is deleted. The revised measurement model is tested. The results show that the fitting degree of the modified measurement model is good, and the standardised factor load of each observation item reaches the acceptable standard of 0.7. The average variance extracted (AVE) and composite reliability (CR) of latent variable are greater than 0.50 and 0.70 respectively (Fornell & Larcker, 1981), and the correlation coefficient between all latent variables is less than the square-rooted of the AVE (Lim & Loosemore, 2017) ([Table 5](#)). Accordingly, the

Table 5. Comparison of correlations and square-rooted AVE of constructs.

Latent variables	CR	AVE	IS	SR	CR	IC	II	FPM
IS	0.88	0.60	0.77					
SR	0.88	0.60	-0.13	0.77				
CR	0.88	0.72	0.18	0.03	0.85			
IC	0.88	0.71	0.13	0.11	0.11	0.84		
II	0.83	0.62	0.18	0.03	0.17	-0.05	0.79	
FPM	0.79	0.56	0.05	0.24	0.03	0.20	-0.02	0.75

Note. Diagonal bold elements are square roots of the average variance extracted (AVE).

Source: data analysis results of the study.

Table 6. Formal scale of investor demand.

Demand latent variables	Description of observation items
Investment income (II)	<p><i>II1</i>: Investors expect to increase investment income from operating income by participating in PPP projects</p> <p><i>II2</i>: Investors expect to obtain investment income from government preferential policies by participating in PPP projects</p> <p><i>II3</i>: Investors expect to obtain investment income from the government's additional private products and resource allocation by participating in PPP projects</p>
Industry competitiveness (IC)	<p><i>IC1</i>: Investors expect to improve the PPP professional and technical ability of enterprises by participating in PPP projects</p> <p><i>IC2</i>: Investors hope to enrich the professional theoretical knowledge of PPP of enterprises by participating in PPP projects</p> <p><i>IC3</i>: Investors expect to train PPP professionals of enterprises by participating in PPP projects</p>
Future project market (FPM)	<p><i>FPM1</i>: Investors expect to ensure the future project resources of the enterprise by participating in PPP projects</p> <p><i>FPM2</i>: Investors hope to ensure that enterprises can obtain the cooperation channel of the project by participating in the PPP project</p> <p><i>FPM3</i>: Investors expect to take the initiative in the future project market by participating in PPP projects</p>
Cooperative relationship with government (CR)	<p><i>CR1</i>: Investors expect to gain the trust of the government by participating in the PPP project</p> <p><i>CR2</i>: Investors expect to maintain close contact and benign interaction with the government through participation in PPP projects</p> <p><i>CR3</i>: Investors expect to form a good relationship atmosphere with the government through participation in PPP projects</p>
Social reputation (SR)	<p><i>SR1</i>: Investors expect to obtain public approval through participation in PPP projects</p> <p><i>SR2</i>: Investors expect to gain the public's trust in the enterprise brand by participating in the PPP project</p> <p><i>SR3</i>: Investors expect to gain industry recognition by participating in PPP projects</p> <p><i>SR4</i>: Investors hope to obtain the recognition of partners through participating in PPP projects</p> <p><i>SR5</i>: Investors expect to obtain positive disclosure of their information by social media through participation in PPP projects</p>
Industry status (IS)	<p><i>IS1</i>: Investors expect to increase the market share of PPP by participating in PPP projects</p> <p><i>IS2</i>: Investors expect to improve their industry ranking by participating in PPP projects</p> <p><i>IS3</i>: Investors expect to improve the brand awareness of enterprises by participating in PPP projects</p> <p><i>IS4</i>: Investors expect to improve the PPP performance of enterprises by participating in PPP projects</p> <p><i>IS5</i>: Investors expect to improve the growth rate of enterprises by participating in PPP projects</p>

Source: data analysis results of the study.

revised questionnaire items have better convergence validity and discrimination validity, which indicates that the scale is reliable. Based on the above analysis, the formal scale of investor demand is shown in [Table 6](#).

4. Conclusion

The study identified six investor's demands in the PPP project through theoretical analysis, including investment income, industry competitiveness, future project market, establishing cooperative relationship with the government, social reputation and industry status. Second, the formal investor demand scale was constructed through

data (Table 6). Investment income is one of the important conditions for the survival of enterprises. Investment failure or loss will directly lead to the acquisition or bankruptcy of enterprises. The industry competitiveness of enterprises is the foundation and premise for the long-term development of enterprises. Constantly breaking the core competitiveness, strengthening technology research and development, creating brand effect and enriching enterprise culture are the key links for enterprises to establish themselves in the industry market. At present, there is still a lack of enterprises with high professional and technical capabilities in the PPP market, especially the lack of low-carbon management technology. Therefore, enterprises need to gain project experience through continuous participation in PPP projects to strengthen their own resources and capabilities and improve the competitiveness of the industry.

Industry status is an important indicator for enterprises to base themselves on the PPP market. In the bidding process of PPP projects, the government may prefer private capitals with strong qualifications. High industry status can bring more project market resources for enterprises. In practice, economic activities such as enterprise investment and financing are part of social activities, which interact with other economic people in the society in the basic form of transactions. Efficient interaction can certainly promote the smooth realisation of trading activities, thus ensuring the smoothness of the whole economic activities and reducing the risk of market economic chaos. Therefore, in the PPP project company, the enterprise needs to maintain a good cooperative relationship with the public sector, which is the key link for the enterprise to obtain the advantages of future project market resources and project subsidies. At the same time, in order to gain the trust and support of the government, enterprises also need to maintain a good social image and reputation. The social reputation of an enterprise is the foundation of its success, and the trust and support of the public to the enterprise is also the key to its success. By cooperating with the government to provide high-quality public services for the people, it is conducive to the enterprises to win better social reputation and social recognition, and gain the trust of the government.

5. Contributions, limitation and future research

PPP has been widely applied in social and economic development, environmental governance and rural revitalisation. In the green and low-carbon development, PPP mode will also become an important financing method for green infrastructure and new energy infrastructure. The research is helpful for the public sector or project managers to grasp the demands of investors and meet the demands of investors in the market to attract more private capital to participate in low-carbon construction and provide more funding sources for domestic green low-carbon transformation by PPP scheme. The investor demand measurement scale developed is conducive to further analysing the mechanism of investor behaviour based on demand motivation theory.

The current research on the demand in PPP projects mainly focuses on the purpose of the project itself, and the people-centered demand analysis is still lacking. Therefore, there may be omissions in demand indicators and measurement items based on literature and

practice. The study mentioned the significance of demand satisfaction in attracting investors to participate in PPP green buildings, but did not conduct a more in-depth analysis. In the future, first, we will collect more demand indicators and analyze the demand levels of different stakeholders in the PPP project. Second, based on demand theory and motivation theory, it is important to analyze the impact mechanism of investor demand on behavior (such as participation in double-carbon and speculation).

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Data availability statement

Some or all data, models, or code that support the findings of this study are available from the corresponding author upon reasonable request.

Disclosure statement

The authors report there are no competing interests to declare.

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