

Research Article

Influencing Factors on Profit Distribution of Public-Private Partnership Projects: Private Sector's Perspective

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As an important issue in the public-private partnership (PPP) projects, the profit distribution has a critical impact on both the public and private sectors. Moreover, the influence of the private sector on the profit distribution of PPP projects cannot be ignored because the private sector are the implementers of PPP projects and responsible for the life-cycle performance and management of PPP projects. Therefore, this study aims at (1) investigating the influencing factors of the profit distribution of PPP projects from the private sector's perspective and (2) analyzing the relationships between the factors and the profit distribution by the qualitative comparative analysis (QCA). The results first showed that the five key influencing factors on the profit distribution from the private sector's perspective were the risk sharing, financing ability, investment, management ability, and effort level. Moreover, the results indicated that the risk sharing was the most important factor that had a positive impact on the profit distribution. Furthermore, the strong management ability and the high ratio of investment were identified as critical factors that led to a larger proportion of profits distributed to the private sector. In addition, the financing ability and the effort level of the private sector should also be considered in the profit distribution plan. The findings first contributed to the body of knowledge on the influencing factors of the profit distribution in PPP projects. In addition, this study is the first attempt of exploring the characteristics of the private sector under the context of profit distribution of PPP projects and using the QCA method to enrich the theoretical research. Thus, the findings would help the private companies improve their abilities and ensure their profits. Besides, the public and private sectors can make appropriate profit distribution proposals in practice based on the conclusion of this study.

1. Introduction

The public-private partnership (PPP) mode, which is the cooperation between the private company and the government, has been widely used for the development of various infrastructure projects all over the world such as the transportation, waste water treatment, and hospital [1, 2]. Moreover, the research on the PPP has been diversified in many aspects such as financing, laws, management, and contract standards [3]. Among these topics, the profit distribution of PPP projects, which means the sharing of profits between the public and private sectors, is the core concern of both the public and private sectors [4]. The government cares about the saving of financial fund, while private companies pay attention to their own profits [5]. A balanced profit distribution plan has a critical impact on

the achievement of a triple-win scenario among the public sector, private company, and the general community [6]. On the contrary, an unfair profit distribution may lead to the negative influence on a project's outcome and stakeholders. In addition, many factors, such as the equity structure, risk allocation, and management, can influence the profit distribution of PPP projects [7]. Because the private sector are the implementers of PPP projects and are responsible for the life-cycle performance and management of PPP projects [8], analyzing the critical factors influencing the profit distribution of PPP projects from the private sector's perspective is quite necessary. However, there is currently still a lack of such relevant research.

Therefore, the objectives of this study are to (1) investigate the influencing factors on the profit distribution of PPP projects from the private sector's perspective using

document analysis and (2) analyze the relationships between the influencing factors and profit distribution results based on data from cases using the qualitative comparative analysis (QCA) method. The findings first contributed to the body of knowledge on the influencing factors of the profit distribution in PPP projects. Moreover, this study is the first attempt of exploring the characteristics of the private sector under the context of profit distribution in PPP projects. Thus, the findings would not only help the private companies improve their abilities and ensure their profits but also provide references for the public and private sectors to make appropriate profit distribution proposals in practice.

2. Literature Review

2.1. PPP Projects and the Profit Distribution

2.1.1. Concepts of PPP Projects. As an important and widely used mode for providing public infrastructure and service, the PPP mode is a working arrangement based on the mutual commitment between the private company and the government [9]. The public sector remains the guarantor and supervisor but not the provider anymore. Correspondingly, the private sector plays an increasingly important role in the financing, constructing, management, and operation of the projects [10]. Although there are many types of public-private arrangements, such as BOT, BOOT, and TOT [11], the fair sharing risks and profit distribution is the core principle of PPP [12]. Through PPP, the public sector aims at delivering the infrastructure early and achieving the value for money [13], maximizing the benefits of the public. On the contrary, the private sector cares more about the profits obtained by their companies from PPP projects. Thus, the profit distribution is a key issue in PPP projects for both the public and private sectors.

2.1.2. Profit Distribution of PPP Projects. The profit distribution means the allocation of the total profits of a PPP project between the public and private sectors. A fair profit distribution typically indicates the balance of the interests between the partners [2, 14]. The developments of PPP projects are complex because of the increasing number of participants and different targets from different participants [15]. Thus, making a scientific and proper profit distribution plan is hard but important and necessary. To achieve this objective, the precondition is to identify and analyze the factors influencing the profit distribution of PPP projects. First, the optimization of equity capital structure can balance the interests between the public and private sectors [14]. Second, a proper risk management framework helps to balance the benefits among the government, private partners, and end users [16]. Besides, a higher level of risk to a participant should lead to a higher share of revenues. Ashuri et al. [7] proposed a risk and revenue sharing mechanism that combined the risk sharing result with the profit allocation. In addition, the allocation ratio of additional profits in PPP projects is related to an investor's fair preference and effort level coefficient [17].

In view of the above, the profit distribution of PPP projects could be influenced by risk allocation, equity investment, management, and other factors. Currently, there is still a lack of research systematically analyzing factors influencing the profit distribution of PPP projects, especially from the private sector's perspective. Therefore, this study aims at filling this research gap.

2.2. The Private Sector in PPP Projects. In PPP projects, the private sector develops and operates the public infrastructure and services, which is previously the responsibility of the public sector in the traditional development mode [10]. Therefore, the abilities and influence of the private sector draw great attention from many researchers.

2.2.1. Abilities of the Private Sector. Tiong [18] analyzed the critical success factors for a private sector to win a tender of a PPP project, including entrepreneurship, leadership, financial strength, relationships management, and technical advantages. Moreover, Zhang [19] stated that the appropriate private sector should be selected from four aspects: (1) financial, (2) technical, (3) safety, health, and environmental, and (4) managerial. In addition, Kumaraswamy and Anvuur [20] proposed a framework for selecting the proper private sector with three criteria: technology, sustainability, and relationship. Besides, the performance in existing projects was also identified as a basic condition.

Considering the above, the financial, managerial, and technical abilities and the ability of relationship management as well as good experiences are all essential capabilities for the private sector to achieve a good PPP project.

2.2.2. Influence of the Private Sector. Simões et al. [21] claimed that the private sector's participation increased the efficiency according to the productivity and efficiency analysis results. Moreover, Liu et al. [8] believed that the private sector, which has a good experience, relevant knowledge, and communication skills, could increase the effectiveness and efficiency of the tendering process in PPP projects. Besides, the private sector's investment behaviors, such as the timing and capacity of investment and the claim of the toll rate, can be different because of the government incentives, improving the outcome of the project [22]. In addition, De Schepper et al. [15] indicated that a dynamic management tool considering the high complexity of PPP projects will achieve an effective management of the private sector so as to get a successful result.

On the contrary, after investigating 35 failed PPP projects, Soomro and Zhang [23] claimed that the improper decisions and actions of the private sector over a project were fatal factors leading to a projects' failure. After analyzing the failure mechanism of PPP projects, Zhang and Ali Soomro [24] discussed the causal relationship between the private sector and projects' failure using multiple regression path analysis. Furthermore, the opportunistic behavior of the private sector is also harmful to the outcome of a project

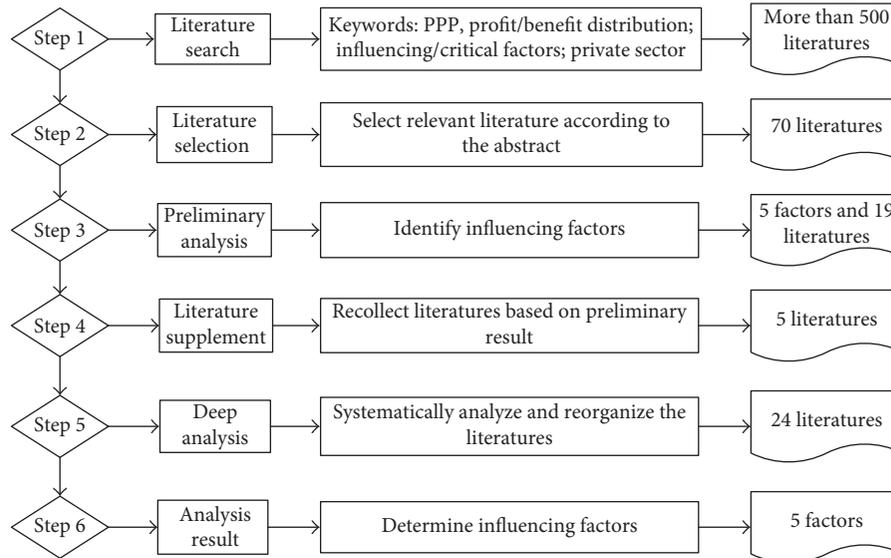


FIGURE 1: Document analysis process for identifying influencing factors.

and the public interests, which can be reduced by improving the profit distribution proportion of the private sector [25].

In view of the above, the private sector has been studied in many aspects. However, there is still a lack of research on the influence of the private sector on the profit distribution of PPP projects. Thus, identifying and analyzing the influencing factors on the profit distribution of PPP projects from the private sector's perspective can help to ensure the success of PPP projects and the profit of the private sector.

3. Methodology

3.1. Document Analysis. As an important part of qualitative analysis methods, the document analysis is a systematic progress to analyze the literatures [26]. To catch the original meanings of the literatures, this study conducted document analysis by the following systematic steps [27], as shown in Figure 1.

The document analysis was conducted through six steps. First, this study used the PPP, benefit/profit distribution, influencing/critical factors, and private sector as key words to search for the relevant literatures in the Scopus. At this stage, more than 500 literatures about these fields were listed. Second, this study screened the irrelevant papers through reading the abstract. After this step, about 70 literatures that are closely related to this topic were kept, while other papers with little correlation were omitted. Third, this study conducted a preliminary literature analysis to identify the influencing factors of the profit distribution on PPP projects from the private sector. Five influencing factors were summarized from these papers by skimming and scanning the full texts. Besides, 19 papers that have deep relationship with these factors were selected and organized together. Then, using the five factors as key words, respectively, 5 literatures were selected to supplement information. After that, a systematic and in-depth analysis was conducted relied on the 24 literatures. In this step, these literatures were reorganized according to

the factors. Besides, the specific content of each factor was generalized based on these literatures. Finally, the five factors were determined scientifically.

3.2. Qualitative Comparative Analysis. To analyze the relationships among the factors and the profit distribution result, this study adopted the qualitative comparative analysis (QCA) method. QCA is a method combining qualitative analysis with quantitative calculation based on multiple cases [28].

3.2.1. Case Selection. To get a convincing result, the cases were selected according to two principles. On the one hand, the cases should have the same characters that can be treated as constant variables indicating the homogeneity of all cases [29]. On the other hand, these cases need to cover different fields and results, which can help to maintain the variety of the selected cases [30]. In addition, as a case-oriented method, the mechanical program, such as random selection, is not suitable. Therefore, the MDSO-MSDO (most different cases, similar outcome/most similar cases, and different outcome) procedure was used to achieve the systematic and scientific selection of cases. In this study, the outcome, which can also be called a dependent variable, is the result of the profit distribution in PPP projects. Moreover, the five influencing factors concluded by the literature analysis are descriptive variables. The focus of this research is that the changing of influencing factors from the private sector brings about different profit distribution results. Therefore, the MSDO procedure, which is used to search for the reasons for different profit distribution results in alike small samples, is appropriate [30].

To quantify these variables, the first step was to set up the binary threshold of the outcome and five descriptive variables. Second, every case was evaluated according to the binary threshold so as to assign "0" or "1" to each variable. Thus, a binary data sheet of the cases, which is the basic

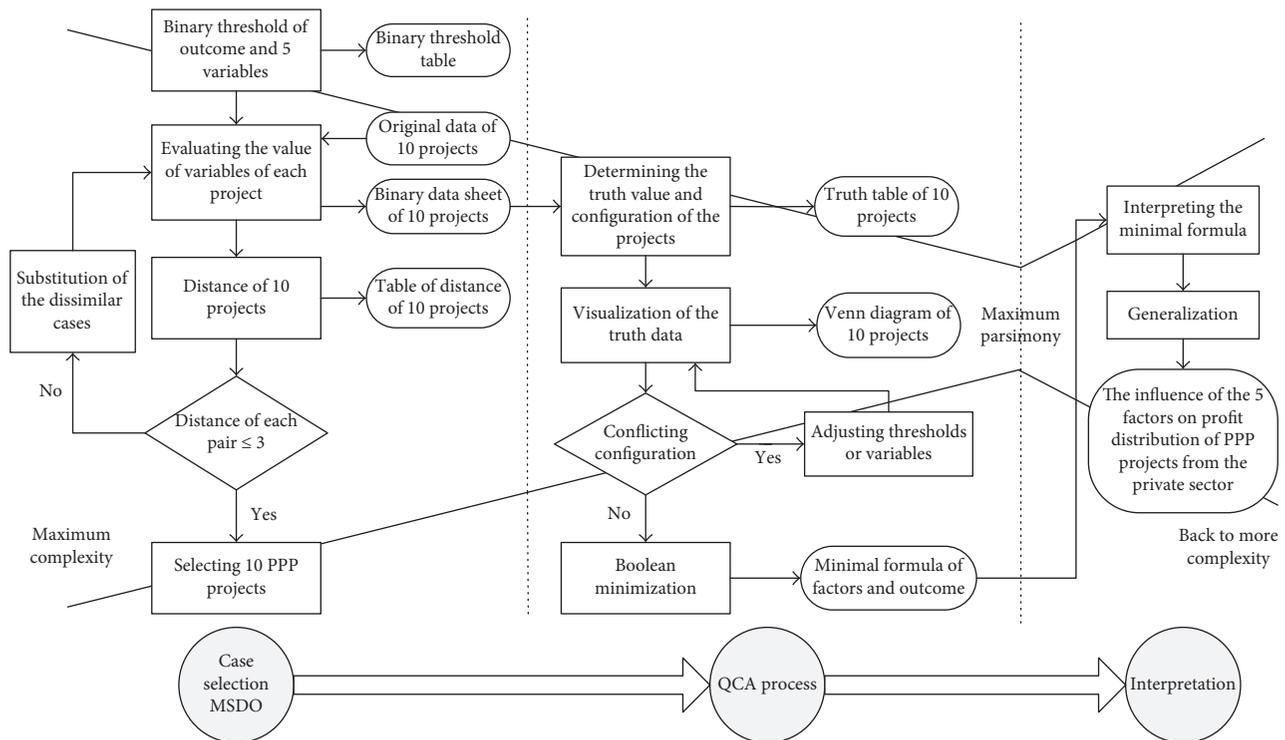


FIGURE 2: Process of QCA about the influencing factors of profit distribution.

information for both case selection and QCA process, was produced. Third, a Hamming distance, which is the number of variables with differing values, for each pair of cases was calculated. If the distance for each pair of projects is smaller than half of the descriptive variables, they are similar cases. By contrast, the distance that larger than 3 means the dissimilar cases [31]. Then, the dissimilar cases were replaced by a new project, and the binary data were renewed. After several cycles, 10 PPP projects were selected through the MDSO procedure.

3.2.2. QCA of 10 PPP Projects. After the selection of 10 PPP projects, the QCA method can be applied [30]. This study uses csQCA (crispy set QCA) to analyze the influences of factors from the private sector on the profit distribution of PPP projects because the descriptive variables and outcome can be expressed by the binary threshold clearly [30].

Based on the binary data sheet of case selection, the truth table of the 10 PPP projects can be concluded, which represents the configurations of these cases. The content of the table can be visualized in the Venn diagram. Without conflicting configuration in the 10 projects, there is no need to add variables or change projects. Then, through TOSMANA software, there are several formulae representing the configurations of cases. After the Boolean minimization, the minimal formula can show the relationships among the influencing factors and profit distribution outcome. Finally, the interpretation and generalization of the formulae contribute to the understanding of the results. To sum up, the QCA process can narrow the maximum complexity of the influence on the profit distribution of PPP projects from

the private sector to the maximum parsimony situation, which are the minimal formula, and back to more complexity by the interpretation and generalization of the results [31]. The whole procedure is shown in Figure 2.

4. Results and Discussion

4.1. Determination of Influencing Factors. Through the deep analysis of literatures, five factors were identified as the most influencing factors on the profit distribution of PPP projects by considering the impact of the private sector, as shown in Table 1.

Based on the frequencies of these factors mentioned in the 24 literatures, the risk sharing in PPP projects was identified as the most important factor because it was mentioned 14 times in the 24 literatures, accounting for more than 30% of all the frequencies. Moreover, the financial ability and the investment of the private sector, which have a deep relationship with the finance of PPP projects, were identified as very essential factors, accounting for about 19% each. Besides, as an important skill of the private sector, the management ability was mentioned 8 times in the 24 literatures. In addition, the effort level of the private sector appeared for many times during the document analysis process. To sum up, the five factors were identified as critical factors that can represent the impact of the private sector on the profit distribution of PPP projects. The content of each factor is shown in Table 2.

First, as one of the most important parts of a PPP project, the party that takes the risks should adopt measures to control the risks, causing the increase of costs. Therefore, the amount of risks that is taken by each party has a closely relationship

TABLE 1: Results of literatures in the process of document analysis.

Number	Reference	Factors				
		Risk sharing	Financing ability	Investment	Management ability	Effort level
1	Tiong [18]	√	√	—	—	—
2	Dewatripont and Legros [32]	√	—	—	—	√
3	Zhang [19]	—	√	—	√	—
4	Zhang [33]	√	√	√	—	—
5	Zou et al. [16]	√	—	—	—	—
6	Ho and Tsui [34]	—	—	√	—	—
7	Ashuri et al. [7]	√	—	—	—	—
8	Sharma et al. [14]	—	—	√	—	—
9	Takashima et al. [35]	√	—	√	—	—
10	Jin and Zhang [36]	√	—	—	√	—
11	Valsangkar [37]	√	√	√	—	—
12	Soomro and Zhang [23]	—	√	—	√	—
13	Tang et al. [38]	—	√	—	√	—
14	Atmo and Duffield [39]	√	√	—	√	—
15	Fan and Zhai [40]	√	—	—	—	—
16	Khadaroo [41]	√	—	—	—	—
17	Wang and Liu [17]	√	—	—	—	√
18	Sharaffudin and Al-Mutairi [42]	√	√	—	√	—
19	Osei-Kyei and Chan [43]	√	√	—	√	—
20	Liu et al. [8]	—	—	—	√	—
21	Liu et al. [25]	—	—	—	—	√
22	Sokolitsyn et al. [44]	—	—	√	—	—
23	Li et al. [45]	√	—	√	—	—
24	Li and Cai [22]	—	—	√	—	—
	Frequency	15	9	8	8	3

TABLE 2: Influencing factors on profit distribution from the private sector.

Number	Factor	Content
1	Risk sharing	Amount of risks taken by the private sector and the costs of taking risk control measures
2	Financing ability	Ability of the private sector to finance, including the funding resources, rates, possibility of attracting investors, etc.
3	Investment	Investment ratio of the private sector in a project, that is, the amount of capitals invested in
4	Management ability	Ability of the private sector in the life-cycle management of a project
5	Effort level	Effort taken by the private sector for the success of a project, including the contributions except funds

with the profit distribution results [7]. Second, the financing ability of the core skills of the private sector has deep relationship with the adequacy of funds and influences the efficiency and effectiveness of the project [18]. Thus, the changing of this factor will lead to different total profits of a PPP project so as to impact the profit distribution result. Then, the investment is important for the life-cycle performance [22], shortage of which would cause the failure of a project and sharply decrease of profits. Therefore, embodying the investment factor in a profit distribution plan is necessary [14]. Moreover, the management ability of the private sector determines the effectiveness and efficiency of the

development of a project [23]. In addition, the management ability has a close correlation with the life-cycle performance of a project [8], greatly affecting the profit distribution. Finally, a profit distribution plan need to consider the effort level of the private sector, which has social-economic effect on the project, leading to different profit results and distribution plans [17].

4.2. Impact of Influencing Factors on Profit Distribution

4.2.1. Case Description. According to the contents of variables and status quo of PPP projects, the binary threshold of these variables is shown in Table 3.

In PPP projects, the private sector and public sector are two parties who share the profits, implying that the basic profit distribution proportion is 50% [2, 40]. However, in many projects, the private sector is the major investor who shares more profits than the public sector. Considering this, this study adjusted the binary threshold of the outcome as 60%. Moreover, allocating risks to the private sector is an important approach of the public sector to use the PPP mode [46]. According to the information in real cases, the private sector often takes more risks than the public sector in PPP projects [32]. Thus, this study adjusted the threshold of risk as 70%. Besides, the private sector is the major investor in PPP projects [14]. Therefore, the binary threshold of the investment is adjusted as 70%. In addition, the financing ability, management ability, and effort level are important factors but hard to quantify by specific ratio. Thus, the thresholds of the three variables were determined by the degree rather than the proportion.

TABLE 3: Binary threshold of variables.

Variable	Value of variable	
	0	1
Profit distribution	Profit distributed to private sector is smaller than 60%	Profit distributed to private sector is larger than 60%
Risk sharing	Risk allocated to private sector is smaller than 70%	Risk allocated to private sector is larger than 70%
Financing ability	Financing ability is weak	Financing ability is strong
Investment	Investment of private sector is smaller than 70%	Investment of private sector is larger than 70%
Management ability	Management ability is weak	Management ability is strong
Effort level	The effort level is low	The effort level is high

TABLE 4: Basic information of 10 PPP projects.

Case ID	Title	Total investment (billion yuan)	Mode	Concession period
1	Beijing Metro Line 4	2.4	BLT + LDOT	2006–2036
2	Zhongdu medical and nursing combined project	0.10	BOO	2016–2046
3	Luoyang ancient city protection and renovation project	1.4	BOT + TOT + ROT	2016–2036
4	M6 Toll Road	1.7	PFI	2000–2053
5	Delhi Airport	79	BOT	2005–2024
6	Xinyi sewage treatment plant PPP reconstruction project	0.05	ROT	2015–2040
7	Intelligent parking system in Hongshan district	0.16	DBFOT	2016–2041
8	Rehabilitation center for disabled persons in Juye county	0.02	BOT	2015–2045
9	Water diversion project in Ningyang	0.21	BOT	2015–2045
10	Hangzhou Metro Line 1	3.5	BOT	2008–2033

TABLE 5: Binary data of variables in 10 PPP projects.

Case ID	Factors					
	Risk sharing	Financing ability	Investment	Management ability	Effort level	Profit distribution
1	0	1	0	1	1	0
2	1	1	1	1	1	1
3	1	1	0	1	1	1
4	1	1	1	1	1	1
5	1	1	1	0	1	0
6	0	0	0	1	1	0
7	1	0	1	0	0	1
8	1	1	1	1	0	1
9	1	1	0	1	1	1
10	0	1	0	1	1	0

Based on the MDSO procedure, this study chose 10 PPP projects covering different areas, sectors, and modes to analyze [47–50]. The basic information is shown in Table 4.

Based on the threshold values of the variables, this study analyzed the identified PPP cases and generated the binary data of the outcome, as shown in Table 5.

The results showed that the binary data of Zhongdu medical and nursing combined project (Case ID = 2) and M6 Toll Road (Case ID = 4) were all 1. The other eight projects had one or more different values. Subsequently, this study applied csQCA using these data.

4.2.2. Results of QCA. Through the combination of the projects that have same situation, this study generated the

truth table, as shown in Table 6. This table shows all the configurations.

The results showed that there were seven different configurations because cases 1 and 10, cases 3 and 9, and cases 2 and 4 have the same value of all variables, respectively. In the seven configurations, there was no confliction, indicating that there is no need to adjust the variables and their thresholds. Besides, this study visualized the configurations by the Venn diagram, as shown in Figure 3.

The green area indicates configuration [1], which means a project had a negative profit distribution result (profit distributed to private sector is smaller than 60%); the red area indicates configuration [0], which shows that the positive profit distribution result (profit distributed to the private sector is larger than 60%). The white area is the remainders of

TABLE 6: Truth table of 10 PPP projects.

Case ID	Risk sharing	Financing ability	Investment	Management ability	Effort level	Outcome
6	0	0	0	1	1	0
1 and 10	0	1	0	1	1	0
7	1	0	1	0	0	1
3 and 9	1	1	0	1	1	1
5	1	1	1	0	1	0
8	1	1	1	1	0	1
2 and 4	1	1	1	1	1	1

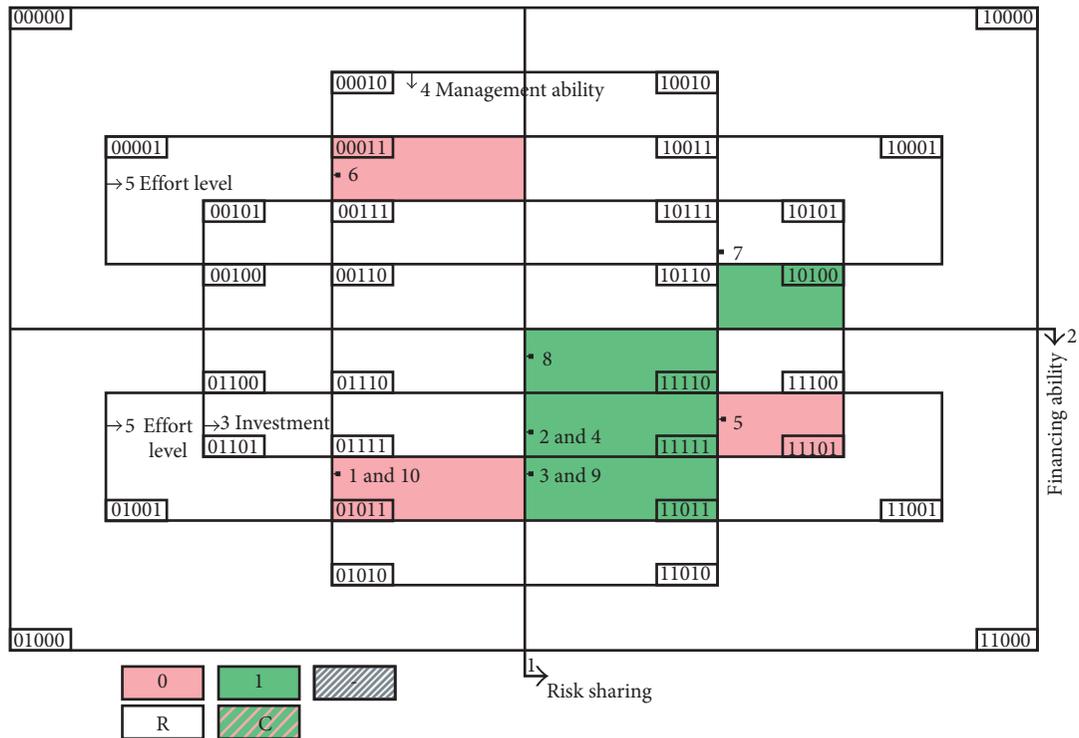


FIGURE 3: Venn diagram of 10 PPP projects. 0: negative outcome; 1: positive outcome; R: remainders of logic; C: conflicting configuration.

logic, implying the field that the cases cannot represent. It is a common situation that there are many remainders due to the limitation of the number of projects. Therefore, it is necessary to include the remainders in the minimization process to simplify the formulae [30].

Based on the information above, the results can be got by TOSMANA. To show the impact of the factors clearly and comprehensively, these configurations were minimized as formulae. The results were discussed as follows.

(1) *Result of Configuration [1]*. The minimization of configuration [1] including the remainders is summarized in Table 7.

There were four formulae of configuration [1] from cases 2, 3, 4, 7, 8, and 9, whose outcomes were positive. The results showed that the risk sharing, management ability, and investment had an important and positive impact on the profit distribution result. The effort level and financing ability had value of {0}, indicating that they did not have an essential positive

influence on the result. Through the Boolean minimization process, the four formulae can be simplified to one minimal formula, which can also be called the Boolean expression, as shown:

$$\begin{aligned}
 & \text{Risk sharing } \{1\} \times \text{management ability } \{1\} \\
 & + \text{risk sharing } \{1\} \times \text{financing ability } \{0\} \quad (1) \\
 & \times \text{investment } \{1\} \times \text{effort level } \{0\}.
 \end{aligned}$$

(2) *Result of Configuration [0]*. On the other hand, as for configuration [0], the result of minimization is shown in Table 8.

The two formulae represent the results of cases 1, 5, 6, and 10. The results showed that the profits distributed to the private sector are smaller than 60%. It indicated that the negative result of the risk sharing and management ability led to the negative outcome of the profit distribution for the private sector, while the effort level and financing ability may not have critical influences. Besides, investment variable is

TABLE 7: Results of configuration [1].

Formula 1	Effort level {0}	+	Risk sharing {1}, management ability {1}
Case ID	(7 + 8)	—	(2, 4 + 3, 9 + 8)
Formula 2	Risk sharing {1}, financing ability {0}	+	Risk sharing {1}, management ability {1}
Case ID	(7)	—	(2, 4 + 3, 9 + 8)
Formula 3	Risk sharing {1}, management ability {1}	+	Financing ability {0}, investment {1}
Case ID	(2, 4 + 3, 9 + 8)	—	(7)
Formula 4	Risk sharing {1}, management ability {1}	+	Financing ability {0}, management ability {0}
Case ID	(2, 4 + 3, 9 + 8)	—	(7)

TABLE 8: Results of configuration [0].

Formula 1	Risk sharing {0}	+	Financing ability {1}, management ability {1}
Case ID	(1, 10 + 6)	—	(5)
Formula 2	Risk sharing {0}	+	Management ability {0}, effort level {1}
Case ID	(1, 10 + 6)	—	(5)

not in the formulae, indicating that the negative outcome does not have a direct relationship with this factor. After the Boolean minimization, the minimal formula can be seen as:

$$\begin{aligned} & \text{Risk sharing } \{0\} + \text{financing ability } \{1\} \\ & \times \text{management ability } \{0\} \times \text{effort level } \{1\}. \end{aligned} \quad (2)$$

4.3. Discussion of the Results

4.3.1. Configuration [1]. In configuration [1], the result can interpret the relationship between the influencing factors and the positive profit distribution result, which means the private sector can get more than 60% profits in PPP projects. Equation (1) can be explained in the following.

The private sector which (1) takes more than 70% risks and has a strong management ability OR (2) takes more than 70% risks and affords more than 70% of total investment without strong financing ability and high effort level can receive more than 60% profits in PPP projects.

This formula showed that the risk sharing had the most important impact on the profit distribution of PPP projects, indicating that the private sector who takes more risks should share more profits. This result coincided with the result of the literature analysis [7]. Moreover, the management ability was identified as an essential factor. The private sector with a strong management ability should get more profits because the private sector can ensure a good performance of a project. This opinion was also supported by Soomro and Zhang [23]. Besides, the investment had a close relationship with the profit distribution result. A large proportion of investment means a large ratio of profit distribution, which satisfies the basic rule of projects that equity investment and profit distribution should be balanced [14]. However, this study identified that a strong financing ability and effort level were not so important when risk allocated to the private sector is larger than 70% and investment of the private sector is larger than 70%. Therefore, the financing ability and effort level were identified as relevant but not decisive influencing factors on the profit distribution.

4.3.2. Configuration [0]. Configuration [0] means that the private sector gets smaller than 60% profits in PPP projects. Thus, the minimal formula represents the combination of factors that leads to this result. Equation (2) can be interpreted in the following.

The private sector which (1) burdens smaller than 70% risks OR (2) has a weak management ability with strong financing ability and high effort level can just obtain smaller than 60% of total profits.

This equation showed that a small ratio of risk sharing led to a small part of profit distribution, indicating the direct positive relationship between the risk sharing and the profit distribution. Moreover, the management ability was identified as a very necessary factor that had a negative influence on the profit distribution result. The private sector which has a strong financing ability and high effort level cannot guarantee a high proportion of profit distribution due to the weak management ability. The results of this study also implied that the financing ability and effort level were not as important as the management ability because they cannot bring a different profit distribution result without the change of the management ability.

To sum up, the two minimal formulae of contradict configurations showed the same relationships between the influencing factors and the profit distribution of PPP projects. On the one hand, the risk sharing was identified as the most important factor that had a positive impact on the profit distribution. Moreover, the management ability and the investment of the private sector were identified as two very critical factors that had a positive influence on the profits distributed to the private sector. On the other hand, the financing ability and effort level of the private sector were identified not as important as the three factors mentioned above for the profit distribution of PPP projects, indicating that they cannot lead to a different profit distribution result without considering the other three factors. Therefore, the private sector needs to pay more attention to the risk sharing ratio, the equity investment proportion, and the improvement of the management ability rather than just focusing on the raising of the financing ability and effort level to ensure the success of PPP projects and the fair profit distribution.

5. Conclusion

Profit distribution is an essential issue in a PPP project, which has important influence on both the public and private sectors. As the implementer of a PPP project, the private sector is responsible for the life-cycle performance and management that have direct relationship with the profit

and its distribution. Therefore, this study analyzed the influencing factors on profit distribution of PPP projects from the private sector's perspective. Through document analysis, this study identified five factors. Furthermore, the results of QCA indicate that the risk sharing is the most important factor which has a positive impact on the profits obtained by the private sector. Moreover, management ability and investment are also critical factors that have positive influence on the profit distribution. Besides, financing ability and effort level also should be considered, but they do not have a decisive impact on the profit distribution. The findings first contributed to the body of knowledge on the influencing factors of the profit distribution in PPP projects. In addition, it is the first attempt of exploring the characteristics of the private sector under the context of profit distribution of PPP projects and using the QCA to enrich the theoretical research. Thus, the findings would help the private sector improve their abilities and pay more attention on the risk sharing and equity investment of PPP projects to ensure profits and promote the success of projects. Besides, the public and private sectors can make appropriate profit distribution proposals in practice based on the conclusion of this study.

Although the objectives of this study were achieved, there are still some limitations. First, the major influencing factors determined through the comprehensive literature review may not cover all the possible aspects. Second, due to the limitation of cases in the csQCA procedure, some other areas and fields are not covered. To overcome these limitations, further investigation on the influencing factors will be applied to expand the factors comprehensively. Moreover, future research will select more proper PPP projects from other areas and fields and rectify the conclusion, making the identified relationships more convincing and widely adaptable.

Data Availability

The cases in this study come from the online database of Public Private Partnership Projects in China. The data can be obtained through the following link: <http://www.cpppc.org:8082/efmisweb/ppp/projectLibrary/toPPPList.do>.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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References

- [1] M. Hammami, J.-F. Ruhashyankiko, and E. B. Yehoue, "Determinants of public-private partnerships in infrastructure," *IMF Working Papers*, vol. 6, no. 99, p. 1, 2006.
- [2] L. Zhu and D. K. H. Chua, "Model for negotiation of refinancing gain from public-private partnership," in *Proceedings of the 3rd International Symposium on Life-Cycle Civil Engineering (IALCCE 2012)*, Taylor & Francis Group, Vienna, Austria, October 2013.
- [3] S. Zhang, A. P. C. Chan, Y. Feng, H. Duan, and Y. Ke, "Critical review on PPP research—a search from the Chinese and international journals," *International Journal of Project Management*, vol. 34, no. 4, pp. 597–612, 2016.
- [4] J. J. Reijniers, "Organization of public-private partnership projects," *International Journal of Project Management*, vol. 12, no. 3, pp. 137–142, 1994.
- [5] J. Wu, J. Liu, X. Jin, and M. C. P. Sing, "Government accountability within infrastructure public-private partnerships," *International Journal of Project Management*, vol. 34, no. 8, pp. 1471–1478, 2016.
- [6] S. Thomas Ng, Y. M. W. Wong, and J. M. W. Wong, "Factors influencing the success of PPP at feasibility stage—A tripartite comparison study in Hong Kong," *Habitat International*, vol. 36, no. 4, pp. 423–432, 2012.
- [7] B. Ashuri, H. Kashani, and J. Lu, "Financial valuation of risk and revenue sharing options in build operate transfer highway projects," in *Proceedings of the Engineering Project Organizations Conference*, South Lake Tahoe, CA, USA, November 2010.
- [8] T. Liu, Y. Wang, and S. Wilkinson, "Identifying critical factors affecting the effectiveness and efficiency of tendering processes in Public-Private Partnerships (PPPs): A comparative analysis of Australia and China," *International Journal of Project Management*, vol. 34, no. 4, pp. 701–716, 2016.
- [9] T. Bovaird, "Public-private partnerships: from contested concepts to prevalent practice," *International Review of Administrative Sciences*, vol. 70, no. 2, pp. 199–215, 2016.
- [10] J. M. Sarmento and L. Renneboog, "Anatomy of public-private partnerships: their creation, financing and renegotiations," *International Journal of Managing Projects in Business*, vol. 9, no. 1, pp. 94–122, 2016.
- [11] J. Du, H. Wu, and L. Zhu, "Research on the participation mode selection of construction enterprises in PPP projects," in *Proceedings of the Construction Research Congress 2018*, pp. 332–342, New Orleans, LA, USA, April 2018.
- [12] G. A. Hodge and C. Greve, "Public-private partnerships: the passage of time permits a sober reflection," *Economic Affairs*, vol. 29, no. 1, pp. 33–39, 2009.
- [13] D. Grimsey and M. K. Lewis, "Are public private partnerships value for money?," *Accounting Forum*, vol. 29, no. 4, pp. 345–378, 2005.
- [14] D. Sharma, Q. Cui, L. Chen, and J. Lindly, "Balancing private and public interests in public-private partnership contracts through optimization of equity capital structure," *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2151, no. 1, pp. 60–66, 2010.
- [15] S. De Schepper, M. Dooms, and E. Haezendonck, "Stakeholder dynamics and responsibilities in public-private partnerships: a mixed experience," *International Journal of Project Management*, vol. 32, no. 7, pp. 1210–1222, 2014.
- [16] P. X. W. Zou, S. Wang, and D. Fang, "A life-cycle risk management framework for PPP infrastructure projects," *Journal of Financial Management of Property and Construction*, vol. 13, no. 2, pp. 123–142, 2008.
- [17] Y. Wang and J. Liu, "Evaluation of the excess revenue sharing ratio in PPP projects using principal-agent models," *International Journal of Project Management*, vol. 33, no. 6, pp. 1317–1324, 2015.
- [18] R. L. K. Tiong, "CSFs in competitive tendering and negotiation model for BOT projects," *Journal of Construction Engineering and Management*, vol. 122, no. 3, pp. 205–211, 1996.

- [19] X. Zhang, "Criteria for selecting the private-sector partner in public private partnerships," *Journal of Construction Engineering and Management*, vol. 131, no. 6, pp. 631–644, 2005.
- [20] M. M. Kumaraswamy and A. M. Anvuur, "Selecting sustainable teams for PPP projects," *Building and Environment*, vol. 43, no. 6, pp. 999–1009, 2008.
- [21] P. Simões, N. F. Cruz, and R. C. Marques, "The performance of private partners in the waste sector," *Journal of Cleaner Production*, vol. 29–30, pp. 214–221, 2012.
- [22] S. Li and H. Cai, "Government incentive impacts on private investment behaviors under demand uncertainty," *Transportation Research Part E: Logistics and Transportation Review*, vol. 101, pp. 115–129, 2017.
- [23] M. A. Soomro and X. Q. Zhang, "Roles of private sector partners in transportation public-private partnership failures," *Journal of Management in Engineering*, vol. 31, no. 4, p. 04014056, 2013.
- [24] X. Zhang and M. Ali Soomro, "Failure path analysis with respect to private sector partners in transportation public-private partnerships," *Journal of Management in Engineering*, vol. 32, no. 1, p. 04015031, 2016.
- [25] J. Liu, R. Gao, C. Y. J. Cheah, and J. Luo, "Incentive mechanism for inhibiting investors' opportunistic behavior in PPP projects," *International Journal of Project Management*, vol. 34, no. 7, pp. 1102–1111, 2016.
- [26] F. K. Stage and K. Manning, *Research in the College Context: Approaches and Methods*, Routledge, Abingdon, UK, 2015.
- [27] G. A. Bowen, "Document analysis as a qualitative research method," *Qualitative Research Journal*, vol. 9, no. 2, pp. 27–40, 2009.
- [28] C. Q. Schneider and C. Wagemann, "Reducing complexity in Qualitative Comparative Analysis (QCA): Remote and proximate factors and the consolidation of democracy," *European Journal of Political Research*, vol. 45, no. 5, pp. 751–786, 2006.
- [29] B. Rihoux, "Qualitative comparative analysis (QCA) and related systematic comparative methods," *International Sociology*, vol. 21, no. 5, pp. 679–706, 2016.
- [30] B. Rihoux and C. C. Ragin, *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques*, China Machine Press, Beijing, China, 2017.
- [31] D. Byrne and C. C. Ragin, *The SAGE Handbook of Case-based Methods*, SAGE Publication, Thousand Oaks, CA, USA, 2009.
- [32] M. Dewatripont and P. Legros, "Public-private partnerships: contract design and risk transfer," *European Investment Bank*, vol. 10, pp. 120–145, 2005.
- [33] X. Zhang, "Critical success factors for public-private partnerships in infrastructure development," *Journal of Construction Engineering and Management*, vol. 131, no. 1, pp. 3–14, 2005.
- [34] S. P. Ho and C.-W. Tsui, "The transaction costs of public-private partnerships: implications on PPP governance design," in *Proceedings of the Lead 2009 Specialty Conference: Global Governance in Project Organizations*, pp. 5–7, South Lake Tahoe, CA, USA, 2009.
- [35] R. Takashima, K. Yagi, and H. Takamori, "Government guarantees and risk sharing in public-private partnerships," *Review of Financial Economics*, vol. 19, no. 2, pp. 78–83, 2010.
- [36] X.-H. Jin and G. Zhang, "Modelling optimal risk allocation in PPP projects using artificial neural networks," *International Journal of Project Management*, vol. 29, no. 5, pp. 591–603, 2011.
- [37] P. Valsangkar, *Revenue Sharing Models in a Public Private Partnership (PPP) Context*, 2008, http://www.csi-sigegov.org/1/11_375.pdf.
- [38] L. Y. Tang, Q. Shen, M. Skitmore, and E. W. L. Cheng, "Ranked critical factors in PPP briefings," *Journal of Management in Engineering*, vol. 29, no. 2, pp. 164–171, 2013.
- [39] G. Atmo and C. Duffield, "Improving investment sustainability for PPP power projects in emerging economies," *Built Environment Project and Asset Management*, vol. 4, no. 4, pp. 335–351, 2014.
- [40] D. Fan and F. Zhai, "Study on the risk of PPP projects based on the shapley value of a cooperative game," in *Proceedings of the ICCREM 2014*, pp. 645–650, Kunming, China, September 2014.
- [41] I. Khadaroo, "The valuation of risk transfer in UK school public private partnership contracts," *British Accounting Review*, vol. 46, no. 2, pp. 154–165, 2014.
- [42] H. Sharaffudin and A. Al-Mutairi, "Success factors for the implementation of build operate transfer (BOT) projects in Kuwait," *International Journal of Business and Management*, vol. 10, no. 9, pp. 68–78, 2015.
- [43] R. Osei-Kyei and A. P. C. Chan, "Review of studies on the critical success factors for public-private partnership (PPP) projects from 1990 to 2013," *International Journal of Project Management*, vol. 33, no. 6, pp. 1335–1346, 2015.
- [44] A. S. Sokolitsyn, M. V. Ivanov, N. A. Sokolitsyna, and V. P. Semenov, "Optimal finance distribution between public-private partnership project participants," in *Proceedings of the 2016 XIX IEEE International Conference on Soft Computing and Measurements (SCM)*, pp. 529–530, St. Petersburg, Russia, May 2016.
- [45] Y. Li, T. Huang, N. Li et al., "Equitable distribution of wastewater treatment PPP project on shapley value method with ANP risk correction," *Journal of Residuals Science and Technology*, vol. 13, pp. 810–817, 2016.
- [46] R. C. Marques and S. Berg, "Risks, contracts, and private-sector participation in infrastructure," *Journal of Construction Engineering and Management*, vol. 137, no. 11, pp. 925–932, 2011.
- [47] China Public Private Partnership Center, *List of Public Private Partnership Projects*, Beijing, 2017, <http://www.cpppc.org:8086/pppcentral/map/toPPPList.do>.
- [48] T. Liu and S. Wilkinson, "Can the pilot public-private partnerships project be applied in future urban rail development?: a case study of Beijing metro line 4 project," *Built Environment and Property Management*, vol. 3, no. 2, pp. 250–263, 2013.
- [49] R. Jain, G. Raghuram, and R. Gangwar, *Airport Privatization in India: Lessons from the Bidding Process in Delhi and Mumbai*, India Institute of Management, Karnataka, India, 2007.
- [50] China Public Private Partnerships Center, *Foreign PPP Cases Selection*, China Commerce and Trade Press, Beijing, China, 2014.



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