






## Article

# Local Government's Intention to Use Public-Private Partnerships for Infrastructure Projects in China: Antecedents in a Technology Acceptance Model

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**Abstract:** Public-private partnerships (PPPs) are globally recognized for their innovative infrastructure delivery and public services; however, the factors influencing their adoption in China remain unexplored. This study investigates PPPs using the technology acceptance model (TAM). Surveying 353 regional civil servants reveals a direct positive impact of complexity on PPP policy. Additionally, policy positively correlates with perceived usefulness and ease of use, mediated by relative advantage, belief in benefits, and facilitating conditions. Regional disparities exist, with notable differences in complexity, perceived ease of use, and usage intention. These findings contribute to the PPP literature and offer practical insights for policymakers regarding sustainable PPP coordination.

**Keywords:** public-private-partnership; infrastructure projects; local government usage intention; technology acceptance model; China



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## 1. Introduction

With the rapid growth of China's economy and the sharp acceleration of urbanization, the demand for public services has increased rapidly in recent decades. To deal with the huge costs involved, the government tends to absorb social capital via financing means, such as through public-private-partnerships (PPPs) [1], with concomitant advantages in improving the quality of public services by exploiting the different capabilities and readiness of stakeholders [2]. PPPs have been recognized since the late 1990s as a potentially suitable option in the public procurement strategy for infrastructure projects because of their unique advantages [3,4]. In particular, for local governments, adopting PPPs is paramount due to compelling reasons, such as flexibility and innovation in financing, innovation and technology integration, efficiency and expertise, risk allocation, and long-term service sustainability, highlighting its necessity [5]. Driven by the central government, local governments have been enthusiastic about initiating PPP projects since 2014 [6]. PPPs improve personal competencies and effective project management [7]. By the end of 2016, China had witnessed at least 11,260 PPP projects with a total investment of 13.5 trillion yuan.

However, this has faltered over the years, with an obvious fluctuation in the government's intention to use PPPs [8,9]. Since 2017, the central government has introduced a series of policies to minimize the hidden risks associated with local debts. This has created a gradual slowdown in developing PPPs, with a low implementation rate of only 47.3% in 2018 [10]. In addition, many non-compliant PPP projects have been halted due to stricter regulations, including value-for-money (VFM) evaluations and fiscal affordability assessments [11,12]. At the same time, there was a cautious approach to newly proposed projects, requiring them to be strictly within the "application scope" of PPPs. These projects needed a long-term stable demand, large investment scale, clear return mechanism, and reasonable profitability levels [13]. Overall, PPPs in China have undergone an important shift from rapid growth to a more resilient and rational approach.

While PPPs offer significant advantages in improving public service delivery, their implementation also exposes local governments to certain risks. The involvement of private sector entities in these projects introduces potential conflicts between the profit-driven motives of private firms and the public welfare objectives of the local governments. These differences in goals can complicate project management and reduce the overall effectiveness of the partnership [14]. Moreover, reliance on private sector financing and the long-term financial commitments required for PPPs may expose local governments to fiscal instability, especially if these projects face cost overruns, delays, or unforeseen economic shifts [15,16]. As a result, managing these risks while ensuring the sustainability and financial viability of PPP projects remains a critical challenge for local governments.

Despite criticisms of past practices, PPPs are still considered a mechanism for delivering cost-effective and sustainable infrastructure [17,18]. Their dynamic evolution is closely tied to regional infrastructure, local government policies and attitudes, economic and financial strength, and the regulatory environment [19]. Local governments have different interests and attitudes toward PPPs [20,21], shaped by both endogenous needs and an exogenous context [8,22]. Indeed, local governments in China are not only responsible for the supply of infrastructure facilities and services but also act as the main force promoting the healthy and standardized development of PPP projects [23,24]. However, examining local governments' practices is challenging without understanding their interests in Public-Private Partnerships (PPPs). Understanding the incentives for sustainable development and the Chinese context is crucial, and the full picture remains unknown.

Previous research has provided some evidence of how local governments promote PPPs (e.g., Boyer et al., 2016; Thierie and De Moor, 2017) [25,26], but there is very limited knowledge about why local governments in different regions have different levels of commitment to PPPs. Although certain studies separately mention several driving factors of PPP adoption from the perspective of local governments [8,12], primarily emphasizing the local benefits they generate (e.g., bridging the infrastructure gap and alleviating ballooning local debts), there has been limited empirical research that systematically examines the influencing factors and their effects on local government PPP usage intention. The existing literature largely lacks a systematic framework that addresses the complexity of local governments' intentions to adopt PPPs and the interdependencies among various influencing factors. In this regard, two issues require further investigation: (1) What factors are involved? (2) How do they influence local government PPP usage intention?

Therefore, this current study aimed to explore the influencing factors and the underlying mechanisms involved. Following the TAM model and advocacy coalition framework, a questionnaire survey was conducted of civil servants with PPP infrastructure project experience in different regions of China (eastern, central, western, and northeast) to examine the mechanisms driving local government PPP usage intention using structural equation modeling (SEM) and one-way ANOVA. The findings contribute to the PPP body of knowl-

edge by revealing the specific mechanism driving local government PPP usage intention and providing practical implications for policymakers to coordinate PPPs in a high level and sustainable manner.

This study first reviews the relevant literature, constructs a theoretical framework based on the TAM and the advocacy coalition framework, and formulates research hypotheses. It then outlines the research methodology, including the survey design, data collection, and analysis. Following this, the empirical analysis explores regional variations in PPP adoption willingness and tests the proposed hypotheses. Finally, this paper concludes by summarizing the key findings and offering recommendations for future research directions.

## 2. Literature Review and Research Hypotheses

### 2.1. The Technology Acceptance Model

The technology acceptance model (TAM), originally developed by Davis (1989) more than 30 years ago, is widely used to explain the potential acceptance of technological innovations by individuals [27,28]. To date, TAM has evolved into a relatively robust conceptual model and plays an increasingly important role in understanding the predictors of human behavior in adopting new technology in various contexts [29,30]. According to the refined TAM, the ultimate usage intention of innovated technology can be explained by the user's perceived usefulness, perceived ease of use, and attitude toward use (Davis, 1989) [27]. Perceived usefulness refers to the degree to which users believe in the performance improvement created by technological innovation, while perceived ease of use is defined as the effort users believe is required to adopt a specific technology [31]. Additionally, attitudes toward technology innovation are influenced by both positive and negative feelings [32].

As Davis (1989) hypothesized, user attitude can directly affect individual usage intention and can also be predicted by perceived ease of use and usefulness [27]. In this context, as shown in Figure 1 (right-hand side), perceived ease of use directly influences perceived usefulness, forming a significant relationship within the framework [33]. It is worth noting that external variables in the TAM model should be defined according to the background and characteristics of specific innovative technology, users, and application fields to improve the predictive validity of the model [34].

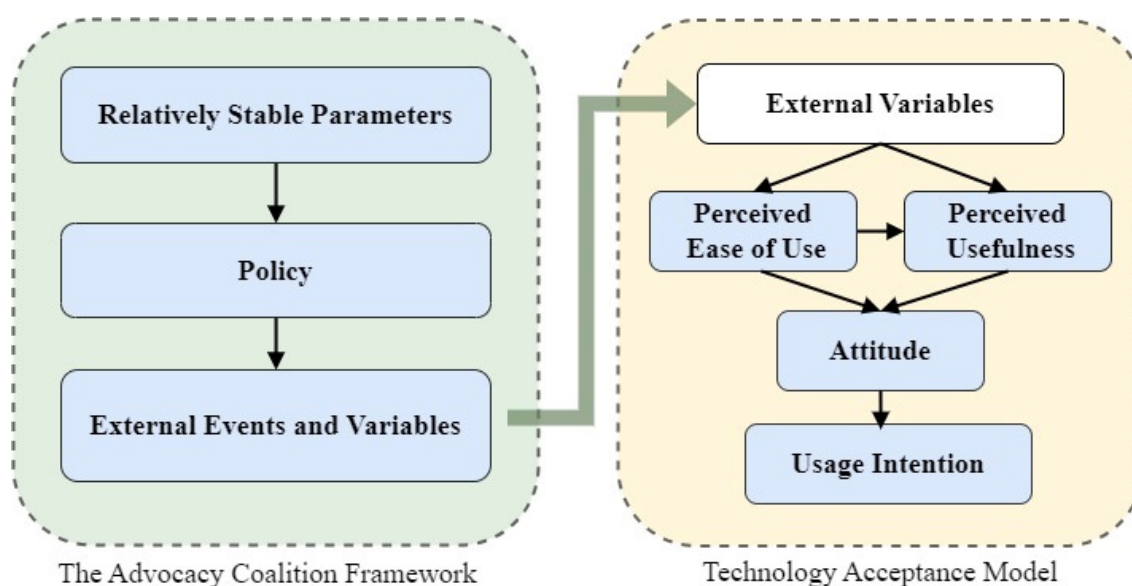


Figure 1. Theoretical framework.

Although PPP is not a new technology but rather a new model, TAM has been effectively applied to analyze the acceptance of various emerging models, such as the circular economy [35] and whole-process engineering consulting [36], all of which have yielded satisfactory results. Moreover, the PPP model incorporates new technical elements, including contractual mechanisms and operational models. As such, the TAM, a framework designed to understand the acceptance of innovative models and technologies, is well-suited for analyzing local governments' acceptance of PPPs. Additionally, while TAM was initially developed to explain individual behavior in adopting information technologies, its underlying principles can be adapted and extended to explore user acceptance in broader "innovation" contexts (e.g., interactive systems, environments, tools, applications, services, and devices) [37–40]. Innovation has emerged as one of the most common keywords associated with PPPs in the literature [41,42]. Moreover, there are many examples of PPPs being recognized as a tool or providing an environment that fosters innovation, such as creating additional services or products, better technologies, and optimizing managerial and organizational efficiency [4,43]. The present research focuses on local governments' intention to adopt PPPs, consistent with the key principles outlined in the technology acceptance model [27]. Importantly, the advocacy coalition framework integrates the unique characteristics and complexity of PPPs as institutional arrangements or formalized management structures to comprehensively understand their acceptance and adaptation [41,44].

## 2.2. The Advocacy Coalition Framework

The advocacy coalition framework (ACF) is one of the most prominent and widely used frameworks for understanding policy processes in various geographical and political fields [45,46]. Developed by Paul Sabatier and Hank Jenkins-Smith in the 1980s [47,48], the ACF posits that policy change results from the interactions between competing advocacy coalitions—groups of individuals, organizations, and government agencies that share similar beliefs, values, and policy preferences [49]. Each advocacy coalition is characterized by its policy core beliefs, which represent fundamental assumptions concerning how the world works and the desired outcomes of policy intervention. In addition to core beliefs, coalition members may have secondary beliefs about policy issues and strategies, which can vary within and between advocacy coalitions, leading to differences in policy preferences and strategies.

In this framework, policy processes occur within an ecosystem characterized by both relatively stable parameters (e.g., inherent attributes of a policy problem) and external events (e.g., changes in socioeconomic conditions) [50]. Typically, a relatively stable parameter influences the policy system through long-term opportunity structures, whereas the policy system impacts external events through short-term constraints and resources [46]. This interaction between relatively stable parameters and external events is seen as crucial for the emergence of policy needs [51,52]. This is especially the case in China, where consideration is needed of such important issues as country-wide characteristics (i.e., its relatively stable parameters) and rapid changes in policy outcome (i.e., its external events) on the stability of advocacy coalitions [52].

Since developing PPPs for infrastructure projects heavily depends on relevant policy processes, the current study extends the ACF by incorporating external events and ACF variables into the TAM. These external variables subsequently impact the core TAM constructs of perceived ease of use and perceived usefulness, thereby influencing local governments' intentions to adopt PPPs. Figure 1 shows the theoretical framework in which TAM and ACF are used to reveal the influencing factors and their underlying mechanisms driving local government PPP usage intention. In this study, the TAM and ACF are the main theoretical foundations for analyzing local governments' attitudes toward PPPs. However,

other psychological factors, such as personal beliefs, values, and socio-cultural dynamics, may also influence governments' willingness to adopt PPPs. Therefore, future research should further explore the impact of these factors on local governments' decision-making to gain a more comprehensive understanding of the complexity of PPP adoption.

### 2.3. Research Hypotheses

#### 2.3.1. Technology Acceptance of PPPs

To solve the problems of the public sector, which often lacks technology, skills, expertise, and money, governments worldwide have adopted PPPs as an innovative means to improve infrastructure project delivery [53]. As with other technological innovations, PPP has relative advantages over traditional procurement methods (e.g., project efficiency, risk allocation, innovation, and long-term sustainability), complexity (involving complex legal and regulatory frameworks, complex negotiations, multiple stakeholders, and technical complexities), and uncertain outcomes (may be caused by financial risks, operational challenges, legal and regulatory changes, and market dynamics) [54,55].

Moreover, as stated earlier, TAM is suitable for analyzing the intention to use the PPP. Hence, following the TAM model, the four hypotheses of PPP usage in infrastructure projects are as follows:

**H1.** *Perceived ease of use has a direct positive influence on perceived usefulness.*

**H2.** *Perceived usefulness has a direct positive influence on attitude.*

**H3.** *Perceived ease of use has a direct positive influence on attitude.*

**H4.** *Attitude has a direct positive influence on usage intention.*

#### 2.3.2. Policy Process for PPP Infrastructure Projects

It has been acknowledged that policy is a critical foundation associated with PPP infrastructure projects [56]. Changes in local policies may cause fluctuations, further affecting local government PPP usage intentions [6]. In the field of PPP infrastructure, complexity is assumed to be the basic attribute of the problem area in relatively stable parameters [8,45]. In general, PPP infrastructure projects involve a complex network of public and private sector partners (e.g., designers, contractors, and operators) and technical complexities, which leads to complexity in multiparty contractual arrangements and long-term costs [57,58]. The complex contractual relationships between participants and long concession periods related to PPP make it different from traditional infrastructure development routes [59]. Given this deficiency in PPP implementation, policy reform is required to alter the external environment of governance mechanisms and construct regulating networks [4], prompting the following hypothesis:

**H5.** *Complexity has a direct positive influence on policy.*

According to the ACF, as well as the characteristics of PPP infrastructure projects, relative advantage, belief in the benefits, and facilitating conditions are the main changes in social and economic conditions and the key external variables under the policy framework [8,45]. First, PPPs have a significant potential relative advantage only under a mature policy. A mature policy can eliminate the negative effects of various risks and promote the development of PPP projects [60,61]. Moreover, in practice, a policy is crucial to the local government's belief in the benefits of using PPPs as an effective tool for public procurement. As Wang et al. (2020) and Boardman et al. (2016) indicated, effective PPP management can



achieve the expected outcomes by introducing or tailoring policies under a specific, legal, and appropriate economic and administrative system [62,63]. Additionally, policy guidelines based on the principles of accountability, fairness, transparency, efficiency, and participation provide facilitating conditions for newly adopted PPP governments to improve their effectiveness [8,64]. Hence, the following hypotheses are proposed:

**H6a.** *Policy has a direct positive influence on relative advantage.*

**H6b.** *Policy has a direct positive influence on the belief in its benefits.*

**H6c.** *Policy has a direct positive influence on facilitating conditions.*

### 2.3.3. Link Between ACF and TAM

Relative advantage is defined as the degree to which an innovation is considered to provide more benefits than its traditional counterpart [65]. According to Min et al. (2019), the relative advantage of innovation includes practical and hedonic traits, which affect users' overall evaluation of innovation [66]. Then, it leads to the users' willingness to use it. Similarly, being regarded as an innovation to improve infrastructure, local governments can evaluate the relative advantages of a PPP compared to the existing traditional procurement method before using it [53,67]. The relative advantages can positively affect local governments' perceived usefulness of a PPP in delivering infrastructure and its use intention [8,68]. Thus:

**H7.** *Relative advantage has a direct positive influence on perceived usefulness.*

Belief in innovation forms the basic attitude toward technology innovation [69]. Belief in the benefits of PPP infrastructure projects means that the local government believes that infrastructure development can benefit from PPPs, including enhanced efficiency, innovation, cost-effectiveness, and risk mitigation through private sector involvement. It can be theorized that users form benefit beliefs at the individual level and form a common belief with peers and other public sectors [58,70]. The perceived usefulness of PPPs refers to perceptions of their effectiveness, efficiency, and utility in addressing infrastructure needs, compared with traditional procurement methods. More specifically, the local government's belief in the benefits of using PPPs lies mainly in their potential to provide better public services [71].

Perceived ease of use reflects stakeholders' perceptions of the extent to which the PPP approach facilitates efficient, transparent, and collaborative processes for infrastructure development. Some key elements of the perceived ease of use in PPPs are highlighted [5], such as ease of interaction, risk management mechanisms, technical assistance and support, and clarity of process. Stakeholders who strongly believe in the benefits of PPPs may engage in motivated reasoning, interpreting the complexities of PPPs as minor obstacles that are easily overcome, thereby perceiving PPPs as easier to use [72]. Overall, this implies that the belief in the benefits of the PPP infrastructure project impacts its perceived usefulness and ease of use, leading to usage intention. Thus:

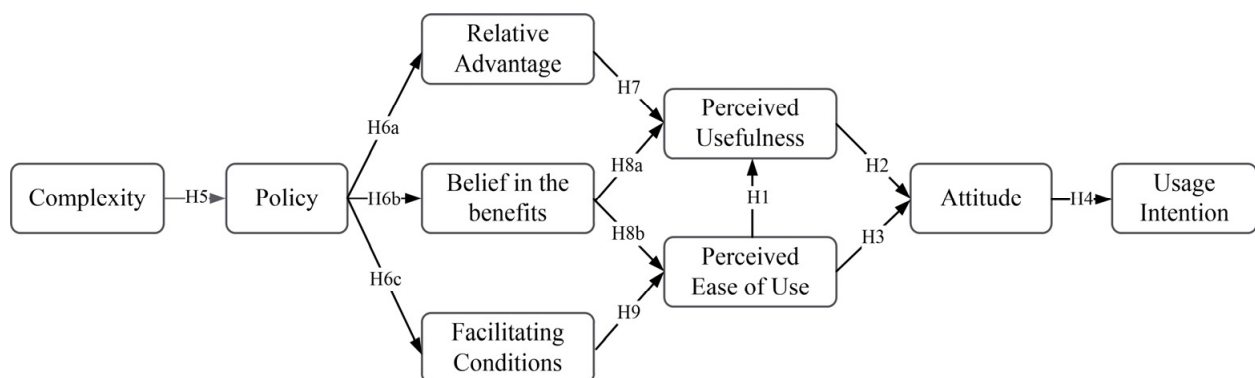
**H8a.** *Belief in the benefits has a direct positive influence on perceived usefulness.*

**H8b.** *Belief in the benefits has a direct positive influence on perceived ease of use.*

Facilitating conditions can be viewed as external control factors affecting a person's behavior. If the conditions support it, the behavior may occur; otherwise, it will not [73]. Previous studies on technology acceptance have verified that facilitating conditions significantly affect perceived ease of use [74]. Regarding PPP infrastructure, facilitating conditions, including the policy environment, available information or materials, and administrative support, have been rated as important factors influencing the PPP's perceived ease of use [56,75]. With the support of facilitating conditions provided by appropriate policies, local governments find it easier to use PPP to deliver infrastructure projects [61]. Hence:

**H9.** *Facilitating conditions have a direct positive influence on the perceived ease of use.*

Figure 2 presents the final hypothesized relationship model that integrates the PPP relative policy process and user acceptance.



**Figure 2.** Hypothesized model of the relationships.

### 3. Methods and Measures

The methodology of this study is based on the traditional test paradigm. First, a theoretical framework concerning local government PPP usage intention was built through a comprehensive literature review and interviews with experts. Second, following the hypothesized relationships model, an Internet-based questionnaire survey was conducted to collect data on perceived ease of use, usefulness, usage intention, attitudes toward PPP, complexity, etc. Third, statistical methods were used to analyze the data collected.

#### 3.1. Measurement of Constructs

In addition to the respondents' demographic characteristics, the questionnaire contained nine constructs and 30 scale items (as show in Appendix A). Each survey item was developed and supported by previous studies [66,67,70,75–78]. Considering that most of the measurement scales originally focused on innovative information or electronic technology, each item was modified and optimized to suit the specific characteristics of the PPP infrastructure industry. For all measurement items, respondents were asked to evaluate their agreement on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Table 1 presents the final variables for each construct in the model.

**Table 1.** Variables of each construct.

Latent Variable		Item	Source
Perceived Usefulness (PU)	PU1	Using a PPP improves the delivery of infrastructure and public service.	[64]
	PU2	A PPP enables local government to alleviate financial burdens.	
	PU3	Using a PPP enhances public convenience.	
	PU4	Overall, PPP is useful for local government.	
Perceived Ease of Use (PEU)	PEU1	The PPP process to support infrastructure development is clear and understandable.	[64,66]
	PEU2	Using a PPP does not require much mental effort.	
	PEU3	Learning to use the PPP application is easy for me.	
	PEU4	Overall, a PPP is easy for me to use in the construction and operation.	
Attitude (AT)	AT1	The PPP application will make infrastructure project delivery easier.	[70,75]
	AT2	The PPP application will be better than the traditional procurement.	
	AT3	I look forward to those aspects of my job related to the PPP application.	
Usage Intention (UI)	UI1	My department wants to continue using a PPP in its next infrastructure. project.	[67,76]
	UI2	My department wants to try other PPP types in the future.	
	UI3	The local government intends to continue using PPPs rather than traditional procurement.	
Policy (PL)	PL1	The current policies encourage the local government to adopt PPPs for infrastructure projects.	[77]
	PL2	The current policies provide guidelines for PPP infrastructure projects.	
	PL3	The current policies provide service support for PPP infrastructure projects.	
	PL4	The current policies provide the necessary facilities for PPP infrastructure projects.	
Complexity (CP)	CP1	The PPP application requires much mental effort and time to learn new operational processes.	[66]
	CP2	The PPP application can be frustrating.	
	CP3	The PPP application requires specific skills and knowledge.	
Relative Advantage (RA)	RA1	Compared to traditional procurement, PPP applications improve the quality of infrastructure projects.	[66,67]
	RA2	Compared to traditional procurement, PPP applications improve the delivery efficiency of infrastructure projects.	
	RA3	Compared to traditional procurement, PPP applications bring more advantages to infrastructure projects.	
Belief in the Benefits (BE)	BE1	My department team believes in the benefits of PPP applications.	[75]
	BE2	My peers believe in the benefits of PPP applications.	
	BE3	I believe in the benefits of PPP applications.	
Facilitating Condition (FC)	FC1	When I need help in adopting a PPP, guidance is available.	[75]
	FC2	When I need help in adopting a PPP, specialized instruction is available.	
	FC3	When I need help in adopting a PPP, a specific person is available to assist.	



Before undertaking the main survey, a pilot study was conducted to check the reliability and validity of the scale. This received a response from 60 members, of which 57 were considered valid. Correspondingly, Cronbach's alpha and exploratory factor analysis were applied to verify the reliability and validity of the survey data. The results show that the Cronbach's alpha values of the different constructs all exceeded 0.7 (ranging from 0.7 to 0.773), and the KMO (Kaiser-Meyer-Olkin) values range from 0.781 to 0.847, which means the designed questionnaire has sufficient reliability and validity [79].

### 3.2. Samples and Data Collection

The snowball sampling process, considered an appropriate method for obtaining representative samples, selects respondents from functionaries involved in PPP infrastructure projects in the public sector. First, according to China's five-year plan series and the Western Development Program, the survey area was divided into four parts: coastal (eastern), central, western, and northeast regions [80]. Second, local government civil servants with substantial experience in PPP infrastructure projects were selected through the research team's networks, with each respondent recommending the next participant. Strict sampling criteria were followed to ensure that the sample was representative, with the initial sample comprising a diverse range of sectors, including finance, construction, and investment management. Third, the sampling process was concluded once the required number of completed questionnaires was obtained, with data collection stopping at the fifth stratum to minimize bias.

The initial questionnaire survey was conducted through the Internet (e.g., E-mail and WeChat) from 1 March to 30 October 2020. To further supplement the data with updated information, a subsequent round of questionnaires was distributed from 8 December to 16 December 2024. The Internet-based survey overcomes the limitations of time and space with evident advantages in cost, high efficiency, and timeliness [81]. More specifically, respondents (government agency staff) from different regions who are difficult to reach become available through an online questionnaire survey [82]. In terms of valid questionnaire screening, the following inclusion criteria were applied: (1) respondents with an answer time of more than 60 s, (2) respondents with no less than three years of working experience in PPP projects, and (3) not all the checked options in the whole questionnaire are the same. After excluding incomplete and invalid questionnaires, there were 353 usable responses available for analysis from a total of 371 questionnaires, comprising 99, 87, 87, and 80 from the eastern, central, western, and northeastern regions, respectively. Table 2 provides the descriptive statistics of the respondents' demographic characteristics.

**Table 2.** Demographic characteristics of respondents.

Profile	Category	Number	Frequency	Cumulative Percent
Gender	Male	181	51.27%	51.27%
	Female	172	48.73%	100.00%
Age	18–25	44	12.46%	12.46%
	26–35	119	33.71%	46.18%
	36–44	137	38.81%	84.99%
	45–60	53	15.01%	100.00%
Education level	≤Junior college	23	6.52%	6.52%
	Undergraduate	227	64.31%	70.82%
	≥graduate	103	29.18%	100.00%

Table 2. Cont.

Profile	Category	Number	Frequency	Cumulative Percent
Work Experience	≤2 years	95	26.91%	26.91%
	2–5 years	194	54.96%	81.87%
	5–10 years	53	15.01%	96.88%
	≥10 years	11	3.12%	100.00%
Working Department	Development and reform-related	26	7.37%	7.37%
	Treasury related	47	13.31%	20.68%
	Transportation related	39	11.05%	31.73%
	Urban development related	74	20.96%	52.69%
	Water related	21	5.95%	58.64%
	Environment related	30	8.50%	67.14%
	Others	116	32.86%	100.00%
Project Location	Eastern China	99	28.05%	28.05%
	Central China	87	24.65%	52.69%
	Western China	87	24.65%	77.34%
	Northeast China	80	22.66%	100.00%

In detail, the eastern investigation region in China includes Zhejiang province, Beijing, Jiangsu province, Hebei province, and Shandong province, with 30, 8, 36, 15, and 10 final valid questionnaires, respectively; the central investigation region includes Anhui province and Henan Province, with 31 and 56, final valid questionnaires, respectively; the western investigation region includes Sichuan Province, Chongqing, Shaanxi province, Qinghai province, and Guangxi, with 13, 12, 26, 10, and 26 final valid questionnaires, respectively; and the northeast investigation region is Liaoning province, with 80 final valid questionnaires.

### 3.3. Data Analysis

The data were processed in three steps. First, tests involving composite reliability, KMO values, and common method bias were conducted to analyze whether the data met the required reliability standard, convergence, and structural validity. Second, regional differences in local government PPP usage intention were explored using one-way ANOVA. Specifically, one-way ANOVA is a statistical method that compares the means of three or more independent groups, making it particularly effective for examining variations in PPP adoption intentions across different regions [83]. Third, structural equation modeling (SEM), a vital statistical tool for analyzing the relationship between variables (including latent and explicit variables), was used to evaluate the hypothesized relationships mentioned above. All analytical procedures strictly adhered to the scientific method and were carefully executed using SPSS 23.0, AMOs 23.0, and SmartPLS 4.0 software to uphold the validity and reliability of the experimental findings.

## 4. Results

### 4.1. Initial Validation of Data

As Cronbach's alpha is easily influenced by the number of items, which may lead to underestimation of the results, composite reliability (CR) was also used in the data processing to assess internal consistency reliability [84]. Table 3 shows that all Cronbach's alpha and composite reliability values were higher than 0.70, indicating that the internal consistency was acceptable. Meanwhile, Kaiser-Mayer-Olkin (KMO) was adopted to check the correlation and partial correlation between indicators. The closer the KMO value is to 1, the stronger is the correlation between the variables [85]. As shown in Table 3, the questionnaire demonstrated good reliability and validity. Therefore, the measurement model is considered satisfactory, as sufficient evidence of reliability, convergence, and structural validity was provided.

**Table 3.** Reliability and validity test results of the questionnaire.

Latent Variable	Cronbach's $\alpha$	KMO	Bartlett's Test of Sphericity	CR	AVE
Perceived Usefulness (PU)	0.810	0.913	$\chi^2 = 5091.122$	0.876	0.638
Perceived Ease of Use (PEU)	0.813		df = 435	0.878	0.642
Attitude (AT)	0.833		Sig. = 0.000	0.9	0.749
Usage Intention (UI)	0.809			0.887	0.723
Policy (PL)	0.808			0.873	0.633
Complexity (CP)	0.702			0.83	0.622
Relative Advantage (RA)	0.808			0.886	0.722
Belief in the Benefits (BE)	0.842			0.905	0.76
Facilitating Condition (FC)	0.768			0.866	0.683

Harman's single-factor model explained only 34.460% of the total variance, indicating that there was no significant common method bias in the data. When all items of all variables were located onto one factor in the chi-square difference test using a common latent factor, the results of the fitted model ( $\chi^2 = 1996.56$ , d.f. = 405), goodness-of-fit index (GFI) = 0.694, adjusted goodness-of-fit index (AGFI) = 0.648, comparative fit index (CFI) = 0.674, root mean square error of approximation (RMSEA) = 0.106, and the chi-square differences ( $\Delta\chi^2 = 1175.967$ ,  $\Delta$ d.f. = 12,  $p < 0.001$ ) confirmed the single-factor results, indicating that CMB issues were not present in the dataset. Consequently, common method bias was not a critical threat in this study.

#### 4.2. Regional Differences

The respondents showed different perceptions of PPPs' usefulness, ease of use, complexity, and usage intention under different economic and policy conditions. The current study analyzed the differences between four regions—the eastern, central, western, and northeast of China—based on the economic region division principle of the National Bureau of Statistics. A one-way ANOVA was used to analyze regional differences in the perception and intention of PPP infrastructure projects. Table 4 shows the descriptive statistics, revealing that the kurtosis and skewness coefficients of all variables adhere to a multivariate normal distribution, affirming the suitability of the data for one-way ANOVA analyses and structural equation modeling (SEM).

This study employed a one-way ANOVA to examine whether significant variations exist in the acceptance of PPPs across different regions. As presented in Table 5, the one-way ANOVA results reveal significant regional variations in the perceptions of PPP adoption. Respondents from the northeast region reported higher levels of Perceived Ease of Use compared to their counterparts in the eastern and central regions. Meanwhile, Usage Intention was notably higher among respondents from the central, western and northeast regions. In contrast, perceptions of Complexity were significantly greater in the eastern and central regions than in the western and northeast regions. While no statistically significant differences were found in Perceived Usefulness, Policy, Relative Advantage, Belief in the Benefits, or Facilitating Condition, subtle regional differences indicated variations in readiness and attitudes toward PPP implementation. These findings underscore the importance of developing region-specific strategies to mitigate perceived challenges and enhance the adoption and effectiveness of PPP projects.

**Table 4.** Statistical results for the descriptive variables.

Factor	Indicator	Mean	Std. Dev	Kurtosis	Skewness
Perceived Usefulness	PU1	3.881	0.651	0.523	−0.376
	PU2	3.870	0.739	1.539	−0.767
	PU3	3.442	0.831	0.481	−0.442
	PU4	3.904	0.650	1.158	−0.465
Perceived Ease of Use	PEU1	3.244	0.821	−0.311	−0.136
	PEU2	3.201	0.830	−0.131	−0.091
	PEU3	3.195	0.800	−0.224	0.034
	PEU4	3.195	0.828	−0.315	−0.016
Attitude	AT1	3.561	0.676	−0.102	−0.306
	AT2	3.606	0.762	0.214	−0.324
	AT3	3.445	0.733	0.378	−0.177
Usage Intention	UI1	3.793	0.630	0.684	−0.491
	UI2	3.705	0.681	0.826	−0.638
	UI3	3.728	0.612	1.697	−0.963
Policy	PL1	3.666	0.671	0.099	−0.338
	PL2	3.691	0.643	0.154	−0.323
	PL3	3.728	0.630	0.644	−0.602
	PL4	3.589	0.714	0.105	−0.199
Complexity	CP1	3.742	0.673	0.252	−0.37
	CP2	3.575	0.640	−0.148	−0.185
	CP3	3.898	0.580	0.643	−0.255
Relative Advantage	RA1	3.533	0.670	−0.169	−0.205
	RA2	3.790	0.627	0.972	−0.644
	RA3	3.541	0.764	−0.308	−0.235
Belief in the Benefits	BE1	3.745	0.697	0.979	−0.517
	BE2	3.680	0.646	0.84	−0.598
	BE3	3.652	0.683	0.432	−0.399
Facilitating Condition	FC1	3.448	0.800	0.462	−0.347
	FC2	3.575	0.724	−0.136	−0.332
	FC3	3.538	0.753	0.425	−0.532

**Table 5.** Results of one-way ANOVA on regional differences.

Factor	Region	Mean	Std. Dev	F	Sig	Multiple Comparisons
Perceived Usefulness	Eastern	3.796	0.681	1.737	0.159	1-2-3-4
	Central	3.839	0.473			
	Western	3.799	0.444			
	Northeast	3.650	0.637			
Perceived Ease of Use	Eastern	3.106	0.691	4.414	0.005	4 > 1, 4 > 2
	Central	3.089	0.628			
	Western	3.270	0.512			
	Northeast	3.400	0.737			
Attitude	Eastern	3.505	0.696	1.19	0.313	1-2-3-4
	Central	3.621	0.526			
	Western	3.456	0.564			
	Northeast	3.575	0.694			

**Table 5.** *Cont.*

Factor	Region	Mean	Std. Dev	F	Sig	Multiple Comparisons
Usage Intention	Eastern	3.546	0.738	6.228	0.000	2 > 1, 3 > 1, 4 > 1
	Central	3.824	0.419			
	Western	3.816	0.393			
	Northeast	3.817	0.474			
Policy	Eastern	3.634	0.657	1.039	0.375	1-2-3-4
	Central	3.675	0.398			
	Western	3.624	0.367			
	Northeast	3.753	0.617			
Complexity	Eastern	3.855	0.572	14.074	0.000	1 > 3, 1 > 4, 2 > 3, 2 > 4
	Central	3.931	0.384			
	Western	3.594	0.450			
	Northeast	3.542	0.454			
Relative Advantage	Eastern	3.613	0.615	0.728	0.536	1-2-3-4
	Central	3.602	0.528			
	Western	3.697	0.409			
	Northeast	3.571	0.747			
Belief in the Benefits	Eastern	3.596	0.702	1.391	0.245	1-2-3-4
	Central	3.763	0.485			
	Western	3.724	0.458			
	Northeast	3.700	0.655			
Facilitating Condition	Eastern	3.599	0.677	2.445	0.064	1-2-3-4
	Central	3.510	0.431			
	Western	3.582	0.398			
	Northeast	3.367	0.880			

Note: in multiple comparisons: 1, 2, 3, and 4 represent Eastern, Central, Western, and Northeast China; ">" indicates that, at a 95% confidence interval, the difference between the values on both sides is statistically significant, with the left-sided value significantly greater than the right-sided value; "-" indicates that, when the confidence interval is 95%, the difference between the values on both sides of the symbol is not statistically significant.

#### 4.3. Structural Model and Hypotheses Testing

The current SEM model fit indices indicate that all the parameters met the predetermined recommended values. Table 6 shows the results of the hypotheses tests, including (standardized and unstandardized) path loadings and significance levels.

**Table 6.** Confirmatory factor analysis results.

Statistic	Recommended Value	Current Model
Chi-square/d.f.	<3.0	2.088
RMR	<0.08	0.033
RMSEA	<0.08	0.056
GFI	>0.80	0.869
CFI	>0.90	0.913
IFI	>0.90	0.913
TLI	>0.90	0.903

All hypothesized links based on ACF and TAM between the external variables, perceived usefulness, perceived ease of use, attitude, and usage intention, were supported at the  $p < 0.001$  significance level (see Table 7). Attitude has a direct positive impact on usage intention. It is affected by perceived usefulness and perceived ease of use, the latter of which has a direct and positive influence on perceived usefulness. Among all external variables, policy is directly and positively influenced by complexity and positively influences

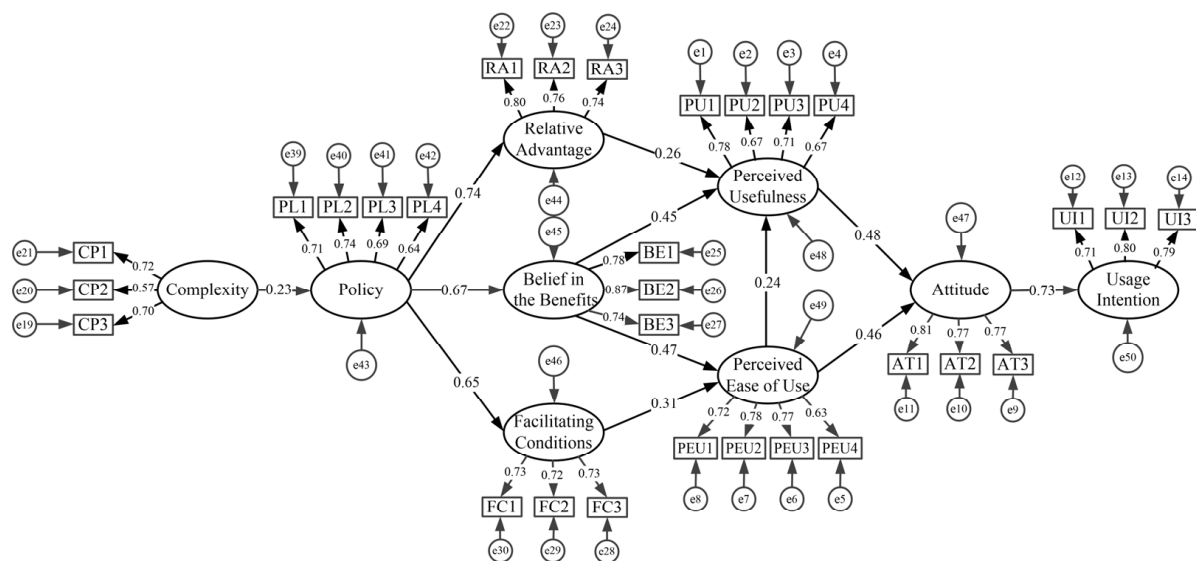


relative advantage, belief in the benefits, and facilitating conditions. Moreover, belief in the benefits directly influences perceived usefulness, and the latter is also affected by relative advantage and perceived ease of use. In this mix, the perceived ease of use is affected by facilitating conditions (Figure 3).

**Table 7.** Hypotheses testing results.

Hypotheses	Unstandardized Estimates	S.E.	Standardized Estimates	Critical Ratio	Sig.	Hypotheses Testing
H1	0.232	0.064	0.243	3.604	***	Supported
H2	0.537	0.076	0.481	7.054	***	Supported
H3	0.492	0.077	0.461	6.428	***	Supported
H4	0.586	0.057	0.732	10.223	***	Supported
H5	0.27	0.082	0.232	3.292	***	Supported
H6a	0.832	0.081	0.738	10.307	***	Supported
H6b	0.773	0.080	0.672	9.631	***	Supported
H6c	0.748	0.087	0.650	8.646	***	Supported
H7	0.246	0.056	0.263	4.379	***	Supported
H8a	0.408	0.068	0.446	6.020	***	Supported
H8b	0.449	0.068	0.468	6.591	***	Supported
H9	0.297	0.066	0.310	4.502	***	Supported

Note: \*\*\*  $p < 0.001$ .



**Figure 3.** The SEM model with standardized path loadings.

## 5. Discussion

### 5.1. Main Effects

Consistent with Renny's (2013) study, perceived usefulness significantly and positively affects attitudes, while attitudes directly affect the intention to use [86]. This means that perceived usefulness is the basis for stimulating users' intention to adopt PPPs. When users' perceived usefulness is higher, they are more likely to have a favorable attitude toward PPPs and thus make use and "willingness to use" decisions. Similarly, Davis' (1989) conclusion is verified in that perceived ease of use directly impacts attitudes [27]. In other words, an application model perceived as easy to use is more acceptable to the users. In addition, the finding that perceived ease of use positively affects perceived usefulness confirms Davis' (1989) findings [27]. From a causality perspective, the perceived ease of use is an antecedent of perceived usefulness. In this regard, dozens of studies have shown

that the effectiveness of new technologies depends largely on their usability (e.g., [87,88]). *Ceteris paribus*, the easier it is to interact with new innovative technology, and the less effort required to operate it, the more useful it is to users [89]. Overall, Hypotheses H1–H4 were tested, indicating that the PPP application model is consistent with the technology acceptance theory, which aligns with previous findings.

The findings also demonstrate that complexity has a positive impact on policy. Introducing PPPs into infrastructure and public services has significantly promoted China's economic upgrading [14]. However, apart from remarkable positive externalities, PPP projects also have the complexity of a long payback period and certain risks [90]. Thus, as many studies emphasize, policy support is needed to develop PPPs [91,92]. In this sense, complexity stimulates the output of policies or, more accurately, complexity has a direct positive impact on PPP policies, which means that Hypothesis H5 is confirmed.

Furthermore, as Table 7 shows, it was verified that policy has a direct positive effect on relative advantage (Hypothesis H6a), belief in the benefits (Hypothesis H6b), and facilitating conditions (Hypothesis H6c). On the one hand, this result strengthens the findings of De Bruycker (2020) [93], in that policy directly impacts relative advantage and facilitating conditions. As China's economic development enters 'the new normal', the main goal of the PPP policy system is to improve the quality and efficiency of PPP projects [94], which is conducive to enhancing its relative advantage. In addition, as one of the government's important regulatory tools, the policy has played a significant role in improving the PPP system and guiding the active participation of social capital [95], which matches the conclusion that policy has a direct positive effect on facilitating conditions. Conversely, as claimed by Rosell and Saz-Carranza (2020) [96] and Fathi and Shrestha (2021) [97], the PPP policy is available to regulate project revenue and prevent the company's franchise from profiteering. Indeed, a favorable policy environment helps to increase the benefit consensus of PPP participants [61]. Therefore, as verified above, the policy has a direct positive impact on the benefits.

In terms of how relative advantage, belief in the benefits, and facilitating conditions influence perceived usefulness, the SEM model results show that these occur through one or two paths. To begin with, this study validates Swanson's (1987) finding that relative advantage directly affects perceived usefulness [98]. Such relative advantages as "improved quality" and "improved delivery efficiency" are closely related to perceived usefulness [67]. Moreover, similar to Lin's (2011) findings [99], belief in the benefits is closely associated with perceived usefulness and ease of use and has a significant positive impact on the latter two. Belief in the benefits refers to the unified view and evaluation of PPP participants of the concept, distribution, and behavioral norms of project benefits. Theoretically, perceived usefulness is the user's subjective judgment, and perceived ease of use is an objective measure of effort. Whether subjective judgment or objective effort, perceived usefulness and ease of use result from a belief in the benefits [27]. Moreover, the results show that facilitating conditions positively affect perceived usefulness through perceived ease of use. The unique organizational and resource advantages make it easier for local governments to adopt PPPs in infrastructure construction [4].

## 5.2. Regional Differences

As shown in Table 5, the significant regional differences in local government PPPs usage intention for infrastructure projects revealed that in the central, western, and north-east regions, it is higher than in the eastern region, which coincides with the previous finding that the willingness to invest in PPP projects is imbalanced in space [10,100]. The possible reasons are as follows: first, given that a large infrastructure gap and heavy financial burden are the main factors influencing PPP usage intention [101], it is reason-

able to find a higher score in PPP usage intention in the central, western, and northeast regions, although there is no obvious correlation between PPP usage intention and local economic development [3,10]. Second, there is also evidence to show that the central region's local governments have a higher usage intention because many inappropriate projects there were withdrawn at the end of 2017 due to the strict withdrawal regulations in China, which led to a stronger intention of local governments to initiate valuable and appropriate PPP projects [102]. Third, the higher usage intention in the western and northeast region is likely because the eastern regions already had most PPP projects, while the underdeveloped western and northeast region only had very few [12]. In addition, Pan et al. (2020) [100] observed that PPP adoption in eastern China is predominantly market-driven, while in the central, western, and northeastern regions, it is more strongly influenced by institutional environmental factors, offering valuable insight into the observed regional disparities in PPP usage intention.

The results of the one-way ANOVA also indicate that the perceived ease of use varies by region. Specifically, the perceived ease of use of PPPs in the northeast region was significantly higher than that in the central and eastern regions. Initiated in 2003 and reinforced in 2016, the "Northeast Revitalization Strategy" aimed to address structural and economic challenges in the region by emphasizing reforms and infrastructure development [103]. The region's extensive engagement with PPP projects has fostered both improved local infrastructure and a skilled workforce proficient in managing PPP operations, thereby enhancing familiarity with PPP management and perceptions of ease of use [104]. These findings underscore the impact of targeted regional policies on shaping local perceptions of PPP projects.

Additionally, concerning complexity, both the central and eastern regions scored significantly higher in PPP complexity than the western and northeast regions, which aligns with Li et al.'s (2017) conclusions [5]. Regarding government and social capital, PPPs are incomplete contracts involving a long cycle and complex engineering, prone to complex problems of insufficient input or insecure project income [105]. The central region has a firmer financial condition than the western and northeast regions. Similarly, compared with the eastern region, the urbanization level and infrastructure in the western and northeast regions are less mature. As suggested, the central and eastern regions are more likely to be favored by social capital, which also means that much relevant information needs to be collected before making a decision.

This paper explores the acceptance mechanisms of local governments in adopting the PPP model for infrastructure development, analyzing the differences in policy, perceived ease of use, and complexity in different regions. However, as an innovative financing model, PPP adoption and implementation are also influenced by external factors such as market dynamics and global economic fluctuations [106,107]. For instance, economic shifts can affect social capital's willingness to participate and financing costs, while market changes may introduce uncertainties in project returns. Future research should address these external influences to provide a more comprehensive understanding of the factors driving PPP adoption and success.

## 6. Conclusions

Considering the vital role the PPP approach plays in improving infrastructure delivery and public services, this study aims to identify the influencing factors and how they affect the local government's intention to use PPPs in infrastructure projects by following the TAM model and the advocacy coalition framework. The findings significantly enrich the knowledge of infrastructure project PPP applications and provide useful insights into the specific mechanism of local government PPP usage intention in China. Targeted policy

support, streamlined regulatory processes, and improved facilitating conditions are vital for fostering greater PPP adoption, especially in less developed regions. These insights have important practical implications for policymakers and PPP professionals, including government officials, consultants, and corporate strategists, in effectively coordinating and sustaining PPP projects at a high level.

- (1) Enhancing perceived usefulness and ease of use can improve local governments' adoption of PPPs, with targeted policy support needed to address project complexity and boost confidence in PPP models.
- (2) Significant regional differences in PPP adoption highlight the need for tailored policies that address the unique infrastructure needs of economically diverse regions and promote balanced development across China.
- (3) Optimizing factors such as perceived usefulness, ease of use, and facilitating conditions can improve PPP success, while refining the policy environment will attract private investment, and enhance infrastructure quality and efficiency.

The principal findings are as follows:

- (1) Complexity has a direct and positive influence on PPP-related policies.
- (2) Policy is positively associated with perceived usefulness and ease of use, both directly and indirectly, through relative advantage, belief in the benefits, and facilitating conditions.
- (3) Regional characteristics also influence the local governments' intentions to use PPPs. Significant differences exist in complexity, perceived ease of use, and usage intention between the eastern, central, western and northeast regions.

Although the antecedents of the TAM model related to the intention to use PPP usage were explored and verified empirically, the current study is limited in terms of the choice of variables and sampling range. For example, only a few critical elements influencing local governments' PPP usage intention were measured and modeled, and more research is needed to examine the impact of other cultural, social, and economic factors on the results. Future research should also consider a wider sample range to reflect PPP usage intention accurately.

Furthermore, this study primarily focused on the perspectives of local government officials, potentially overlooking the views of other key stakeholders, such as private sector partners and the general public. It also focuses on the psychological motivations and decision-making processes of government departments in adopting PPPs, without addressing potential goal discrepancies between the public and private sectors. Additionally, this study does not fully consider variations in the abilities of local governments or external factors, such as market fluctuations and global economic conditions, which may also significantly influence the outcomes of PPP projects. These areas warrant further investigation in future research. Finally, the TAM and Advocacy Coalition frameworks used in this study may not have adequately considered other psychological and social factors in government decision-making, and future research should further explore the impact of these factors.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the School of Civil Engineering and Architecture at Zhejiang Sci-Tech University 20200127 on 1 March 2020.

**Informed Consent Statement:** Informed consent for participation was obtained from all subjects involved in the study.

**Data Availability Statement:** The data presented in this study are available upon request from the corresponding author. The data are not publicly available due to privacy concerns.

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## Appendix A

Questionnaires in measuring local government's intention to use PPP

(当地政府采用PPP意向的测量条款)

Notice (注意): In the following items (在后续题项中),

1-Extremely Disagree (极其不同意)

2-Disagree (不同意)

3-Neutral (既不同意也不反对)

4-Agree (同意)

5-Extremely Agree (极其同意)

No. 编号	Items 题项	Options 选项				
Perceived Usefulness (PU)/感知有用性 (PU)						
PU1	Using a PPP improves the delivery of infrastructure and public service. 采用PPP模式改善了基础设施和公共服务项目的交付。	1	2	3	4	5
PU2	A PPP enables local government to alleviate financial burdens. PPP模式能够缓解该项目给当地政府带来的财政负担。	1	2	3	4	5
PU3	Using a PPP enhances the public convenience. 该项目采用PPP模式能够提高公共便利性。	1	2	3	4	5
PU4	Overall, PPP is useful for local government. 总体而言，PPP模式对当地政府是有用的。	1	2	3	4	5
Perceived Ease of Use (PEU)/感知易用性 (PEU)						
PEU1	The PPP process to support infrastructure development is clear and understandable. 用以支持基础设施项目发展的PPP操作流程是清晰易懂的。	1	2	3	4	5
PEU2	Using a PPP does not require a lot of my mental effort. 采用PPP模式并不会花费我太多精力。	1	2	3	4	5
PEU3	Learning to use the PPP application is easy for me. 我觉得学习采用PPP模式比较简单。	1	2	3	4	5
PEU4	Overall, a PPP is easy for me to use in construction and operation. 总体而言，在项目建设及运营过程中应用PPP模式是简单的。	1	2	3	4	5



No. 编号	Items 题项	Options 选项				
Attitude (AT)/态度 (AT)						
AT1	The PPP application will make infrastructure project delivery easier. PPP模式的应用将使基础实施项目交付更加容易。	1	2	3	4	5
AT2	The PPP application will be better than the traditional procurement. PPP模式的应用将优于传统的采购模式。	1	2	3	4	5
AT3	I look forward to those aspects of my job related to the PPP application. 我很期待与PPP模式应用相关的工作内容。	1	2	3	4	5
Usage Intention (UI)/使用意图 (UI)						
UI1	My department wants to continue using a PPP in the next infrastructure. 本部门希望继续采用PPP模式开发基础设施项目。	1	2	3	4	5
UI2	My department wants to try other PPP types in the future. 本部门未来想尝试（使用）其他类型的PPP模式。	1	2	3	4	5
UI3	The local government’s intention is to continue using PPPs rather than traditional procurement. 地方政府将继续采用PPP模式代替传统采购模式。	1	2	3	4	5
Policy (PL)/政策 (PL)						
PL1	The current policies encourage local government to adopt PPPs for infrastructure projects. 现行政策鼓励地方政府采用PPP模式交付基础设施项目。					
PL2	The current policies provide guidelines for PPP infrastructure projects. 现行政策为PPP基础设施项目提供了指导。					
PL3	The current policies provide service support for PPP infrastructure projects. 现行政策为PPP基础设施项目提供了服务支持。					
PL4	The current policies provide necessary facilities for PPP infrastructure projects. 现行政策为PPP基础设施项目提供了必要的便利。					
Complexity (CP)/复杂性 (CP)						
CP1	The PPP application requires much mental effort and time to learn new operational processes. PPP模式应用要求工作人员投入大量精力和时间来学习新的操作流程。					
CP2	The PPP application can be frustrating. PPP模式应用可能令人抓狂。					
CP3	The PPP application requires specific skills and knowledge. PPP模式应用需要工作人员具备特定的技能和知识。					
Relative Advantage (RA)/相对优势 (RA)						
RA1	Compared to traditional procurement, PPP applications improve the quality of infrastructure projects. 与传统的采购模式相比，PPP模式应用提高了基础设施项目质量。					
RA2	Compared to traditional procurement, PPP applications improve the delivery efficiency of infrastructure projects. 与传统的采购模式相比，PPP模式应用提高了基础设施项目交付效率。					

No. 编号	Items 题项	Options 选项
RA3	Compared to traditional procurement, PPP applications bring more advantages to infrastructure projects. 与传统的采购模式相比，PPP模式应用给基础设施项目带来更多优势。	
Belief in the Benefits (BE)/利益共识 (BE)		
BE1	My department team believes in the benefits of PPP applications. 我的部门团队相信PPP模式应用的好处。	
BE2	My peers believe in the benefits of PPP applications. 我的同行相信PPP模式应用的好处。	
BE3	I believe in the benefits of PPP applications. 我相信PPP模式应用的好处。	
Facilitating Condition (FC)/便利条件 (FC)		
FC1	When I need help in adopting a PPP, guidance is available. 当在应用PPP模式方面需要帮助时，我可以获得操作指南。	
FC2	When I need help in adopting a PPP, specialized instruction is available. 当在应用PPP模式方面需要帮助时，我可以获得专门的说明文件。	
FC3	When I need help in adopting a PPP, a specific person is available to assist. 当在应用PPP模式方面需要帮助时，我可以找到专门的人才来提供协助。	

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