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Evaluating the Effect of Prefabricated Building Incentive Policies Using Structural Equation Modeling: A Chinese Empirical Study

Weidong Yan [1], Chunbing Guo [1,*] and Lihong Li [2]

[1] School of Civil Engineering, Shenyang Jianzhu University, Shenyang 110168, China
[2] School of Management, Shenyang Jianzhu University, Shenyang 110168, China; lilihong@sjzu.edu.cn
* Correspondence: chunbingguo@stu.sjzu.edu.cn; Tel.: +86-139-9830-6979

Abstract: Building production increases energy demand, which raises carbon dioxide emissions and leads to environmental degradation. The use of prefabricated buildings has the potential to play an important role in promoting sustainable development in the construction industry, and prefabricated building incentive policies (PBIP) are an effective means of improving the development level of prefabricated buildings (PBDL). This study investigated the significance of PBIP using a structural equation model (SEM) analysis of the results of 519 questionnaire surveys obtained in 10 prefabricated building demonstration cities in China. The results indicate that policy satisfaction has the most substantial impact on PBDL, with direct funding subsidy policy being the most influential factor. Policy application enthusiasm ranks second according to influence on PBDL, while policy awareness has the most negligible impact on PBDL among the examined factors. This research provides a reference for the government to formulate reasonable and effective prefabricated building incentive policies, and it may be useful for promoting the development of prefabricated buildings.

Keywords: prefabricated building; incentive policy; impact path; questionnaire survey; SEM

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1. Introduction

The construction industry serves as a major energy consumer, accounting for 40% of the world's total energy consumption [1]. China leads the world in terms of building scale [2], generating over 2 billion tons of construction waste annually and contributing to one-third of total CO_2 emissions [3]. Prefabricated buildings, assembled on-site from factory-made components, offer numerous advantages over traditional construction methods [4]. These advantages include reduced reliance on labor, improved construction site conditions, decreased material waste, noise, dust, construction waste, and CO_2 emissions [5,6], as well as enhanced construction efficiency and quality [7]. Thus, the development of prefabricated buildings is vital to the sustainability of the construction industry [8,9].

In 2022, newly constructed prefabricated buildings accounted for 26.5% of the total area of new building starts in China, which remains significantly behind that of developed countries [10]. This indicates a bottleneck in developing prefabricated buildings [11–13]. The growth of prefabricated buildings in China is constrained by high construction costs, limited skilled professionals, and inadequate technical support [14]. Prefabricated building incentive policies (PBIP) are a key driver for prefabrication [15]. To overcome the current challenges in the development of prefabricated buildings, the Chinese government is exploring innovative approaches to promote their growth based on local conditions. Consequently, Chinese central and local governments have issued many PBIPs to help promote the application of prefabricated buildings [16,17].

Referring to the relevant research of PBIP and the classification of prefabricated building policies by the Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD), the PBIP is divided into land policy (LP), planning policy (PP), funding and tax policies (FTP), financial policies (FP), and construction management policies (CMP) [18,19]. Scholars have conducted many studies on the above policies. Some literature summarizes the policy text and analyzes the importance of issuing PBIP but does not reveal the influence mechanism of the policy [20,21]. And, most studies focus on a certain type of PBIP or only analyze PBIP from a single perspective, such as decision-makers or developers, but do not consider all the participants of prefabricated buildings in the research [12,22]. To fill the research gap, this study analyzed the impact path of PBIP. Then, it makes a series of assumptions that incentive policies affect the development level of prefabricated buildings (PBDL) by reference to relevant literature. Finally, according to the investigation data of government, development enterprises, design enterprises, component manufacturers, research institutions, and other perspectives, the structural equation model (SEM) is established to analyze the influence effect of PBIP. This study mainly addressed the following two questions:

1. How should the influence of China's PBIP on PBDL be investigated? What factors have the most important impact on PBDL?
2. From the research results, how should the current policies be improved? What new policies should the government formulate?

The paper is structured as follows. Section 2 presents a literature review of related fields. Section 3 provides the six study hypotheses and a hypothetical model for the influence process of PBIP. Section 4 reports the methods and data sources used. Section 5 is model verification, data processing, and results. Section 6 is the analysis and discussion of the research results. Section 7 identifies the research results, and some policy recommendations are put forward.

2. Literature Review

2.1. Prefabricated Building

Numerous scholars have emphasized the importance of developing prefabricated buildings and analyzed their advantages [23–25]. Prefabricated building technology can enhance project quality [26], reduce material waste, and improve construction efficiency [27]. Prefabricated construction offers significant economic and environmental benefits [28] and promotes prefabricated buildings that can effectively reduce CO_2 emissions [29,30].

Prefabrication technology was introduced to China in the 1950s, but due to various constraints [31], it has yet to be widely adopted [32]. Existing studies identified the most crucial factors hindering the development of prefabricated buildings in China as high construction costs [33], lack of effective PBIP [34], and inadequate technological innovation [35]. However, fiscal subsidies, tax breaks, and other incentive policies have proven effective in overcoming these barriers [36,37].

2.2. Prefabricated Building Incentive Policies

PBIP promotes the application of prefabricated buildings by stimulating the productivity of all parties and is seen as an effective means to promote the development of prefabricated buildings [38,39]. For example, the government has increased investment in technological innovation and research and development related to prefabricated buildings to expand its supply. The government controlled the land supply of the traditional construction methods to urge developers to promote prefabricated buildings [40]. In addition, the government offers loan concessions to buyers or developers of prefabricated buildings and offers financial incentives to developers to increase the demand in the prefabricated construction market [41]. Multiple policies have been formulated related to the PB as a government intervention tool. Luo et al. and Wang et al. sorted out and analyzed the PBIP of various countries; as early as 1976, the United States proposed industry norms, providing land concessions and financial support for prefabricated buildings. The British government has developed technical specifications and talent training standards for the prefabricated building industry chain to promote the development of prefabricated buildings. The Japanese government encourages prefabricated buildings in terms of housing concessions. Singapore has enacted laws and regulations related to building standardization codes to encourage stakeholders to implement prefabricated buildings and to strengthen the reform and innovation of development enterprises by using cash incentives and personnel training [14,20]. The policy instruments for prefabricated buildings in China have evolved into a diversified policy mix [14,42], playing a leading role in developing the country's prefabricated building industry [25]. Reputational and financial incentive policies are considered effective in promoting real estate enterprises' behavioral intentions and actual behavior regarding the adoption of prefabricated buildings [15]. Favorable incentive policies, such as providing financial subsidies, reducing development costs, and increasing the popularity of prefabricated buildings in the construction market, are crucial for promoting their development [43]. The stronger the subsidy, publicity, and operability of incentive policies, the more they can attract real estate enterprises to adopt prefabricated buildings [44]. Targeted policies can better stimulate the enthusiasm of prefabricated building-related enterprises and help improve the acceptance rate of industrial buildings [45].

Scholars studying prefabricated building policies generally agree that well-designed PBIPs are essential for rapid growth in the sector [46,47]. Therefore, the academic community evaluated PBIP, and some scholars evaluated the policy text of PBIP and made suggestions based on the evaluation results. Su et al. analyzed the impact of PBIP on the implementation of prefabricated buildings by developers, investigated the effectiveness of the policy, and put forward an effective policy framework [38]. Wang et al. established the evaluation index system of PBIP from the aspects of capital, land, floor area ratio reward, construction links, and technical support and used the gray relationship analysis to evaluate PBIP. The research shows that targeted incentive policies should be formulated according to the development characteristics of different regions, and economic policies in underdeveloped areas should be increased, while for developed regions, technical standards and management systems should be improved [48]. Gan et al. studied PBIP from the perspective of importance and performance and found that there were differences in stakeholders' demand for PBIP, and more attention should be paid to policy tools such as technology development, talent support, economic incentives, public services, and guidance information [49]. Many scholars have used game theory to construct the game model between the government and real estate enterprises [42,50], the game model between the government and consumers [51], and the three-party game model among the government, real estate enterprises, and consumers to study the effect of PBIP [52]. Existing research has found that there is a benefit game between real estate enterprises and the government, and the efficiency of PBIP did not turn out as expected. In addition, the incentive policies should not only focus on the real estate development enterprises but also focus on easing the financial pressure on consumers.

The above research results provide theoretical support for the development of this study. However, few studies have analyzed how PBIP affects the development of prefabricated buildings. The existing research mainly focuses on real estate development enterprises and does not involve all the stakeholders of the PBIP. To put forward perfect opinions on PBIP more comprehensively and give full play to the maximum effect of PBIP, this paper takes all stakeholders of PBIP into account, deeply analyzes the impact path of PBIP, and evaluates the effect of PBIP.

2.3. The Application of SEM in Policy Evaluation

The SEM is a statistical method for analyzing the relationships between variables and is often used to measure causal relationships between latent variables [53]. SEM has been widely used in the research field of prefabricated buildings. The existing studies have analyzed the influencing factors of the construction quality of prefabricated buildings [54], the influencing factors of the prefabricated building construction risk [55], and the influencing factors of the prefabricated building supply chain elasticity [56], and explored the relationship between various factors by using SEM. With the development and application of SEM, some scholars have applied SEM to the study of the impact paths. Wang et al. analyzed the relationship between risk factors and identified the risk path of construction projects using SEM [57]. Qi et al. have used SEM to explore the elastic improvement path of the prefabricated building supply chain [58]. In recent years, SEM has been widely applied to study the impact paths of incentive policies, such as environmental protection incentive policies [59], information technology incentive policies [60], and marine economic policies [61]. Compared to traditional quantitative methods, SEM can more effectively explain the impact path of incentive policy through hypothesis models [62]. Therefore, it is reasonable to use SEM to explore the impact path of PBIP.

3. Research Hypotheses

The influence of PBIP on the PBDL in China has been divided into policy awareness (PA), policy satisfaction (PS), and policy application enthusiasm (PAE). They influence each other and work together to increase the PBDL [12]. Therefore, the following hypotheses are proposed:

H1: PA and PS have mutual influence;

H2: PA and PAE have mutual influence;

H3: PS and PAE have mutual influence.

3.1. The Research Hypothesis of PA

PA mainly includes the awareness of the scope of policy use (PA1), the specific content of the policy (PA2), and the implementation details of the policy (PA3). When the enterprise and the public have a higher awareness of the incentive policy and the more comprehensive the understanding, the more likely it is to promote the development of prefabricated buildings [63]. Therefore, Hypothesis 4 is proposed.

H4: The awareness of PBIP has an impact on the PBDL.

H4a: PA1 has a positive effect on PBDL;

H4b: PA2 has a positive effect on PBDL;

H4c: PA3 has a positive effect on PBDL.

3.2. The Research Hypothesis of PS

Previous studies have established that PS has a direct causal relationship with PBDL [49,64], and this study examined the impact of existing PBIP on PBDL. Land policies include preferential land transfer prices (LPS1), priority land use (LPS2), and annual increases in land use (LPS3). Well-structured land policies ensure that real estate enterprises prioritize acquiring land for prefabricated construction projects, benefiting from preferential transfer prices and reduced costs, which encourages real estate enterprises to invest in prefabricated construction projects. Planning policies (PP) reward real estate enterprises with a particular plot ratio, reducing incremental costs and increasing their willingness to pursue prefabricated construction projects.

Funding and tax policies encompass funding subsidies for prefabricated building projects (FTPS1), prioritizing the return of Wall Reform Funds (FTPS2), funding support for breakthrough technologies (FTPS3), exemption from taxes on new technology R&D expenses (FTPS4), reduction of value-added tax on prefabricated components (FTPS5), and consumer subsidies (FTPS6). Funding and tax subsidies to real estate enterprises, research institutions, and consumers can effectively promote prefabricated building development.

Financial policies prioritize loans (FPS1) and loan interest discounts (FPS2) for prefabricated construction projects that meet requirements, ensuring that real estate enterprises have sufficient funds for constructing prefabricated projects. Reducing interest costs can increase the willingness of real estate companies to build. Financial policies also affect consumers purchasing prefabricated houses at the sale stage, prioritizing lending to consumers (FPS3) and reducing their down payment (FPS4), which enhances consumer buying intention, increases real estate enterprise revenue, and promotes their willingness to build.

Construction management policies provide support for the pre-sale of prefabricated building commercial housing (CMPS1), prioritize hydropower projects (CMPS2), and support the transport of prefabricated components (CMPS3) during construction. These policies offer convenience to all participants in the construction process. Figure 1 demonstrates the influence diagram.

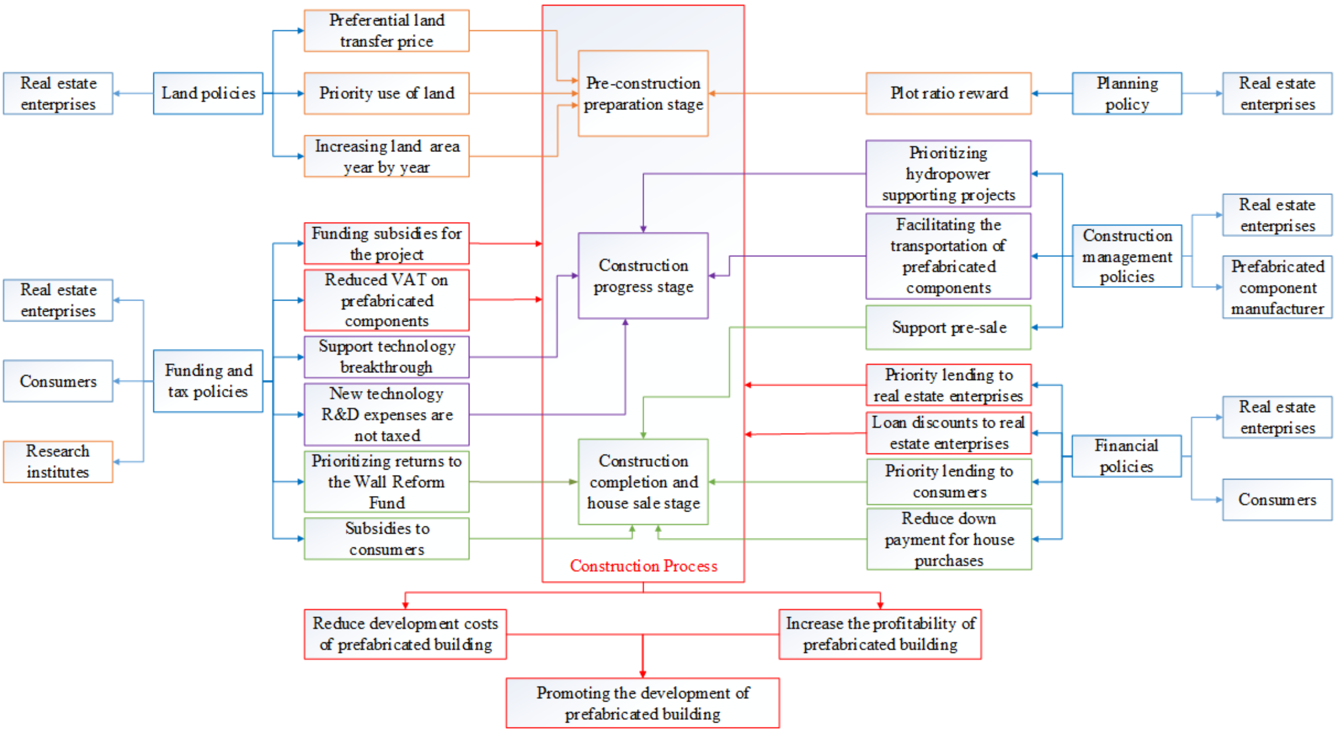

Figure 1. Application subject and impact relationship diagram of PBIP.

This study holds that the satisfaction of the above-mentioned incentive policies will have a positive impact on the PBDL. Therefore, Hypothesis 5 is proposed.

H5: The satisfaction of PBIP has an impact on PBDL.

(1) Land policies

H5a: LPS1 has a positive impact on PBDL;

H5b: LPS2 has a positive impact on PBDL;

H5c: LPS3 has a positive impact on PBDL.

(2) Planning policy

H5d: PPS has a positive impact on PBDL.

(3) Funding and tax policies

H5e: FTPS1 has a positive impact on PBDL;

H5f: FTPS2 has a positive impact on PBDL;

H5g: FTPS3 has a positive impact on PBDL;

H5h: FTPS4 has a positive impact on PBDL;

H5i: FTPS5 has a positive impact on PBDL;

H5j: FTPS6 has a positive impact on PBDL.

(4) Financial policies

H5k: FPS1 has a positive impact on PBDL;

H5l: FPS2 has a positive impact on PBDL;

H5m: FPS3 has a positive impact on PBDL;

H5n: FPS4 has a positive impact on PBDL.

(5) Construction management policies

H5o: CMPS1 has a positive impact on PBDL;

H5p: CMPS2 has a positive impact on PBDL;

H5q: CMPS3 has a positive impact on PBDL.

3.3. The Research Hypothesis of PAE

The shorter the time spent on policy application approval (PAE1), the simpler the policy application process (PAE2), and the lower the conditions for policy application (PAE3), the more active the application and use of the policy by real estate enterprises and the public will be, and the stronger the willingness to participate in the construction of prefabricated buildings [44]. Therefore, Hypothesis 6 is proposed.

H6: The application enthusiasm of PBIP has an impact on the PBDL.

H6a: PAE1 has a positive impact on PBDL;

H6b: PAE2 has a positive impact on PBDL;

H6c: PAE3 has a positive impact on PBDL.

A model of PBIP's impact path on PBDL is proposed to represent the six research hypotheses, as shown in Figure 2.

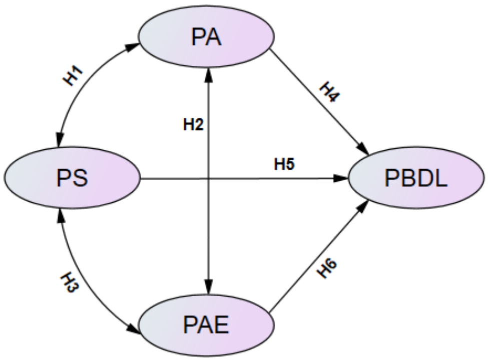

Figure 2. Hypothetical model of the interaction of PBIP.

4. Research Methods

The methodology of this study consists of four steps, as presented in Figure 3. First, sort out the PBIP that has been issued and applied according to the text of the policy document. According to the literature analysis, the type of PBIP was divided into five parts: LP, PP, FTP, FP, and CMP, and the effect of PBIP was studied from three aspects: PA, PS, and PAE. Secondly, By combing the previous research and referring to the research results of other scholars, the research hypothesis of the impact path of PBIP is put forward, and the influence relationship diagram of PBIP and the conceptual model of PBIP impact path are established. Then, a questionnaire survey was conducted on the impact path of PBIP, and the respondents covered all the stakeholders of PBIP, mainly the staff who have been engaged in prefabricated building management and research for a long time. Finally, the reliability and validity of the data were tested, the modified PBIP impact path was proposed by applying SEM, and the key impact path was analyzed. The research results can help to put forward targeted policy improvement suggestions, which can promote the development of prefabricated buildings.

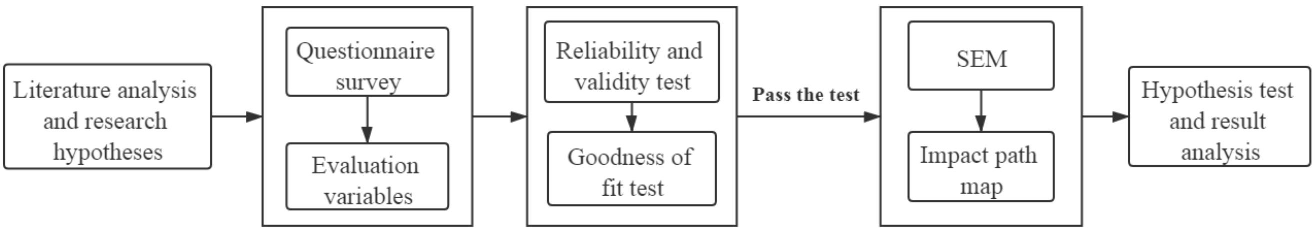

Figure 3. Research methods and steps.

4.1. Questionnaire Design

This questionnaire included items to collect the following information to improve the objectivity and authenticity of the questionnaire and survey data.

1. Basic information. The respondents' age, occupation, work location, years of work experience, education, channels for learning of government policies that have been issued, understanding of these policies, and usage of them were collected;
2. Measured variables. The primary measured variables are depicted in Table 1. Responses were given on a 5-point Likert scale, where 1 and 5 denote "strongly dissatisfied" and "strongly satisfied", respectively. Responses on a 5-point Likert scale were combined with a keyword table from PLanguage [65] to quantify qualitative indicators, which are difficult to describe numerically. The keywords MIN, ORDINARY, BETTER, and MAX were proposed to guide the interviewees' perceptions of the boundaries of policy evaluation, as shown in Figure 4.

Table 1. Questionnaire variable setting of PBIP.

Latent Variables		**Observed Variables**
PA		The awareness of the scope of policy use (PA1) The specific content of the policy (PA2) Implementation details of the policy (PA3)
PS	LPS	Preferential land transfer price (LPS1) Priority use of land (LPS2) Increasing land area year by year (LPS3)
	PPS	Plot ratio reward (PPS)
	FTPS	Funding subsidies for the project (FTPS1) Prioritizing returns to the Wall Reform Fund (FTPS2) Providing funding to support new technological breakthroughs (FTPS3) New technology R&D expenses are not taxed (FTPS4) Reduced VAT on prefabricated components (FTPS5) Subsidies to consumers (FTPS6)
	FPS	Priority lending to real estate enterprises (FPS1) Loan discounts to real estate enterprises (FPS2) Priority lending to consumers (FPS3) Reduce down payment for house purchases (FPS4)
	CMPS	Support pre-sale of commercial housing (CMPS1) Prioritizing hydropower supporting projects (CMPS2) Facilitating the transportation of prefabricated components (CMPS3)
PAE		Policy approval time (PAE1) Policy application process (PAE2) Requirements for policy application (PAE3)

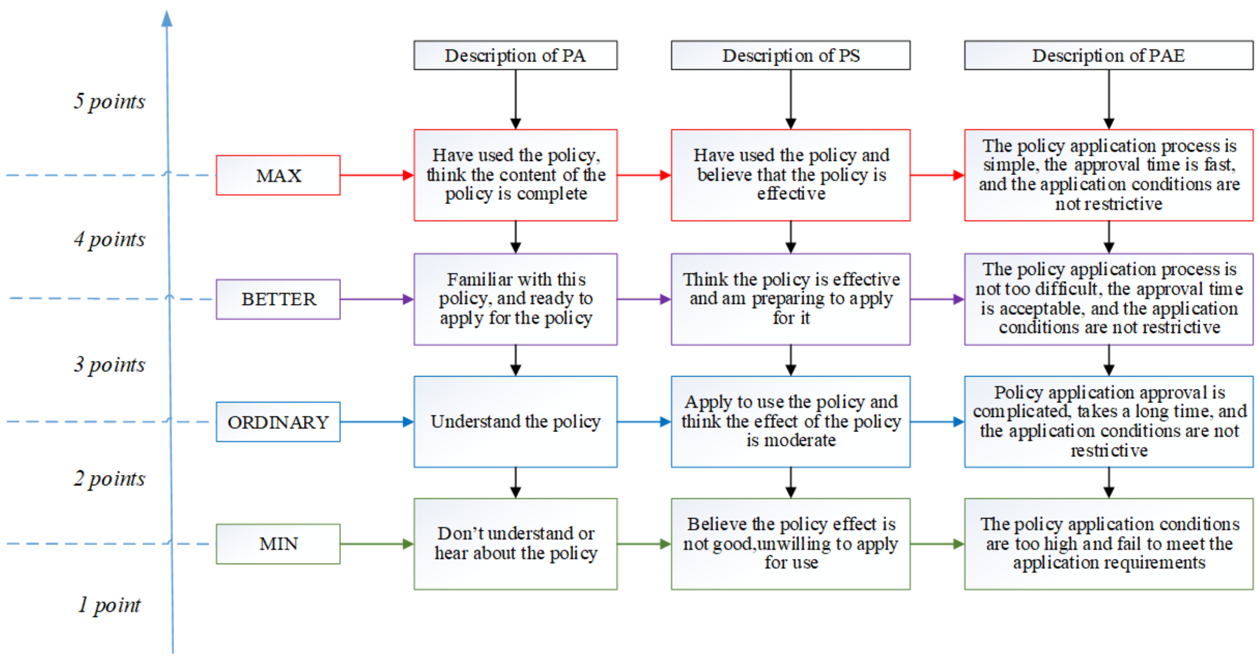

Figure 4. Keywords in PLanguage method and Assessment intervals of the Likert scale.

4.2. Questionnaire Distribution

The data were collected via Questionnaire Star, China's largest online questionnaire provider. The survey area is the first batch of prefabricated building demonstration cities in China, including Beijing, Tianjin, Shanghai, and Shenyang. Questionnaires were issued to companies that have been engaged in the prefabricated construction industry for many years to ensure the effectiveness of the survey and its relevance to this. The survey subjects were workers who had been engaging in prefabricated construction and had an understanding of incentive policies.

4.3. Questionnaire Recovery

A total of 537 questionnaires were collected. After invalid questionnaires were removed, 519 remained, for an effective response rate of 96.6%. First-hand data on the evaluation of PBIP were obtained, including 51 responses from government agencies, 108 responses from design units, 184 from real estate enterprises, 97 from component manufacturing enterprises, and 79 from scientific research institutions. Further, 33 respondents had purchased prefabricated residential buildings, and 134 were planning to purchase prefabricated residential buildings.

Because real estate enterprises play a leading role in the development of prefabricated buildings, a large proportion of respondents were associated with real estate enterprises. All of the interviewees had worked for more than 3 years, and more than 85% of the interviewees had a bachelor's degree or above. Demographic information of this type is shown in Table 2.

Table 2. Basic information and survey data of the interviewee.

	Options	Number	Percentage
Work unit	Government	51	9.83%
	Development enterprise	108	20.81%
	Design enterprise	184	35.45%
	Component manufacturer	97	18.69%
	Research institutions	79	15.22%
Years of work	3–10 years	417	80.35%
	11–15 years	98	18.88%
	15–20 years	2	0.39%
	More than 20 years	2	0.39%

4.4. SEM

SEM is a statistical method that integrates factor analysis and path analysis, often used in confirmatory factor analysis, high-order factor analysis, pathway and causality analysis [66]. Compared with traditional statistical methods, SEM can effectively analyze the relationship between observed and latent variables. The literature review shows that SEM has been widely used in the field of prefabricated buildings, and existing studies consider SEM as a scientific analysis method for collecting data on policy impact paths. This paper used Amos 23.0 software for the data analyses, and SPSS 23.0 was used to test the validity and reliability of the questionnaire.

5. Results

5.1. Data Validity and Model Fit Test

The research utilized SPSS software to test the reliability and validity of the questionnaire data. Cronbach's alpha coefficients of the variables were all greater than 0.9, surpassing the minimum reliability criterion. To measure the validity of the questionnaire, the KMO, Bartlett's test, and AVE were employed. The values for KMO and Bartlett's test exceeded 0.7, while the AVE value for each index was greater than 0.6. These results indicate high data validity.

To ensure the suitability of SEM for the data, Amos was used to fit the initial model established in Figure 2, and the model's fit index was tested. CMIN/DF was less than 3, RMSEA was less than 0.1, and GFI, NFI, TFI, and CFI were all greater than 0.9. Table 3 presents the Model fitting result. Consequently, both the absolute fit index and the relative fit index were ideal, signifying that the model had relatively good applicability [67,68]. The hypotheses put forward in Section 3 were tested, and all six hypotheses were supported. Table 4 presents the Hypothesis assessment.

Table 3. Model fitting result.

Index Name		Meaning	Value	Standard	Result
absolute fit index	CMIN/df	Chi-square degree of freedom ratio	2.687	<3.0	Acceptable
	RMSEA	Approximate root mean square error	0.071	<0.1	Acceptable
	GFI	Goodness of fit index	0.927	>0.9	Acceptable
relative fit index	NFI	Normative fit index	0.923	>0.9	Acceptable
	TLI	Tucker-Lewis index	0.934	>0.9	Acceptable
	CFI	Comparative fit index	0.906	>0.9	Acceptable

Table 4. Hypothesis assessment of the impact path of PBIP.

Variable Relationship	Value	*p* Value	Test Result
PBDL←PA	0.36	***	Acceptable
PBDL←PS	0.78	***	Acceptable
PBDL←PAE	0.53	***	Acceptable
PA↔PS	0.44	**	Acceptable
PA↔PAE	0.56	**	Acceptable
PS↔PAE	0.69	***	Acceptable

** represents p Value < 0.01 and *** represents p Value < 0.001.

5.2. Data Analysis

According to the conceptual model of the PBIP impact path proposed in Figure 2 and the results of Section 4 for data collection and analysis, the SEM is applied to establish the impact path diagram of PBIP. Amos software was used to obtain the PBIP impact path model after correction, as depicted in Figure 5. The coefficients of each impact path were obtained to identify the importance of each measurable variable for the latent variable.

The three PA, PS, and PAE variables exhibited an interactive relationship. The mutual influence between PS and PAE was the highest, up to 0.69. Next, the mutual impact between PA and PAE was 0.56, while the mutual influence of PA and PS was the lowest at 0.44.

PA, PS, and PAE positively affected PBDL. PS had the greatest impact on PBDL, with a direct impact value of 0.78, indicating that for a 1-unit increase in PS, PBDL increased by 0.78 units. Among them, FTPS1 and LPS1 were two highly significant impact paths, with impact values of 0.92 and 0.91. Thus, funding subsidies for projects (FTPS1) and preferential land transfer prices (LPS1) are crucial policies, with real estate enterprises being the primary beneficiaries of both. Impact values of FPS2, CMPS1, and FTPS3 were greater than 0.8, indicating their importance. FPS2 and CMPS1, with an impact value of 0.82, target real estate enterprises by providing loan discounts and supporting pre-sales to help reduce expenses. The impact value of FTPS3 is 0.81. Although this policy primarily benefits scientific research institutions, the research and development contribute to overcoming challenges in prefabricated building construction and generating new technology, reducing construction costs and positively impacting real estate enterprises.

PPS, FPS1, FTPS4, LPS2, FTPS5, FTPS2, and CMPS3 have impact values between 0.7 and 0.8. While their impact paths are not the most critical, they still positively influence prefabricated building development. PPS, FPS1, LPS2, and FTPS2 benefit real estate enterprises, increasing their willingness to construct prefabricated buildings. FTPS5 and CMPS3 directly benefit prefabricated component manufacturers, reducing development costs. FTPS4 aids scientific research institutions, decreasing the costs of prefabricated technology research and development and indirectly promoting prefabricated building development. However, LPS3, FTPS6, FPS4, CMPS2, and FPS3 are less significant as LPS3 and CMPS2 have minimal effects on real estate enterprises' willingness to increase prefabricated building development. FTPS6, FPS3, and FPS4 target consumers who purchase prefabricated houses and have a limited impact on improving PBDL.

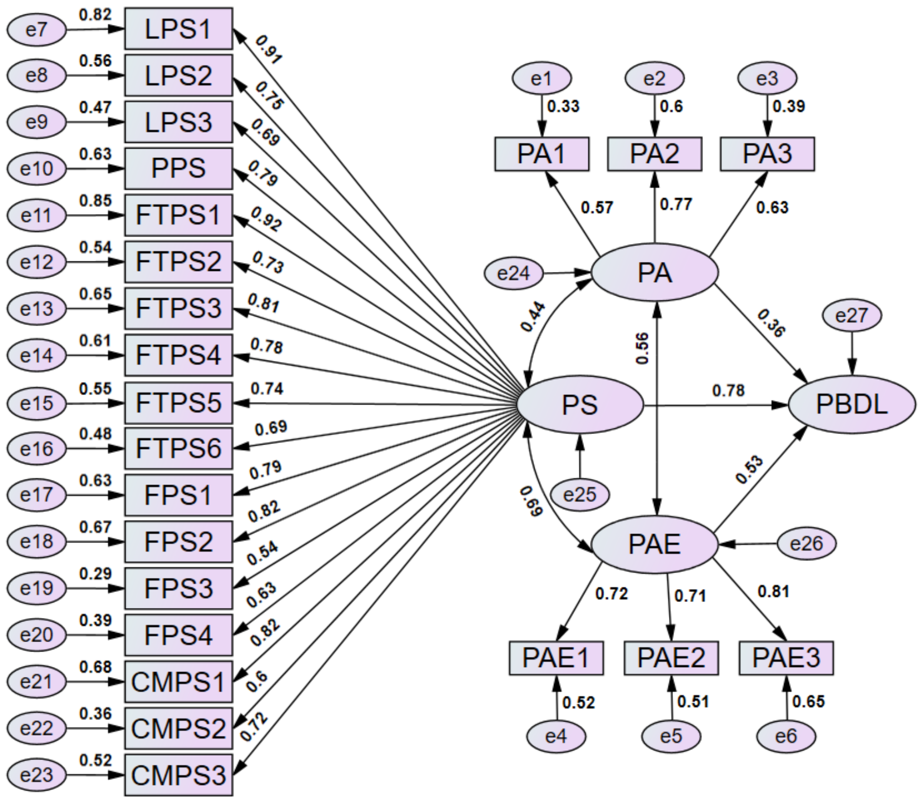

Figure 5. SEM results of impact relationship of PBIP.

The direct impact of PAE on PBDL is 0.53, indicating that a 1-unit increase in PAE increases enthusiasm for PBDL by 0.53 units. Enterprises and the public consider PAE3 as the most important factor, with an impact value of 0.81. This suggests that the fewer conditions required to apply for policy benefits and the higher the enthusiasm to apply for policies, the greater the promotion of prefabricated building development. The impact values for PAE1 and PAE2 were 0.72 and 0.71, indicating that shortening policy approval time and simplifying the policy application process will also improve PBDL.

PA has a minor impact, with an impact value of only 0.36, meaning that a 1-unit increase in PA results in a 0.36-unit increase in PBDL. Simultaneously, in terms of PA, PA2 was the most important impact path, with an impact value of 0.77. The influence values for PA1 and PA3 were 0.57 and 0.63, signifying that neither had a substantial impact.

6. Discussion

6.1. The Discussion on PS

Real estate enterprises are the direct promoters of prefabricated building development. Currently, prefabricated buildings have high incremental costs. From the perspective of real estate enterprises, costs serve as the primary obstacle to the promotion of prefabricated buildings [68]. Due to the aging population in China, construction companies are also confronted with rising labor costs [11]. Consequently, providing financial subsidies to real estate enterprises, reducing land transfer prices, and supporting the pre-sale of commercial housing have somewhat compensated for the increase in costs. The implementation of funding subsidies acts as an effective measure to promote prefabricated building development, and the implementation of funding and tax subsidy policies directly encourages real estate enterprises to invest in prefabricated building production [34,36]. Consequently, real estate enterprises prefer policies that provide direct funding subsidies, which significantly attract them to construct prefabricated buildings.

Supporting pre-sale of commercial housing, providing loan discounts and plot ratio incentives to real estate enterprises, offering financial support to overcome technical barriers of prefabricated buildings, and reducing taxes on related enterprises also decrease the cost of developing prefabricated buildings to some extent, indirectly subsidizing these enterprises. These indirect subsidy policies have a positive impact on improving prefabricated building development levels [22,44,69]. Non-capital subsidy incentive policies that help related enterprises overcome various obstacles in the construction process, such as ensuring transportation for prefabricated construction and increasing the land supply area for prefabricated buildings, have some incentive effects, although these effects are less significant than capital subsidy policies. Providing financial subsidies or prioritizing loan subsidies for house buyers has a minimal impact on prefabricated building development, indicating that the effect of incentive policies to stimulate house buyers is not sufficiently evident [70].

6.2. The Discussion on PAE

Policy application requirements are crucial to prefabricated building-related enterprises. Excessively high application requirements may cause most enterprises to fail to meet eligibility criteria, discouraging real estate enterprises from investing in prefabricated buildings and impeding the improvement of prefabricated building development levels. Conversely, if requirements are set too low, numerous substandard enterprises may apply for subsidies, increasing government financial pressure and leading to chaos in the prefabricated building market [71]. Therefore, establishing an appropriate threshold for policy application is essential for promoting prefabricated building development. Similarly, the time and process of policy approval have garnered significant attention. Shortening the policy approval time and simplifying the process will enhance the enthusiasm of all parties in promoting prefabricated building development.

6.3. The Discussion on PA

The impact of PA is minimal, yet enhancing the specificity of policy documents can promote prefabricated building development to some extent. Comprehensive, detailed, and clear policy documents are invaluable for improving the PBDL [48]. The extent to which enterprises or consumers understand the specific implementation details of policies determines their ability to correctly apply for and utilize policy incentives. Therefore, clarifying the content of policy documents' implementation details has a certain impact. Although understanding the scope and application of policies is not particularly critical, promoting and interpreting the application scope of policy documents remains necessary.

7. Conclusions

In this study, questionnaires were sent to relevant enterprises in China's prefabricated building demonstration cities to investigate the impact of PBIP on the PBDL. PA, PS, and PAE were measured as 27 variables, six main hypotheses were put forward, and SEM was used to analyze the impact of PBIP. The results show that PA, PS, and PAE had a direct impact on the development level of the assembly building, among which PS has the most significant impact on the development level of the assembly building, and it is the most important influence factor. For all prefabricated building-related enterprises, direct funding subsidy policies have the greatest effect on the development of prefabricated buildings, and policies such as tax reduction, tax exemptions, and accelerated return of funds also have a certain effect. Non-financial policies do little to increase the willingness of real estate enterprises to construct prefabricated buildings, and incentive policies for consumers also have little impact here. This study further enriches the research on PBIP for policymakers and academia and provides theoretical references for policy updating and improvement.

7.1. Suggestions

Analyzing the impact of PBIP and providing some meaningful enlightenment for the government as it formulates and improves related policies.

(1) Policies are needed to strengthen guidance, actively encourage relevant enterprises and policy beneficiaries to study policy documents, organize the relevant staff of enterprises to discuss policy contents, policy details, and policy application conditions, and enable relevant staff to obtain a detailed understanding of all aspects of political documents;
(2) Reducing land transfer prices and funding subsidies has the most significant impact on the development of prefabricated buildings, indicating that enterprises prefer policies to provide funding subsidies. Therefore, it is suggested that the subsidy intensity and amount of the two policies be increased. The next step is to increase the number of direct funding subsidy policies to attract real estate enterprises to invest in the construction of prefabricated buildings and promote the healthy development of prefabricated buildings;
(3) Enhancing existing incentive policies. The government should improve land supply policies, tax reduction and exemption policies, and other indirect funding subsidy policies. Given the positive response from enterprises to funding subsidies, it is crucial for the government to increase indirect funding subsidy incentives in addition to augmenting direct funding subsidies. These policies not only promote PBDL but also avoid increasing the financial burden on the government;
(4) The impact of PBIP targeting consumers is insignificant. Therefore, the government should consider which preferential policies consumers truly need and enhance the attractiveness of policy benefits to consumers. The government should contemplate revising or reformulating these policies to improve their effectiveness, enabling them to play a vital role in promoting prefabricated building development;
(5) Most scholars hold that the influence of incentive policies cannot be underestimated in terms of the promotion of prefabricated buildings. The government should regulate policy departments, improve the quality and level of the staff in policy management departments, optimize the application process of policies, speed up the approval rate of policy applications, expand the scope of subsidies, and reduce the restrictions of policy application to make it more convenient for enterprises and the public to apply for a benefit under existing policies.

7.2. Limitations

This study has two main limitations. First, all respondents in this study were from China. Consequently, the direct application of the findings to other contexts should be treated with caution. Second, the proposed SEM in the analysis of PBIP impact is static and fails to consider the dynamic impact of the policy implementation system. Future studies should explore the impact path of prefabricated building incentive policies using dynamic theories such as system dynamics, which could be a potential research project.

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