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Critical Obstacles in the Implementation of Value Management of Construction Projects

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Abstract: At present, the construction industry in China has problems such as low production efficiency, low technical efficiency, low management efficiency of the construction project, delayed delivery, budget overruns, and unreasonable risk allocation. Value management can address these issues by enhancing the value of construction projects in China, reducing construction costs, and ensuring significant investment returns. This study uses literature analysis to identify the critical obstacles to adopting value management and uses questionnaires and surveys, structural equation modeling, and factor analysis to prioritize the critical obstacles to adopting value management. What is more, the main contribution of this research is to identify the critical obstacles to the adoption of value management, which provides a new perspective for related research and has specific positive significance for practice summary and reform direction. The research was limited to the region of Tianjin and its surrounding cities. The critical survey respondents for this study are architects, quantity surveyors, contractors, civil engineers, and service engineers with rich experience in construction management. The research results show that the key obstacles to implementing value management in the construction industry in China are mainly divided into four categories: Environmental Factors; Stakeholder and Management Factors; Technological Factors; Information Factors. In addition, the researchers found that the level of the adoption of value management in the construction industry in China is deficient. Value management was not used in most of the organizations surveyed, and project teams did not practice its concept.

Keywords: construction projects; value management; critical obstacle factor

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1. Introduction

Inefficiency dilemma is a pervasive problem in the construction industry, especially in China [1–4], and that is mainly reflected in the low production efficiency of the construction industry [3], low technical efficiency [1], and low management efficiency of construction projects [4–7], delayed delivery, cost overruns [8], environmental regulation [9], unreasonable allocation of risks [10], etc. The construction industry has a significant impact on promoting the development of the national economy in developing countries [11]. The inefficiency dilemma is not conducive to the positive development of the construction industry, which in turn affects the national economy and national living standards [12]. With these demands increasing, construction projects' cost reduction becomes the primary objective, especially for government-invested projects [13]. In response to the inefficiency dilemma of the construction projects in developing countries, especially in China, value management (VM) is introduced into construction projects to optimize management efficiency, control project risk cost, and promote project success, which is a viable solution [14].

Value management was first utilized in the construction industry in developed countries in the early 1960s [15]. Value management was applied with considerable success in the construction industry in most developed countries [16–19]. However, facts have proved that the value management principles and their implementation in the construction industry in most developing countries were not fully implemented [19]. Value management is still in its infancy in developing countries and has not yet been widely accepted [20–24]. The application of value management in developing countries begs the question, what factors prevent the industry from adopting this obviously beneficial practice?

For decades, value management was utilized to enhance the quality and the standards of the construction project [25,26]. VM is one of the feasible ways to solve inefficiency dilemmas in the whole life of construction projects, balancing time, costs, and quality in a way that solves and maximizes the functional value of the construction project with the lowest possible cost [27,28]. Optimal value management is achieved when every stage of projects are reviewed to improve functionality, performance, and quality, which helps to reduce more unnecessary costs [15,29–32]. Therefore, minimizing costs is one of the goals of VM in the construction industry, and its ultimate goal is to achieve the best value for investment [28,33].

Implementation obstacles for VM were encountered in many countries [18,19,34,35]. Some cases from China also merit a critical reflection [36], considering that the construction industry suffers from poor project performance, which results in frequent owner dissatisfaction. Therefore, this research uses the construction industry in China as a case study to identify and evaluate the possible obstacles to the application of value management in China, with a view to offering some improving measures in construction industries. The research results can help avoid these obstacles and improve the use of value management in the construction industry. Unlike the common practice of choosing a specific region or state to represent the entire country, the respondents selected for this study were drawn from multiple provinces in China. Therefore, the research finding shows a true reflection of the obstacles to implementing value management. To a large extent, its suggestions can increase the implementation of value management in the construction industry in China. The following critical research problems are posed to achieve the objectives of this paper: (1) Identification of the critical obstacles to construction project value management; (2) Structural equation analysis of the critical obstacles to value management. Value management applications in the construction industry suggested highlighting the primary factors and identifying and evaluating those obstacles to VM implementation. Finally, literature analysis methods for finding 33 obstacle factors, and, in combination with structural equation modeling (SEM), to obtain four categories of critical factors that can reduce the probability of falling into the inefficiency dilemma and improve project management performance.

2. Critical Factors in Value Management

In the past few decades, as a method, a useful tool, and a technique, value management (VM) has been approved [37]. The previous literature analyzes the many critical success factors that affect the adoption of value management in some countries [25]. Shen [38] also analyzed the knowledge adoption of value management in the construction industry in Hong Kong, and found three critical factors that influenced why VM was not utilized in construction projects: (1) Lack of knowledge on how to implement value management; (2) Lack of confidence in introducing value management to clients; (3) Lack of appropriate time to adopt value management. However, Shen and Liu [39] used a systematic literature review to list 23 critical success factors (CSFs) for value management in the construction industry. Using a questionnaire, these CSFs were evaluated and divided into fifteen variables. These variables were identified as the key to improving VM implementation performance, and customer assistance and active participation were listed as the first of the most significant factors. Offering a specific objective for value management analysis was the second important factor. Multidisciplinary teams were considered to be the third essential element, while well-trained value management facilitators were in fourth place. In Sri Lanka [40], the adoption of value management in the construction industry is relatively low. Due to a lack of standard procedures for value management processes, the construction industry cannot facilitate and instruct the integration of value management, nor promote and guide the integration of VM, as well as there being a lack of information and recommendations on the benefits of value management. All of these are reasons for the lower use of value management in Sri Lanka. Fard et al. [41] investigated five barriers to adopting value management in the construction industry in Iran, which involved outdated standards and norms, traditional thinking and negative attitudes, insufficient local guidance, insufficient knowledge, changes in construction industry practices, and ownership requirements.

Many developed countries worldwide have applied value management more and achieved good results, so value management has attracted widespread attention in many developing countries [42]. However, VM has not been widely adopted in developing countries [19]. In order to improve this situation, there are many studies on identifying obstacles to VM implementation in developing countries [18,19,34,35]. Some researchers who focus on VM attach great importance to functional analysis. They believe that functional analysis is an indispensable factor that promotes the success of value management research and differentiates value management from traditional cost reduction methods. However, according to American architectural research surveys and case studies, Palmer et al. [43] questioned the dedication of functional analysis to the success of value management research. They believed that the value management seminar itself was a key factor. The degree of success or output level is primarily related to the factors of the value management seminar, such as the personality of the participants, the ability of the host, the appropriate timing of the value management seminar, the interaction of the value management team members, the input of the original design team, and the role of the customer. Lacking VM knowledge is another important issue, although the time that it takes to implement VM in Malaysia did not create a major obstacle [44]. Jaapar et al. [20] also confirmed that insufficient knowledge, resistance to change among all of the parties, and conflicting project objectives among those parties were the main problems faced by VM seminars. The research evaluated the most significant barriers: lack of knowledge; wrong procurement methods; and lack of qualified skills in applying value management in public constructions in Tanzania [35]. What is more, Aduze [45] noted the possibilities and the challenges of implementing value management in construction projects in Nigeria. This research believed that insufficient government legislation and policies, poor reception of customers, and an insufficient understanding of value management were all obstacles to using value management in Nigeria. Moreover, some studies found that the effectiveness of value management procedures cannot be achieved due to insufficient attention to value management and poor positioning [46]. In addition, Hayatu [47] also submitted that a lack of funding from the government, lack of value management professionals, and lack of commitment to implement VM were obstacles to adopting value management. Inadequate preparation and management support and difficulties involved by all of the major participants in the project process are factors that influence the implementation of value management in the construction industry. In addition to the above factors, issues such as the unclear division of labor among the construction industry professionals, low collaboration efficiency, barriers to communication with stakeholders, and lack of VM training can also hinder VM implementation.

First of all, existing studies have found that the unclear division of labor among the professionals in the construction industry is one of the main obstacles to implementing value management [40]. It shows that the critical factor is the cooperation of all of the construction partners to overcome this obstacle. Traditional construction procurement methods do not support strong alliances among construction professionals. Some researchers recognize this and suggest that collaboration among these construction professionals using value management could help work linkages and minimize unprincipled behavior among stakeholders [47]. The value management organization promotes collective procurement opportunities and coordinates the priorities of multiple construction partners to realize the value of customer capital. What is more, some researchers have shown that a potential method to improve the efficiency of value management is using information technology. This opinion conforms to the committee's argument, Coetzee [48] describes a method that uses electronic value management exercises to improve the teaching of value management in the construction industry in South Africa, as the use of technological innovations, such as video conferencing, is the difference compared to traditional seminars organized by teams. The VM team works on the Internet and exercises with new technologies, which is also supported by a previous study. Furthermore, Perera and Karunasena [40] analyzed the adoption of value management in Sri Lanka's construction industry. They found that value management was relatively limited compared with developed countries, due to insufficient knowledge and awareness of value management. Moreover, the owner is a critical participant in the execution of the construction project. Value management training is critical to encouraging value management implementation in developing countries [49]. This training needs to involve all of the procedures required to apply value management. Similarly, Tanko et al. [14] state that value management training is essential for its implementation among construction professionals. Value management experts from developed countries offer all of the value management tools and technologies in value management training. The study found that training construction professionals in value management would minimize the shortage of value management specialists in the construction industry, and showed that appropriate value management education would not only benefit local construction practitioners, but could also facilitate the wider adoption of value management [19]. Malla [23] suggested that providing a reward for value management participants can improve the adoption of value management in construction projects. In addition, Hayatu [47] believes that the project owner's comprehension of VM would encourage the wider adoption of VM construction projects and states that the government's impact on implementing the new policies and regulations could not be ignored. Therefore, the government in United States is working hard to help promote the adoption of value management in the construction industry in United States. The approval clause, which is similar to VM approval clauses, is also required when implementing the construction projects of United States and Australian governments. Government intervention has fostered the construction stakeholder's widespread application of value management. Therefore, customer participation and dedication are essential to improve the implementation of VM.

In summary, 33 construction industry VM obstacles' factors for implementation are found by analyzing the literature, as shown in Table 1.

Table 1. Key obstacles for VM implementation.

Classification	Category	Factor
Environmental Factors (EF)	EF1	Lack of customer awareness of VM and the benefits of VM integration [20,44]
	EF2	Clients are reluctant to fund value management activities [44,50]
	EF3	The industry is not ready to adopt value management [29,47]
	EF4	Lack of establishing and clarifying customer value systems [51]
	EF5	Lack of government encouragement/top management support [36,44]
	EF6	Lack of regular VM workshops [52]
Stakeholder and Management Factors (SMF)	SMF1	Lack of value management experts [19,53]
	SMF2	Lack of commitment to adopt value management [53]
	SMF3	There is no clear definition and scope between different professionals [37,39]

Table 1. *Cont.*

Classification	Category	Factor
Stakeholder and Management Factors (SMF)	SMF4	Lack of a multidisciplinary VM team [29]
	SMF5	Stakeholders struggle to establish common project goals [20]
	SMF6	Lack of an excellent team of professional value managers [19]
	SMF7	Decision-making powers not granted to participants by the organization [54]
	SMF8	Stakeholders cannot fulfill their promises to the VM seminar in a timely manner [39,55]
	SMF9	Lack of active participation and support from customers and stakeholders [29,39]
	SMF10	Some project participants refuse to accept state-of-the-art innovations [20]
	SMF11	Poor relationship and communication among various stakeholders [20,56]
	SMF12	Stakeholder mindset/attitude (reluctance to embrace change and innovation) [20,29]
	SMF13	Stakeholders struggle to establish common project goals [20]
	SMF14	Lack of awareness and implementation experience of value management among project participants [52]
Technological Factors (TF)	TF1	Lack of a proactive, creative and structured method [39,54]
	TF2	Lack of a legal framework for applying value management in the construction industry [9,19,53,57]
	TF3	Lack of creative brainstorming methods [29]
	TF4	Lack of available value management implementation guidance [19,47]
	TF5	Technological Progress Issues using Technological Integration in the VM Approach [48]
	TF6	Traditional procurement and contracting strategies are not suitable for implementing value management [14]
	TF7	Difficulty in analyzing and evaluating features and alternatives [29]
	TF8	Insufficient training and education on value management methods [29,47]
Information Factors (IF)	IF1	Insufficient information sharing among project participants [52]
	IF2	Incomplete project background information collected [52]
	IF3	Some project participants are unwilling to spend time collecting project information to make their own independent decisions
	IF4	There is no effective information feedback and decision-making mechanism for risk factors such as project uncertainty [14]
	IF5	It is difficult for project participants to understand all of the relevant information about the project fully.

3. Research Method and Model Development

3.1. Model Development

Structural Equation Modeling (SEM) is a method for establishing, estimating, and testing causal models [58]. The model can replace methods such as multiple regression, trajectory analysis, factor analysis, and covariance analysis, and clearly analyze the role and interrelationship of each indicator in the population [59]. Among the structural equation modeling methods, the mainstream methods include LISREL and PLS paths.

Partial least square structural equation modeling (PLS-SEM) has attracted much attention in many fields, especially business research and social sciences [60]. SMART-PLS 3.3.9, the latest software edition, was applied to evaluate the collected data, in order to model the priority of the critical obstacles of VM using SEM.

3.2. Data Collection and Analysis

This research aims to identify the obstacles and challenges to implementing value management in China, to promote the approach applied in the construction industry by providing some improvement suggestions. This study was conducted in China and the respondents came from multiple provinces in the country. The study utilized a questionnaire and examined construction professionals who participated in construction projects. The criterion for choosing these professionals was that they must participate in delivering public construction projects as clients, contractors, or consultants. In total, 300 questionnaires were distributed to eligible respondents across the chosen locations in China. The construction professionals from contractors, project management firms, consultancies, and client organizations were the main sources of respondents for this study. A total of 86% (258) of the questionnaires were properly answered and returned. According to Wahyuni [61] and Othman [32], this suggests that a 67% return rate is sufficient for the research.

A structured questionnaire was the research tool for this study, designed based on the information gathered from relevant research reviews. The information received from the previous section quality-checked the answers to the questions about the factors responsible for the non-implementation of value management in the construction industry. This study provided respondents with the obstacles to value management implementation identified in the literature and asked them to rate their severity using a five-point Likert scale, based on their level of knowledge and experience. The five-point Likert scale included a series of statements, of which there were five answers: "strongly agree", "agree", "not necessarily", "disagree" and "strongly disagree", which are 5, 4, 3, 2 and 1. The total score can indicate the respondent's attitude in a certain state, or the attitude of different states. Most questionnaires were mailed individually or in batches. Respondents have to fill in forms, and survey questionnaires were usually more comprehensive, complete, and easier to grasp than interview questionnaires.

4. Results

4.1. Demographics of Respondents

Most respondents have worked in the Chinese construction industry for many years. As shown in Table 2, most respondents (91%) have more than six years of work experience, while only 9% have less than five years of work experience in the construction industry. Therefore, it can be inferred that the respondents have the necessary experience to conduct this research survey.

The role played by the different organizations in the Chinese construction industry is shown in Table 2. A total of 40% of the respondents were from contracting firms, 36% were from owner organizations, and 24% were from consulting/design engineering firms. These indicate that the respondents are from the core domains of the study under investigation. Therefore, the credibility of the data used for this study was demonstrated.

The responses reveal that 40% (103) of the respondents were familiar with VM, 35% (90) were moderately familiar, 10% (26) were completely familiar with VM, while 15%

(39) were not familiar with VM. As a result, approximately 85% of respondents were fully familiar or moderately familiar with VM.

Table 2. General information of the respondents in this research.

Category	Classification	Frequency	Percentage
Working Experience	1–5 years	23	9
	5–10 years	62	24
	10–15 years	77	30
	15–20 years	65	25
	More than 20 years	31	12
	Total	258	100
Organizational Role	Contractor	103	40
	Consulting company	62	24
	Owner	93	36
	Total	258	100
Professional knowledge	Not Familiar	39	15
	Moderately Familiar	90	35
	Familiar	103	40
	Completely Familiar	26	10
	Total	258	100
Comprehension of VM	Career	13	5
	Concept	129	50
	Technology	116	45
	Total	258	100
Implementation of VM	YES	39	15
	NO	219	85
	Total	258	100
Training of VM	YES	26	10
	NO	232	90
	Total	258	100

In Table 2, there are different opinions on value management among the respondents. A total of 50% of the respondents think that VM is a concept, 45% believe that VM is a technology, and only 5% state that VM is a profession. This result indicates that most respondents (95%) believe that value management is a strategy or concept.

4.2. Exploratory Factor Analysis

Usually, the KMO test and Bartlett's sphere test are first used to determine whether the scale data are suitable for factor analysis, and then the exploratory factor analysis step follows. This paper used SPSS22.0 to analyze the factors of these 33 obstacle variables.

Factor analysis is used for information enrichment research. Analyzing whether the data obtained are appropriate for factor analysis, KMO is a measure of the homogeneity of variables. KMO is always utilized to evaluate whether the partial correlations between the variables are minimum [62]. For factor analysis, the KMO index ranges from 0 to 1, and it is recommended to use 0.6 as the minimum value for good factor analysis [63]. While Bartlett's test of sphericity tests whether a correlation matrix is an identity matrix, according to Pallant [64], when $\rho < 0.05$, Bartlett's test of sphericity should be significant. As shown in Table 3, the KMO value is 0.887, greater than 0.6, and the prerequisite factor analysis is met, that is, the data can be used for factor analysis.

It can be seen from Table 3 that the results of the validity analysis are suitable for factor analysis of the factors that affect the implementation of value management. Therefore, the principal component analysis method will be used next to extract the common factors for the measurement items that hinder the implementation of value management. For factors with an eigenvalue > 1, using the maximum variance rotation method, the factor loading matrix after rotation is shown in Table 4.

Table 3. KMO and Bartlett's test of observed variables.

	Kaiser–Meyer–Olkin	Bartlett's Sphericity Test		
		Approx. Chi-Square	df	sig.
Environmental Factors (EF)	0.874	411.367	15	0.000
Stakeholder and Management Factors (SMF)	0.921	1398.729	91	0.000
Technological Factors (TF)	0.932	627.233	28	0.000
Information Factors (IF)	0.872	404.592	10	0.000

Table 4. Factor loading of VM obstacle factor.

Component Loading				
NO.	1	2	3	4
EF1	0.767			
EF2	0.828			
EF3	0.839			
EF4	0.924			
EF5	0.888			
EF6	0.891			
SMF1		0.86		
SMF2		0.879		
SMF3		0.885		
SMF4		0.899		
SMF5		0.872		
SMF6		0.924		
SMF7		0.894		
SMF8		0.858		
SMF9		0.852		
SMF10		0.854		
SMF11		0.89		
SMF12		0.696		
SMF13		0.823		
SMF14		0.836		
TF1			0.871	
TF2			0.922	
TF3			0.902	
TF4			0.848	
TF5			0.904	
TF6			0.865	
TF8			0.828	
IF1				0.924
IF2				0.813
IF3				0.918
IF4				0.934
IF5				0.912
Eigen values	4.415	10.359	6.021	4.061
Total variance xplained cumulatively difference	73.59	73.99	75.26	81.21

As shown in Table 4, the one factor of TF7 is excluded due to cross-loading, and there are only four dimensions left. It can be seen from the above figure that the first six items (EF1, EF2, EF3, EF4, EF5, EF6) are all facing the factor 1, and the factor loading values are all higher than 0.4, indicating that these six items should belong to the same dimension, and that they are Environmental Factors. Similar factor 2 (Stakeholder and Management Factors), factor 3 (Technological Factors), and factor 4 (Information Factors) are three dimensions.

4.3. Reliability and Validity Analysis

(1) Reliability analysis

Reliability analysis refers to the analysis of the reliability of the measurement results of the same research object, in terms of stability or consistency. Using reliability analysis on the questionnaire, the higher the reliability index obtained, of course, the higher the reliability of the collected questionnaire, and the lower the measurement error. Cronbach invented the Cronbach coefficient in 1951, and its values range from 0 to 1. Generally, a higher Cronbach value is considered to mean the higher reliability of the scale and better internal consistency of the questionnaire. For reliability analysis, the Cronbach's α coefficient currently used in learning is very common, and the Composite Reliability (*CR*) coefficient is used. The calculation formula of Cronbach's α coefficient is:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_T^2}\right) \quad (1)$$

Among them, K is the total number of items on the scale, σ_i^2 is the in-question variance of the score of the i question, and σ_i^2 is the variance of the total score of all of the items.

It is generally believed that when the Cronbach's α value is greater than 0.9, the reliability is excellent; when the Cronbach's α value is between 0.8 and 0.89, the reliability is excellent; when the overall Cronbach's α value exceeds 0.8, the questionnaire has a use value.

The overall reliability analysis results of the scale used in this research are shown in Table 5. The overall Cronbach's α coefficient of 33 observed variables is 0.984, indicating that the scale items designed in this research have high internal consistency.

Table 5. The overall reliability analysis.

Cronbach's Alpha	Items
0.984	33

In addition to calculating the Cronbach's α coefficient, this study also further calculated the Composite Reliability (*CR*). *CR* is a more rigorous reliability evaluation index, and its calculation formula is:

$$CR = \frac{\left(\sum_t \pi_{rt}\right)^2}{\left(\sum_t \pi_{rt}\right)^2 + \sum_t\left(1 - \pi_{rt}^2\right)} \quad (2)$$

Among them, t is the number of latent variable indicators, and π_{rt} is the factor load of the r indicator of the t latent variable.

The following is a reliability analysis of the four dimensions of culture and environment, stakeholders and knowledge, standardization, and project site dynamics. The results are shown in Table 6.

From the above analysis results, it can be seen that the comprehensive reliability *CR* value of each question item is greater than 0.7, which indicates that the scale has good reliability [65]. At the same time, all of the Cronbach's Alpha values are greater than the standard 0.5 [65], and the values are distributed around 0.9. Therefore, the reliability of the questionnaire can be considered to be high.

(2) Validity analysis

In the sample data test, validity is also one of the main indicator characteristics. Some researchers have shown that the greater the value of validity, the greater the validity of the survey results, and the greater the representative of the authenticity of the checked events [66], therefore, the greater the possibility of achieving the purpose of the survey. Effectiveness includes two aspects: structural effectiveness and content effectiveness. Usually, the indicator for evaluating the effectiveness of content is the rationality of the topic distribution. The most common evaluation method is expert evaluation, which probably means that relevant experts are invited to evaluate whether the preliminary research scope corresponds to the questionnaire's topic. Structure validity is a common indicator for evaluating the structure of scales. The structure validity test of the structural equation model usually has two aspects: convergence validity and discriminant validity.

Table 6. Reliability analysis.

Dimension	NO.	Outer Loading		Cronbach's Alpha	Composite Reliability	*AVE*
		Initial	Modified			
Environmental Factors	EF1	0.764	0.764	0.927	0.943	0.736
	EF2	0.825	0.825			
	EF3	0.840	0.840			
	EF4	0.925	0.925			
	EF5	0.889	0.889			
	EF6	0.894	0.894			
Information Factors	IF1	0.925	0.925	0.942	0.956	0.812
	IF2	0.810	0.810			
	IF3	0.919	0.919			
	IF4	0.934	0.934			
	IF5	0.912	0.912			
Stakeholder and Management Factors	SMF1	0.86	0.860	0.969	0.973	0.732
	SMF10	0.855	0.855			
	SMF11	0.890	0.890			
	SMF12	0.694	Deleted			
	SMF13	0.823	0.823			
	SMF14	0.836	0.836			
	SMF2	0.880	0.880			
	SMF3	0.885	0.885			
	SMF4	0.899	0.899			
	SMF5	0.872	0.872			
	SMF6	0.924	0.924			
	SMF7	0.893	0.893			
	SMF8	0.858	0.858			
	SMF9	0.851	0.851			
Technological Factors	TF1	0.872	0.872	0.953	0.960	0.753
	TF2	0.923	0.923			
	TF3	0.901	0.901			
	TF4	0.846	0.846			
	TF5	0.905	0.905			
	TF6	0.862	0.862			
	TF7 (The item was excluded due to cross-loading)	0.794	0.794			
	TF8	0.831	0.831			

The difference in the effectiveness of convergence lies in the comparison between Average Variance Extracted (*AVE*) and 0.5. If the *AVE* is greater than 0.5, it indicates that the explanatory power of this dimension has exceeded half of its index, and the convergence validity is good [60]. It is calculated as follows:

$$AVE = \frac{\sum_t \pi_{rt}^2}{\sum_t \pi_{rt}^2 + \sum_t \left(1 - \pi_{rt}^2\right)} \tag{3}$$

When all of the factor loads are standardized, the calculation formula of *AVE* is:

$$AVE = \frac{\sum_t \pi_{rt}^2}{t} \tag{4}$$

The method of calculating regional validity is to compare the correlation coefficients of other structures with the *AVE* of each dimension. If the correlation coefficient between each dimension and other components is greater than the *AVE* of its isotope, it can be considered that each dimension has better discrimination validity.

The validity of the data is tested, and the results are shown in Table 6.

As shown in Table 6, the *AVE* values of all of the dimensions are around 0.700, which is higher than 0.500, so each dimension has good convergence validity [65].

In addition, this research adopted literature analysis and consulting expert interviews to design the measurement scale. The measurement scale was revised and perfected according to the language expression habits and actual learning situation. Therefore, the measurement model has good validity.

4.4. Model Result

Although many developed countries use value management widely in the construction industry, value management is less used in developing countries. China has also encountered the same problems and contradictions as many other developing countries in implementing value management. Implementing VM principles can resolve these issues and contradictions. Practitioners' awareness of VM and its critical construction activities would greatly increase senior managers' decisions to accept value management as an integral platform/element in the project. The successful adoption of value management often depends on requirements for various knowledge and the suitable degree of understanding of value management from the different stakeholders. However, concerning the perception of value management, the study results show that approximately 95% of respondents believe that VM is a concept. The model proposed in this research shows that all of the four key obstacle categories of value management components greatly influence the application of value management. Avoiding these obstacles can improve the sustainability of construction projects. Therefore, the project team can use VM to minimize costs and time, and to improve quality, without losing any project functionality.

Although domestic construction professionals have quite good opinions of VM, they have not yet adopted VM.

Therefore, it is necessary to construct a VM obstacle factor model to help the construction personnel to avoid these obstacles and implement value management. This study would use components from the PLS-SEM model to prioritize the critical obstacles to VM.

The square root of the *AVE* (Table 6) surpassed their correlations with all of the other dimensions, which showed no association between either of the two dimensions. The cross-loading represents the contribution of an item to its latent variable. As shown in Table 7, the load of EF1 in Environmental Factors is 0.764, which is greater than the load of EF1 on the other latent variables. Therefore, EF1 really does belong to Environmental Factors. Eventually, each dimension can be guaranteed to have an excellent unidimensionality. The PLS-SEM model (show in Figure 1) is used to prioritize these factors.

Table 7. Cross loading of measurement dimensions.

	Environmental Factors	Information Factors	Stakeholder and Management Factors	Technological Factors
EF1	**0.764**	0.538	0.624	0.598
EF2	**0.825**	0.562	0.669	0.649
EF3	**0.840**	0.627	0.753	0.686
EF4	**0.925**	0.740	0.792	0.760
EF5	**0.889**	0.688	0.738	0.716
EF6	**0.894**	0.733	0.819	0.745
IF1	0.734	**0.925**	0.769	0.852
IF2	0.581	**0.810**	0.644	0.682
IF3	0.720	**0.919**	0.784	0.820

Table 7. *Cont.*

	Environmental Factors	Information Factors	Stakeholder and Management Factors	Technological Factors
IF4	0.705	**0.934**	0.782	0.832
IF5	0.675	**0.912**	0.752	0.785
SMF1	0.720	0.725	**0.860**	0.732
SMF10	0.716	0.819	**0.855**	0.807
SMF11	0.786	0.706	**0.890**	0.766
SMF13	0.717	0.704	**0.823**	0.755
SMF14	0.644	0.674	**0.836**	0.766
SMF2	0.824	0.767	**0.880**	0.786
SMF3	0.798	0.767	**0.885**	0.800
SMF4	0.799	0.715	**0.899**	0.742
SMF5	0.720	0.714	**0.872**	0.726
SMF6	0.768	0.761	**0.924**	0.801
SMF7	0.749	0.734	**0.893**	0.776
SMF8	0.750	0.724	**0.858**	0.763
SMF9	0.764	0.641	**0.851**	0.715
TF1	0.775	0.756	0.767	**0.872**
TF2	0.743	0.799	0.821	**0.923**
TF3	0.717	0.763	0.796	**0.901**
TF4	0.654	0.698	0.718	**0.846**
TF5	0.740	0.831	0.819	**0.905**
TF6	0.655	0.702	0.709	**0.862**
TF8	0.691	0.785	0.772	**0.831**

The largest value of each factor on its corresponding dimension is highlighted in bold.

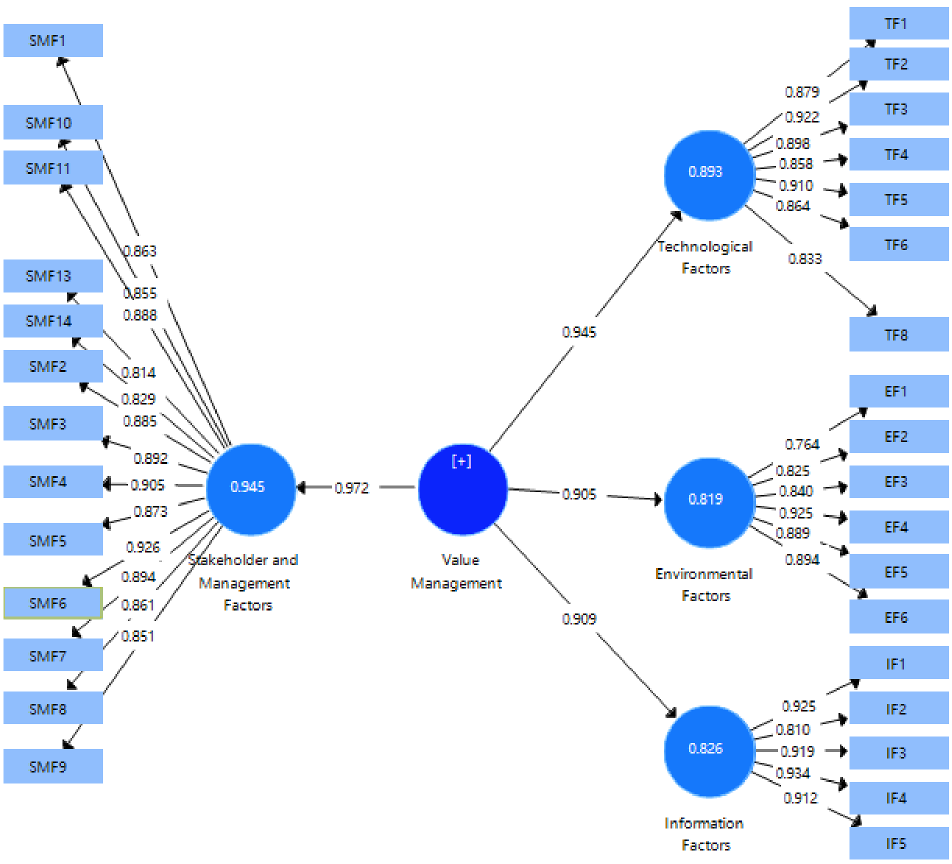

Figure 1. PLS-SEM model.

5. Discussion

D1: (Stakeholder and Management Factors)

In construction project management, there are many managers, which can easily lead to the lack of the main body of value management. For existing managers, value management is not their right or responsibility, so they lack the motivation to implement value management. Moreover, some customers are reluctant to fund VM activities [44,50] due to a lack of awareness of the existence of VM and the benefits of VM integration [20,44]. In addition, the project participants lack an understanding and implementation experience of value management [52]. The project participants are a dynamic factor in the realization of value management and, in a sense, determine the implementation and realization of value management. In implementing value management, enterprises in the construction industry are subject to certain artificial obstacles, mainly because, first, there is a lack of correct understanding of value management. There is also a lack of awareness and implementation experience of value management among project participants [20,52]. Value management is a new management concept and method, and its dissemination and application in the construction industry require a process. Secondly, they are unwilling to accept innovation. The construction industry has decades of development history, and practitioners are very familiar with the existing management concepts and methods. Value management needs to be fully optimized and reformed, which is a big challenge to construction practitioners' business abilities and comprehensive qualities. Employees who lack the spirit of challenge and are unwilling to accept innovation will be resistant to pressure.

As a management concept and method, value management will be constrained and influenced for various reasons by all of the parties involved in the project during its operation. Therefore, forming a professional value management team and constructing a management model with a clear subject is conducive to implementing and realizing value management. The current management model lacks professional value management experts and project teams [19,53], lacks a clear definition and scope for different professionals [37,39], and lacks management's commitment to implementing VM [53]. On the one hand, these problems form the realistic basis for the implementation of value management. On the other hand, they are also obstacles to realizing value management.

D2: (Technological Factors)

For the construction industry in developing countries, because value management is a relatively advanced management concept and method, management techniques such as project management guidelines, contract management, and project procurement methods currently used in the construction industry may not be suitable for value management [14]. In addition, because some practitioners lack knowledge in and experience of value management and its implementation [52], construction companies need to carry out training in, and practice of, value management to enrich practitioners' knowledge of value management [29]. If the above technical issues are not resolved, it will hinder the implementation of value management in construction projects.

D3: (Environmental Factors)

Value management was first utilized in the construction industry in developed countries in the early 1960s [15]. Value management was applied with considerable success in the construction industry in most developed countries [16–19]. The role models of success stories are very influential. More and more companies in the construction industry in developing countries are gradually trying to use value management to improve the efficiency of construction projects, improve project performance, and gradually form a good environment in the industry [29,44]. Therefore, to implement value management, environmental factors are important. Implementing advanced management theories and methods in a positive and favorable environment is relatively less challenged and resisted [29]. For industries that lack that environment, it is a huge project that needs to start by changing personnel's perception.

D4: (Information Factors)

From the perspective of information dissemination, value management is a two-way flow of information. One flow is from top to bottom, from the management level to the staff level, to convey the basic theoretical methods of value management, as well as basic information such as the process and content of the implementation of the value management plan [52]. Another flow is bottom-up, from the employee level to the management, with feedback on the response of front-line positions to the implementation of value management [14]. Whether the information transmission is timely and effective is also related to the realization of value management.

6. Conclusions

Value management has a huge impact on enhancing the value of construction projects, reducing construction costs, and ensuring significant investment benefits. Many resources were invested in construction projects in China, but it still has not escaped the inefficiency dilemma. So, what are the key obstacles to applying value management in China, which is the critical question of this paper. This paper used literature analysis to identify the critical obstacles to VM implementation. Based on previous studies, it classified the critical obstacles in the four dimensions of Stakeholder and Management, Technological, Environmental, and Information. Then it analyzed the construction project's key obstacle factors, to obtain the list of the critical obstacle factors of value management in construction projects. Moreover, SEM was used to prioritize the critical obstacle factors. Finally, the analysis based on the ranking of the critical factors helped provide a certain reference and guidance for the future development and practice of VM in construction projects in developing countries.

The research results show that critical obstacles to implementing value management in the construction industry in China are mainly divided into four dimensions: Stakeholder and Management; Technological; Environmental; and Information. In addition, the researchers found that the level of adoption of VM in the construction industry in China is deficient. Most of the surveyed organizations did not use VM, and the project teams did not practice its concepts. In response to the above problems, some suggestions are given in this research: (1) Regular VM workshops should be promoted, and the workshops should explain the process of value management implementation, not just advertise the benefits and realize benefits [32]; (2) It is necessary to train the construction professional on the value management process, including principles, concepts, and techniques. All construction institutions need to hold training workshops on value management for their employees regularly, and include this content in their continuous professional development evaluation [16]; (3) The government could help facilitate the application of value management by formulating policies, regulations, and guidelines. These policies, regulations, and guidelines will promote the adoption of value management in the construction project [14]; (4) Decision makers should regularly attend VM seminars or training [67,68].

This paper conducts an exploratory study on the critical obstacle factors of implementing value management in construction projects, provides a new perspective for related research and has a certain positive significance in the direction of practice summary and reform. However, this paper still has some shortcomings. Architects, quantity surveyors, contractors, civil engineers, and service engineers in the construction industry were primarily considered in this research. Therefore, the term "construction professionals" cannot be generalized. The results of this research are limited to the construction industry and may not be generalized to another department of the Chinese economy. Therefore, to increase the overall performance of the construction industry in China, empirical research needs to be undertaken, taking into account the other construction professionals and the stakeholders.

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References

1. Zhang, J.; Li, H.; Xia, B.; Skitmore, M. Impact of environment regulation on the efficiency of regional construction industry: A 3-stage Data Envelopment Analysis (DEA). *J. Clean. Prod.* **2018**, *200*, 770–780. [CrossRef]
2. Kineber, A.F.; Othman, I.; Oke, A.E.; Chileshe, N.; Alsolami, B. Critical Value Management Activities in Building Projects: A Case of Egypt. *Buildings* **2020**, *10*, 239. [CrossRef]
3. Wang, X.; Lai, W.; Song, X.; Lu, C. Implementation efficiency of corporate social responsibility in the construction industry: A China study. *Int. J. Environ. Res. Public Health* **2018**, *15*, 2008. [CrossRef] [PubMed]
4. Sha, K.; Yang, J.; Song, R. Competitiveness assessment system for China's construction industry. *Build. Res. Inf.* **2008**, *36*, 97–109. [CrossRef]
5. Horta, I.; Camanho, A.; Johnes, J.; Johnes, G. Performance trends in the construction industry worldwide: An overview of the turn of the century. *J. Product. Anal.* **2012**, *39*, 89–99. [CrossRef]
6. Ozorhon, B.; Karahan, U. Critical Success Factors of Building Information Modeling Implementation. *J. Manag. Eng.* **2017**, *33*, 04016054. [CrossRef]
7. You, T.; Zi, H. The economic crisis and efficiency change: Evidence from the Korean construction industry. *Appl. Econ.* **2007**, *39*, 1833–1842. [CrossRef]
8. Patanakul, P.; Kwak, Y.; Zwikael, O.; Liu, M. What impacts the performance of large-scale government projects? *Int. J. Proj. Manag.* **2016**, *34*, 452–466. [CrossRef]
9. Kissi, E.; Boateng, E.; Adjei-Kumi, T. Strategies for implementing value management in the construction industry of Ghana. In Proceedings of the DII-2015 Conference on Infrastructure Development and Investment Strategies for Africa, Cape Town, South Africa, 16–18 September 2015; pp. 255–267.
10. Patanakul, P. Managing large-scale IS/IT projects in the public sector: Problems and causes leading to poor performance. *J. High Technol. Manag. Res.* **2014**, *25*, 21–35. [CrossRef]
11. Mousa, A. A Business approach for transformation to sustainable construction: An implementation on a developing country. *Resour. Conserv. Recycl.* **2015**, *101*, 9–19. [CrossRef]
12. Durdyev, S.; Ismail, S.; Ihtiyar, A.; Bakar, N.F.S.A.; Darko, A. A partial least squares structural equation modeling (PLS-SEM) of barriers to sustainable construction in Malaysia. *J. Clean. Prod.* **2018**, *204*, 564–572. [CrossRef]
13. Kelly, J.; Male, S.; Graham, D. *Value Management of Construction Projects*; John Wiley & Sons: Hoboken, NJ, USA, 2014.
14. Tanko, B.L.; Abdullah, F.; Ramly, Z.M.; Enegbuma, W.I. Confirmatory factor analysis of value management current practice in the Nigerian construction industry. *J. Adv. Res. Appl. Sci. Eng. Technol.* **2017**, *9*, 32–41.
15. Shen, G.Q.; Ann, T.W. (Eds.) *Value Management in Construction and Real Estate: Methodology and Applications*; Routledge: New York, NY, USA, 2015.
16. Aghimien, D.O.; Oke, A.E.; Aigbavboa, C.O. Barriers to the adoption of value management in developing countries. *Eng. Constr. Archit. Manag.* **2018**, *25*, 818–834. [CrossRef]
17. Bowen, P.; Jay, I.; Cattell, K.; Edwards, P. Value management awareness and practice by South African architects: An empirical study. *Constr. Innov.* **2010**, *10*, 203–222. [CrossRef]
18. Kissi, E.; Boateng, E.B.; Adjei-Kumi, T.; Badu, E. Principal component analysis of challenges facing the implementation of value engineering in public projects in developing countries. *Int. J. Constr. Manag.* **2017**, *17*, 142–150. [CrossRef]
19. Kim, S.Y.; Lee, Y.S.; Nguyen, V.T. Barriers to applying value management in the Vietnamese construction industry. *J. Constr. Dev. Ctries.* **2016**, *21*, 55–80. [CrossRef]
20. Jaapar, A.; Endut, I.R.; Bari, N.A.A.; Takim, R. The impact of value management implementation in Malaysia. *J. Sustain. Dev.* **2009**, *2*, 210–219. [CrossRef]
21. Malla, S. Application of value engineering in Nepalese building construction industry. *Retrieved* **2013**, *2*, 2018.
22. Phyo, W.W.M.; Cho, A.M. Awareness and practice of value engineering in Myanmar construction industry. *Int. J. Sci. Eng. Technol. Res.* **2014**, *3*, 2022–2027.
23. Abdelghany, M.; Rachwan, R.; Abotaleb, I.; Albughdadi, A. Value engineering applications to improve value in residential projects. In Proceedings of the Annual Conference–Canadian Society for Civil Engineering, Regina, SK, Canada, 27–30 May 2015; pp. 27–30.

24. Oke, A.E.; Ogunsemi, D.R. Value management in the Nigerian construction industry: Militating factors and the perceived benefits. In Proceedings of the Second International Conference on Advances in Engineering and Technology, Noida, India, 20–21 December 2011.
25. Tanko, B.L.; Abdullah, F.; Ramly, Z.M.; Enegbuma, W.I. An implementation framework of value management in the Nigerian construction industry. *Built Environ. Proj. Asset Manag.* **2018**, *8*, 305–319. [CrossRef]
26. Kolo, B.; Ibrahim, A.D. Value management: How adoptable is it in the Nigerian construction industry? In Proceedings of the Conference Proceedings of West Africa Built Environment, Accra, Ghana, 27–28 July 2010; pp. 653–663.
27. Rangelova, F.; Traykova, M. Value management in construction project. In Proceedings of the First Scientific-Applied Conference with International Participation Project Management in Construction, University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria, 4–5 December 2014.
28. Wandahl, S. Practitioners' perception of value in construction. *J. Civ. Eng. Manag.* **2015**, *21*, 1027–1035. [CrossRef]
29. Aigbavboa, C.; Oke, A.; Mojele, S. Contribution of value management to construction projects in South Africa. In Proceedings of the 5th Construction Management Conference, Port Elizabeth, South Africa, 28 November–29 December 2016; pp. 28–29.
30. Aghimien, D.O.; Oke, A.E. Application of value management to selected construction projects in Nigeria. *Dev. Ctry. Stud.* **2015**, *5*, 8–14.
31. Oke, A.E.; Aigbavboa, C.O. *Sustainable Value Management for Construction Projects*; Springer: Cham, Switzerland, 2017.
32. Othman, I.; Kineber, A.F.; Oke, A.E.; Zayed, T.; Buniya, M.K. Barriers of value management implementation for building projects in Egyptian construction industry. *Ain Shams Eng. J.* **2021**, *12*, 21–30. [CrossRef]
33. Perera, S.; Hayles, C.S.; Kerlin, S. An analysis of value management in practice: The case of Northern Ireland's construction industry. *J. Financ. Manag. Prop. Constr.* **2011**, *16*, 94–110. [CrossRef]
34. Dallas, M. The journey from cost to value. *J. Value Manag.* **2002**, *8*, 8–11.
35. Luvara, V.G.M.; Mwemezi, B. Obstacles against value management practice in building projects of Dares Salaam Tanzania. *Int. J. Constr. Eng. Manag.* **2017**, *6*, 13–21.
36. Cheah, C.Y.; Ting, S.K. Appraisal of value engineering in construction in Southeast Asia. *Int. J. Proj. Manag.* **2005**, *23*, 151–158. [CrossRef]
37. Othman, I.; Kineber, A.; Oke, A.; Khalil, N.; Buniya, M. Drivers of Value Management Implementation in Building Projects in Developing Countries. *J. Phys. Conf. Ser.* **2020**, *1529*, 042083. [CrossRef]
38. Shen, Q.P. Value management in Hong Kong's construction industry: Lessons learned. In Proceedings of the Save International Conference Proceeding, Hong Kong, China, December 1997; pp. 260–265.
39. Shen, Q.; Liu, G. Critical success factors for value management studies in construction. *J. Constr. Eng. Manag.* **2003**, *129*, 485–491. [CrossRef]
40. Perera, S.; Karunasena, G. Application of value management in the construction industry of Sri Lanka. *Value Manag.* **2004**, *10*, 4–8.
41. Fard, A.B.; Rad, K.G.; Sabet, P.G.P.; Aadal, H. Evaluating effective factors on value engineering implementation in the context of Iran. *J. Basic Appl. Sci. Res.* **2013**, *3*, 430–436.
42. Che Mat, M.M.; Shah, Z.M. Value Management as an Effective and Efficient Tool for Space Management. November 2006. Available online: http://vm-academy.com/seminar_paper_01.pdf (accessed on 10 April 2022).
43. Palmer, A.; Kelly, J.; Male, S. Holistic appraisal of value engineering in construction in United States. *J. Constr. Eng. Manag.* **1996**, *122*, 324–328. [CrossRef]
44. Al-Yami, A.M. An Integrated Approach to Value Management and Sustainable Construction during Strategic Briefing in Saudi Construction Projects. Doctoral Dissertation, Ali Al-Yami, Loughborough University, Loughborough, UK, 2008.
45. Aduze, O.C. A Study of the Prospects and Challenges of Value Engineering in Construction Projects in Delta and Edo States of Nigeria. Master's Dissertation, Nnamdi Azikiwe University, Awka, Nigeria, 2014.
46. Ezezue, B. Value management in Nigerian manufacturing companies: Challenges and prospects. In Proceedings of the An Empirical Study at 11th International Business and Social Research Conference, Dubai, United Arab Emirates, 8–9 January 2015; pp. 8–9.
47. Hayatu, U.A. An Assessment of the Nigerian Construction Industry's Readiness to Adopt Value Management Process in Effective Project Delivery. Master's Thesis, Ahmadu Bello University, Zaria, Nigeria, 2015.
48. Coetzee, C.E.L. Value Management in the Construction Industry: What Does It Entail and Is It a Worthwhile Practice? Thesis (B.Sc. (Hons), University of Pretoria, Pretoria, South Africa, 2010.
49. Oke, A.E.; Ogunsemi, D.R. Key competencies of value managers in Lagos state, Nigeria. In Proceedings of the 5th West Africa Built Environment Research (WABER) Conference, Accra, Ghana, 12–14 August 2013; pp. 773–778.
50. Assaf, S.; Musallami, A.I.; Sughaiyer, M. Value engineering in public construction projects in Saudi Arabia. *Build. Res. Inf.* **1996**, *24*, 152–159. [CrossRef]
51. Ojo, L.D.; Ogunsemi, D.R. Critical drivers (CDs) of value management adoption in the Nigerian construction industry: A Delphi study. *J. Eng. Des. Technol.* **2019**, *17*, 250–264. [CrossRef]
52. Mohamad Ramly, Z.; Shen, G.Q.; Yu, A.T. Critical success factors for value management workshops in Malaysia. *J. Manag. Eng.* **2015**, *31*, 05014015. [CrossRef]
53. Xiaoyong, L.; Wendi, M. Appraisal of value engineering application to construction industry in China. In *Future Wireless Networks and Information Systems*; Springer: Berlin/Heidelberg, Germany, 2012; pp. 303–311.

54. Male, S.; Kelly, J.; Fernie, S.; Grönqvist, M.; Bowles, G. *Value Management: The Value Management Benchmark: A Good Practice Framework for Clients and Practitioners*; Thomas Telford Publishing: London, UK, 1998.
55. Hwang, B.G.; Zhao, X.; Toh, L.P. Risk management in small construction projects in Singapore: Status, barriers and impact. *Int. J. Proj. Manag.* **2014**, *32*, 116–124. [CrossRef]
56. Chhabra, J.; Tripathi, B. Value engineering: A vital tool for improving cost & productivity. *Int. J. Ind. Eng. Technol.* **2014**, *4*, 1–10.
57. Lai, N.K. Value Management in Construction Industry. Master's Dissertation, Universiti Teknologi Malaysia, Johor, Malaysia, 2006.
58. Bullock, H.E.; Harlow, L.L.; Mulaik, S.A. Causation issues in structural equation modeling research. *Struct. Equ. Model. A Multidiscip. J.* **1994**, *1*, 253–267. [CrossRef]
59. Lowry, P.B.; Gaskin, J. Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Trans. Prof. Commun.* **2014**, *57*, 123–146. [CrossRef]
60. Henseler, J.; Hubona, G.; Ray, P.A. Using PLS Path Modeling in New Technology Research: Updated Guidelines. *Ind. Manag. Data Syst.* **2016**, *116*, 2–20. [CrossRef]
61. Whyte, A.; Cammarano, C. Value management in infrastructure projects in Western Australia: Techniques and staging. In Proceedings of the 28th Annual ARCOM Conference, Edinburgh, UK, 3–5 September 2012; ARCOM, Association of Researchers in Construction Management: Edinburgh, UK, 2012; pp. 797–806.
62. Sharma, S. *Applied Multivariate Techniques*; John Wiley & Sons: New York, NY, USA, 1996.
63. Tabachnick, B.G.; Fidell, L.S. *Using Multivariate Statistics*, 5th ed.; Pearson Education: Boston, MA, USA, 2007.
64. Pallant, J. *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows (Version 12)*, 2nd ed.; Allen & Unwin: Crows Nest, Australia, 2005.
65. Hair, J.F.; Ringle, C.M.; Sarstedt, M. PLS-SEM: Indeed a silver bullet. *J. Mark. Theory Pract.* **2011**, *19*, 139–152. [CrossRef]
66. Hair, J.F., Jr.; Hult, G.T.M.; Ringle, C.M.; Sarstedt, M. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*; Sage Publications: Thousand Oaks, CA, USA, 2016.
67. Thneibat, M.; Al-Tamimi, B. Establishing the synergy between the perceptions of construction professionals and the phases of value management. *Eng. Constr. Archit. Manag.* 2021; *ahead-of-print*. [CrossRef]
68. Stevens, D. Value management: Expanding the methodology through future techniques. *Value Manag.* **1999**, *5*, 10–20.