buildings

MDPI

Article

Validating and Applying the Mathematical Models for Predicting Corporate Social Responsibility Behavior in Construction Firms: A Roadmap

Qian Zhang [1,2,3,*], Bee Lan Oo [2] and Benson Teck Heng Lim [2]

[1] School of Management Science and Real Estate, Chongqing University, Chongqing 400045, China
[2] School of Built Environment, University of New South Wales, West Wing, Red Centre Building, Kensington Campus, Sydney, NSW 2052, Australia
[3] School of Physics, Engineering and Technology, University of York, York YO10 5DD, UK
* Correspondence: qian.zhang8@unsw.edu.au

Abstract: The prevalence of the sophisticated doctrine of corporate social responsibility (CSR) is increasing, given the perennial environmental concerns and social demands in the construction industry worldwide. Firms' CSR implementation has been influenced by a broad spectrum of external impetuses and internal motives, yet fragmented assessments of such influences make the prediction and implementation of CSR in construction problematic. This study aimed to validate and apply mathematical models for predicting CSR practices in construction firms. Mobilizing integrated institutional theory, stakeholder theory, and self-determination theory, a questionnaire survey within the top-tier construction contractors was undertaken. Eight mathematical models were developed to predict the key dimensions of CSR practices, such as "government commitment" and "environmental preservation", and validated by five subjective matter expert interviews. The results demonstrated the comprehensiveness, practicality, and robustness of the CSR prediction models in the construction industry. The results also highlighted the perceived importance of CSR practices; external coercive and normative forces, together with internal organizational culture, were the most influential factors directly enhancing construction firms' CSR implementation. Conceptually, the findings refined CSR practice prediction in a construction management context. The proposed CSR assessment checklists can help practitioners improve the often-tenuous overall CSR performance and spur competitiveness in the construction market.

Keywords: construction firms; corporate social responsibility; sustainability; models; factors; practices

Citation: Zhang, Q.; Oo, B.L.; Lim, B.T.H. Validating and Applying the Mathematical Models for Predicting Corporate Social Responsibility Behavior in Construction Firms: A Roadmap. *Buildings* **2022**, *12*, 1666. https://doi.org/10.3390/buildings12101666

Academic Editor: Annie Guerriero

Received: 17 September 2022
Accepted: 8 October 2022
Published: 12 October 2022

1. Introduction

Corporate social responsibility (CSR) is burgeoning in the academic world and construction business circles primarily because of two prominent problems [1]. Being a resource-and-labor-intensive industry, the construction sector contributes widely toward utilizing energy and various resources to materialize the built environment and preventing unemployment in society [2–4]. In 2021, the workforce in the construction industry was approximately 52.83 million population in China [5]; 3.2 million in the European Union [6]; and 10.02 million in the United States [7], accounting for approximately 7% of the total workforce. On the other end, however, the construction has long been notorious for being poor ecological imbalances and facing social challenges in its traditional production systems [8]. The litany of concerns of global warming, climate change, environmental degradation and pollution, dangerous working environment, inequality, collusive bidding, corruption, and child labor has been widely documented in existing studies [9–11].

Given these problems, there is a growing impetus among construction scholars and practitioners to sustain responsible activities while eliminating irresponsible ones [12]. Admittedly, construction firms will always be involved in such social expectations in general.

Many government and regulatory authorities have advocated sustainable development, sustainable construction, and corporate sustainability [13,14]. In particular, CSR has been widely embraced as a necessary business agenda to improve overall organizational performance [15] and spur competitiveness [16]. A critical review shows that multi-faceted relationships between these sustainability-related concepts and CSR might exist. Figure 1 illustrates the potential relationships between these sustainability-related concepts and CSR. Notably, it seems that there are no clear boundaries between the concepts of corporate sustainability and CSR and their respective measures. This study adopted the conceptual view proposed by Chang et al. [17] that corporate sustainability emphasizes a balance among economy, environment, and social dimensions through the triple-bottom-line approach, while the umbrella term "CSR" emphasizes the balance of stakeholders' conflicting interests to fulfill their diverse expectations and needs.

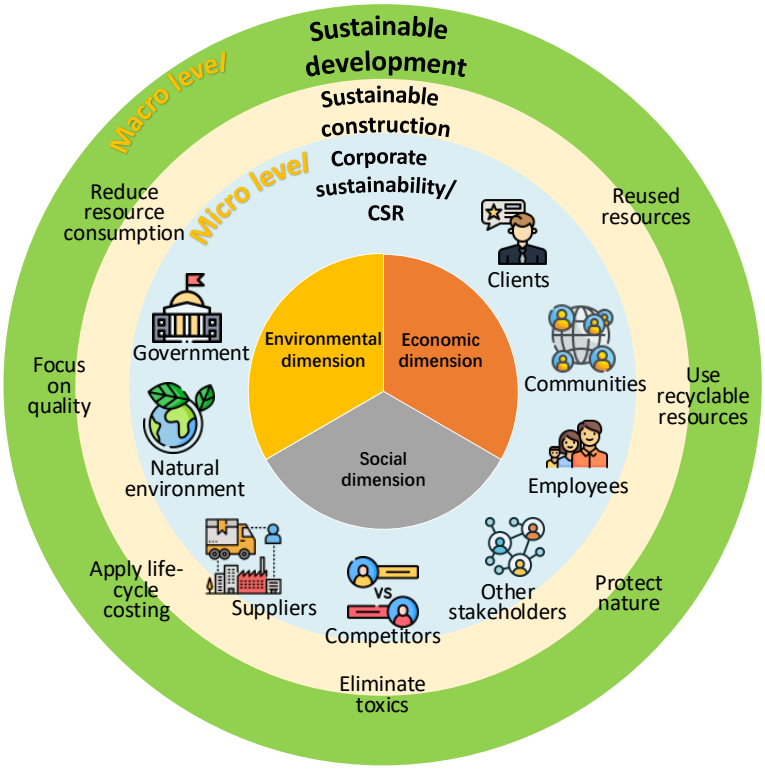

Figure 1. Relationships between sustainable development, sustainable construction, corporate sustainability, and corporate social responsibility (CSR).

Despite the growing interest in CSR discourses, the conceptual vagueness [18], heterogeneity and high fragmentation of the research focuses [19] and limited philosophical debate of CSR motives in construction [20] still plague the subject. Hitherto, there has been little understanding of how construction firms configure, enact, and operationalize CSR in practice, influenced by a broad spectrum of internal and external factors. Based on this backdrop, this study aims to validate and apply the mathematical models for predicting CSR practices within construction firms. Therefore, it should be noted that the scope of this study primarily lies in the construction sector. More specifically, this study seeks to assess the focus and motives of firms' CSR implementation across a range of candidate criteria, including (i) CSR practices in areas such as environmental preservation, the employees' interests, and government commitment, and (ii) influencing factors such as internal organizational factors and external institutional coercive, normative, and mimetic factors. This research is important given the globally inescapable priority of construction businesses, where top management desires to gain socially responsible leadership in the competitive construction market. While Loosemore and Phua [21] stated that there is no

single solution for CSR strategies, conceptual consensus on firms' key CSR practices and the factors affecting CSR implementation for the construction firms is imperative so that CSR can be implemented in general global construction markets [18].

2. Literature Review and Knowledge Gaps

A review of various definitions of CSR shows that construction firms' CSR behavior has four essential characteristics, namely (i) to fulfill social expectations and needs [22,23]; (ii) to balance diverse stakeholders' interests and this sometimes based on the stakeholders' salience [24–26]; (iii) to address the environmental and societal concerns alongside the economic goals [27–29]; and (iv) to implement CSR voluntarily with some statutory controls [30–32]. In the construction management domain, previous studies have generally regarded CSR as a multidimensional concept [33–35] consisting of various dimensions of shareholders' interests, the well-being of the local communities and the public, employees' interests, government commitment, environmental preservation, customers' interests, CSR institutional arrangement, and suppliers' and partners' interests, and a range of practices (or items or activities) under each dimension.

In recent years, substantial studies have documented and discussed the possible factors affecting CSR adoption in mainstream business development. In the context of the construction sector, the typical drivers of CSR implementation range from market pressure, innovation, technology development, and policy pressure [29,30,36] to financial benefits, supplier-induced benefits, human resource benefits, persuasion and inspiration, branding, reputation and image, relationship building, and policy benefits [14,37,38]. Through the lens of the self-determination theory, Deci and Ryan [39] explained that when firms desire the potential benefits of certain organizational practices, they are likely to be motivated to take action. Strategic business direction, organizational culture and awareness, and resource and capability availability are also important motivations for CSR implementation in construction firms [36,40]. Many scholars have pointed out that managers' awareness and the perceived importance of CSR practices are the keys to the success of firms' CSR performance [41–43]. Many studies have documented that organizational ethical consideration or humanitarianism and core business values and beliefs are the main reasons for their CSR implementation (e.g., [18,42,44]) Moreover, Huang et al. [45] noted that when firms intend to expand their business size and scale, or when they have sufficient resources and capabilities, they are more eager to implement CSR to demonstrate they are socially responsible.

From the review of the literature, it is acknowledged that a considerable number of studies have explored and documented various influencing factors of CSR implementation in the construction industry across several countries such as the UK, Australia, and the USA. However, despite all these efforts, there is a lack of a widely accepted framework or methodology for evaluating and predicting CSR implementation among construction firms. Many studies have explored the various influencing factors of CSR implementation across broad disciplines. Nevertheless, there is little empirical research to provide CSR prediction models and application tools that can allow construction firms to anticipate their level of CSR implementation by considering the collective effects of different external and internal factors. However, due to the unique and paradoxical characteristics of both the responsible and irresponsible construction activities in society, as documented above [46], there has been greater interest in modifying and advancing the current body of knowledge on CSR and theoretical frameworks in terms of the influence mechanism of factors on CSR implementation in the construction industry. These thus form the knowledge gaps and led to the generation of the theoretical framework of this study, which integrated stakeholder theory, institutional theory and self-determination theory to explain the rationale behind construction firms' CSR behaviors.

3. Research Methods

The results reported in the present paper were built upon a series of preliminary works from an extensive research project that explored the influence mechanisms of CSR implementation in the construction industry. After a brief description of the research procedure for the preliminary industry-wide questionnaire survey, the research methods applied for the CSR prediction model validation and application are discussed.

3.1. Survey Research

As presented in Figure 2, this study followed a three-phase research process. The main purpose of the exploratory phase was to identify, contextualize, and operationalize the corresponding measurement items (i.e., variables) of various dimensions of construction firms' CSR practices and their influencing factors. This involved (i) the generation of initial categories of CSR practice and the associated influencing factors via a systematic review of 69 studies on CSR in construction [20] and (ii) desktop studies on five leading Chinese construction firms via directed content analysis of nine consecutive years' CSR annual reports [47]. The multiple-case studies were primarily undertaken to examine the appropriateness and usability of the initial categories obtained in the first-round literature review. Based on this, Zhang et al. [48] articulated the theoretical framework of CSR implementation used in this study, underpinned by three primary theoretical lenses of organizational and behavioral studies, namely, the institutional theory, the stakeholder theory, and the self-determination theory. In brief, these theories collectively elaborate on how construction firms adapt, compete, behave, and evolve to gain legitimacy in the institutional field, namely, the construction industry in this case. It is noted that even though these underpinning theories used for theoretical framework development have been largely emphasized when explaining CSR practices in mainstream business contexts, there is little research leveraging them to explain CSR behavior in construction. Nevertheless, there is an ongoing interest in encapsulating these underpinning theories into an integrated theoretical framework of CSR implementation for construction firms.

Following this, a structured questionnaire was developed, constituting four main parts. After several questions about the respondents' personal backgrounds and their firms' backgrounds (parts 1 and 2), two sets of seven-point Likert scale descriptors were adopted in the questionnaire requiring the single key informants (i.e., the managerial staff) to rate the extent of their firms' level of CSR implementation (part 3) and collecting their opinions about the influencing factors of CSR implementation (part 4). The final question was designed to determine the intention of the respondents to participate in the follow-up interview about this survey. This was a quick and economical way to recruit experts to participate in the validation process of this study. After a pilot study and the attainment of ethical approval, the online questionnaire was distributed to the top-tier (i.e., extra-grade) construction contractors in China based on a valid enterprise list obtained from the national construction market supervision public service database. The top-tier contractors are usually recognized as the leading practitioners in the industry with better technology, capital, and credit grades compared with lower-tier construction firms [35,49]. A total of 95 complete and valid data sets (out of 597 firms) were collected, thus presenting a 15.91% response rate. Of these, only 90 were analyzed to develop the mathematical models for predicting CSR practices in construction firms using both exploratory factors analysis (EFA) and partial least squares structural equation modeling (PLS-SEM) methods. The other five respondents (out of 95) were involved in the model validation process. Justifications for and further discussions concerning the detailed list of measurement items used in this study, the development of the theoretical framework, the selection of the appropriate sampling method and sampling frame for data collection, and the use of statistical data analysis methods are provided in a series of fundamental studies [20,46–48]. Of note, the preliminary studies of this paper focused on revealing the results of the EFA and PLS-SEM, while this paper focuses on reporting the results of the model validation.

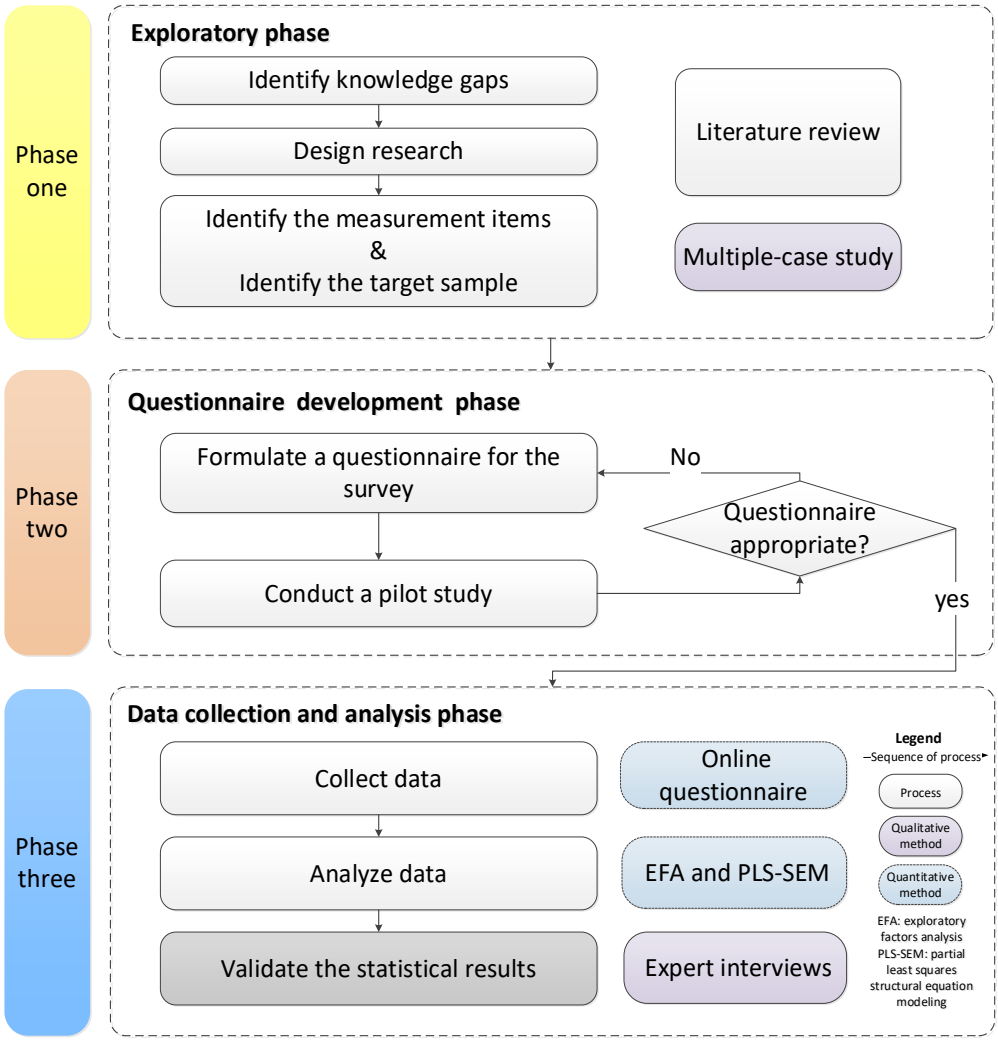

Figure 2. Three phases of the research process.

3.2. Model Validation Process

To evaluate the comprehensiveness and practicality of the developed mathematical models and obtain insights into the research findings, expert interviews were selected as the main validation method of this study. Expert interviews can obtain information from subject matter experts concerning the application of the developed models [50]. Furthermore, they help in identifying the limitations and future directions of the study. The entire CSR prediction model validation process (following Lim et al. [51]) involves three major steps: (i) the development of the mathematical models; (ii) examination of the robustness of the mathematical models; and (iii) a discussion of the expert interviewees' opinions on the comprehensiveness and practicality of those models. Of these, interviews were conducted with five key respondents who were involved in the survey questionnaire and expressed their interest during the follow-up interviews, as mentioned above. However, it is necessary to highlight that the responses provided by these informants were not used in the development of the structural model. In this study, these key informants were considered experts, and their survey responses were used to evaluate the comprehensiveness and practicality of the developed mathematical models. Of these respondents, two were deputy general managers, two were project managers, and one was a technical director in their top-tier construction firms who were involved in their organizations' CSR development and management in China. They were aged between 31 and 43 years old and had been working in the Chinese construction industry for 8 to 20 years (total working experience of

8, 20, 20, 12, and 10 years, respectively), with an average working experience of 14 years. This reveals their extensive industrial experience.

The five experts (coded as E1 to E5) were asked to comment on (i) the identified dimensions of CSR practices; (ii) the comprehensiveness and practicality of the resulting mathematical models; (iii) the suggestions for promoting CSR; and (iv) the needs or trends of China's construction firms' CSR implementation in the future. The resulting model was presented to the experts to probe into the practicality of the developed prediction models. Appendix A presents the interview guide questions used in this study.

Based on the results from PLS-SEM (see [46,48]), eight equations (i.e., mathematical models) were developed to help predict the eight dimensions of construction firms' CSR implementation. These are (i) shareholders' interests (SHi); (ii) government commitment (GOi); (iii) CSR institutional organization (IOi); (iv) environment preservation (ENi); (v) customers' interests (CUi); (vi) employees' interests (EMi); (vii) suppliers' and partners' interests (SPi); and (viii) well-being of the local community and the public (LCi). These equations were developed based on the collective significant direct path coefficients established in the corresponding hypothesized relationships in the structural model.

In examining the robustness of the developed mathematical models, an attempt was made to compare the actual and normalized predictions. Such predictions can be calculated by the weights (ω) for the individual measurement items of the respective key dimensions (constructs) of CSR practices and the associated influencing factors, as presented in Table 1. The weights used in this study were generated by the SmartPLS3.2.8 software, and the weights for individual measurement items amounted to a value of 1. Of note, the item codes in this table are consistent with the preliminary works of this research. The model prediction procedure adopted is as follows:

(i) Part 3 of the survey questionnaire, completed by the experts on the 26 measurement items to characterize their organizational CSR implementation, was used to calculate the *predicted scores* of the respective constructs. According to the results of EFA and confirmatory factor analysis (CFA), the measurement items were factorized into their corresponding dimensions. The ratings assigned to individual measurement items were multiplied by the respective weights presented in Table 1 under the headings of the eight key dimensions of CSR practices, namely SHi, ENi, LCi, EMi, CUi, SPi, GOi, and IOi. Afterward, the weighted ratings were summed to obtain the composite scores for each predicted construct, which characterized firms' CSR efforts. These scores represent the actual scores for the dimensions of CSR implementation.

(ii) The ratings assigned to the measurement items of the respective constructs of the key influencing factors were further applied to predict the scores of the respective key dimensions of CSR implementation. In this study, the composite scores of the respective constructs can be formulated by summing the weighted measurement items accordingly. These construct scores were then substituted into the eight equations to predict the eight key dimensions of CSR implementation. The resulting scores can be treated as the predicted CSR implementation constructs. The linear interpolation method was then adapted to normalize the predicted CSR implementation constructs to a 1–7 scale.

(iii) The actual and normalized predicted dimension scores of CSR implementation were then compared to assess the robustness of the eight mathematical models by calculating the percentage error (*PE*), mean percentage error (*MPE*), and mean absolute percentage error (*MAPE*) [52] (see Equations (1)–(3)). In the equations, n denotes the number of observations.

$$\text{Percentage error } (PE) = \frac{\text{Actual constructs scores} - \text{ predicted constructs scores}}{\text{Actual constructs scores}} \times 100\% \quad (1)$$

$$\text{Mean percentage error } (MPE) = \frac{\sum PE}{n} \quad (2)$$

$$\text{Mean absolute percentage error } (MAPE) = \frac{\sum |PE|}{n} \quad (3)$$

Table 1. Weights (ω) for individual measurement items of respective constructs.

CNO		MI1		MI2		OC		BS		RC	
Item code	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**
CO4	0.196	MI9	0.200	MI4	0.293	IN3	0.415	IN1	0.462	IN7	0.498
CO5	0.133	MI10	0.147	MI5	0.338	IN4	0.456	IN2	0.538	IN8	0.502
NO1	0.134	MI11	0.213	MI6	0.370	IN6	0.129				
NO2	0.147	MI12	0.213								
NO3	0.220	MI13	0.227								
NO4	0.170										
SHa		**ENa-1**		**ENa-2**		**LCa**		**EMa**		**CUa**	
Item code	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**
SHa1	0.512	ENa10	0.306	ENa1	0.447	LCa2	0.189	EMa12	0.227	CUa1	0.128
SHa2	0.488	ENa11	0.188	ENa2	0.553	LCa5	0.144	EMa13	0.222	CUa2	0.201
		ENa12	0.300			LCa6	0.230	EMa14	0.281	CUa3	0.157
		ENa13	0.206			LCa7	0.209	EMa15	0.271	CUa4	0.218
						LCa8	0.228			CUa5	0.182
										EMa1	0.115
SPa		**IOa**		**SHi**		**ENi**		**LCi**		**EMi**	
Item code	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**
SPa4	0.164	IOa1	0.320	SHi3	0.514	ENi10	0.237	LCi6	0.515	EMi12	0.266
SPa5	0.197	IOa2	0.353	SHi4	0.486	ENi12	0.206	LCi8	0.485	EMi13	0.249
SPa6	0.213	IOa3	0.327			ENi13	0.211			EMi14	0.237
SPa7	0.197					ENi8	0.175			EMi15	0.247
SPa8	0.229					ENi9	0.171				
CUi		**SPi**		**GOi**		**IOi**					
Item code	**ω**	**Item code**	**ω**	**Item code**	**ω**	**Item code**	**ω**				
CUi1	0.276	SPi5	0.299	ENi4	0.243	IOi1	0.296				
CUi2	0.413	SPi6	0.379	GOi2	0.276	IOi2	0.353				
CUi3	0.311	SPi8	0.323	GOi3	0.213	IOi3	0.350				
				GOi4	0.268						

Notes: CSR implementation: SHi—shareholders' interests; GOi—government commitment; IOi—CSR institutional arrangement; ENi—environment preservation; CUi—customers' interests; EMi—employees' interests; SPi—suppliers' and partners' interests; LCi—well-being of the local communities and the public. **Identified factors** (i.e., the perceived importance of CSR practices): SHa—shareholders' interests; CUa—customers' interests; LCa—well-being of the local communities and the public; SPa—suppliers' and partners' interests; EMa—employees' interests; ENa-1—environment preservation principles; IOa—CSR institutional arrangement; ENa-2—water conservation. **Intrinsic factors:** OC—organizational culture; BS—strategic business direction; RC—resource and capability. **External institutional factors:** MI1—competitiveness-related mimetic factors-1; CNO—coercive and normative factors; MI2—human-resources-benefits-related mimetic factors-2. All item codes in this table are consistent with the preliminary works of this study; corresponding measurement items can be found in Zhang et al. [48].

4. Results and Discussions

4.1. Development of the Mathematical Models

4.1.1. Shareholders' Interests (SHi)

Based on the results from PLS-SEM, the two significant predictors of contractors' CSR implementation regarding SHi are contractors' perceived importance of the (i) SHa and (ii) LCa in their CSR practices. By substituting the corresponding path coefficients (i.e., parameter estimates) of the predictor constructs, the first mathematical model for predicting contractors' CSR practices that focus on SHi is formulated as follows:

$$\text{SHi} = 0.839\ (\text{SHa}) + 0.311\ (\text{LCa}) \quad (4)$$

Considering the mathematical model and constructs' scores, the higher a construct's score for the perceived importance of the shareholders' interests and the well-being of the local communities and public, the higher the likelihood that the contractors will implement CSR practices to fulfill the shareholders' interests.

4.1.2. Government Commitment (GOi)

The results show that GOi has three statistically significant predictor constructs, namely, (i) contractors' perceived importance of EMi; (ii) coercive and normative factors (CNO); and (iii) human-resources-benefits-related mimetic factors-2 (MI2). Therefore, the mathematical model for predicting contractors' CSR implementation regarding GOi can be formulated as follows:

$$GOi = 0.263\ (EMa) + 0.259\ (CNO) - 0.222(MI2) \quad (5)$$

According to Equation (5) and the constructs' scores, the higher a construct's score for contractors' perceived importance of the employees' interests and the external coercive and normative factors, the higher the score regarding their implementation of the government commitment dimension of CSR practices. Therefore, contractors are more likely to implement CSR practices to fulfill their government commitments when they have great awareness of their employees' expectations and needs and when they perceive the high external institutional coercive and normative forces. On the other hand, contractors who perceive high human resources benefits from their competitors' CSR efforts, exemplified by the high construction score, are more likely to reduce the potential of their CSR implementation regarding government commitment. Corresponding to this, a lower human-resources-benefits-related mimetic factors-2 construct score will contribute to higher firms' CSR implementation regarding government commitment.

4.1.3. CSR Institutional Arrangement (IOi)

Contractors' CSR implementation regarding IOi has the sole statistically significant predictor construct of the perceived importance of IOa. It follows that the mathematical model for predicting the contractors' CSR practices regarding IOi can be formulated as follows:

$$IOi = 0.147\ (IOa) \quad (6)$$

Based on Equation (6) and the constructs' scores, contractors with a high construct score for the perceived importance of CSR institutional arrangement have a greater likelihood of implementing CSR institutional arrangement practices.

4.1.4. Environment Preservation (ENi)

Contractors' CSR implementation regarding ENi has only one statistically significant predictor construct, namely, the perceived importance of environment preservation principles (ENa-1). A mathematical model for predicting the ENi dimension of CSR can consequently be formulated as follows:

$$ENi = 0.582\ (ENa\text{-}1) \quad (7)$$

Equation (7) and the construct scores indicate that the contractors with a higher score for the perceived importance of environment preservation principles construct are more likely to implement CSR practices regarding environment preservation.

4.1.5. Customers' Interests (CUi)

Contractors' perceived importance of CUa is the sole statistically significant predictor of their CSR practices that focus on CUi. Correspondingly, the mathematical model developed for predicting the contractors' CSR practices that focus on CUi can be formulated as follows:

$$CUi = 0.553\ (CUa) \quad (8)$$

According to Equation (8) and the constructs' scores, contractors are more likely to implement CSR practices to address customers' expectations and needs when perceiving the high importance of customers' interests, exemplified by the high construct scores.

4.1.6. Employees' Interests (EMi)

Contractors' implementation of the EMi dimension of CSR has two statistically significant predictor constructs, namely, contractors' perceived importance of the (i) EMa and (ii) IOa. Therefore, the mathematical model for predicting contractors' CSR practices that focus on employees' interests (EMi) can be formulated as follows:

$$EMi = 0.558\ (EMa) + 0.193\ (IOa) \quad (9)$$

According to Equation (9) and the constructs' scores, contractors with higher scores in their perceived importance of the employees' interests and CSR institutional arrangement are more likely to implement CSR to fulfill their employees' expectations and needs.

4.1.7. Suppliers' and Partners' Interests (SPi)

CSR practices that focus on SPi have one statistically significant predictor construct, namely, the perceived importance of SPa. As such, the mathematical model for predicting the CSR practices that focus on SPi can be formulated as follows:

$$SPi = 0.614\ (SPa) \quad (10)$$

Based on Equation (10) and the constructs' scores, contractors with higher scores for the perceived importance of the suppliers' and partners' interests have a greater likelihood of implementing CSR practices that can fulfill suppliers' and partners' expectations and needs.

4.1.8. Well-Being of the Local Communities and the Public (LCi)

The LCi dimension of CSR implementation has two statistically significant predictor constructs, namely, (i) the perceived importance of LCa and (ii) organizational culture (OC). As a result, the mathematical model for predicting contractors' CSR practices regarding LCi can be formulated as follows:

$$LCi = 0.661\ (LCa) + 0.237\ (OC) \quad (11)$$

Equation (11) and the constructs' scores indicate that the higher the construct scores for contractors' perceived importance of the well-being of the local communities and the public and organizational culture, the higher the possibility that contractors will engage in CSR practices that focus on the well-being of the local communities and the public.

Collectively, the above results highlight the influential positions of contractors' perceived importance of CSR practices and external coercive and normative forces, together with internal organizational culture, in directly influencing construction firms' CSR implementation. These results tend to be different from previous studies in mainstream businesses. For instance, Ali et al. [53] found that CSR practices are heavily influenced by the external powerful stakeholders—such as foreign investors, international buyers, and international media and regulatory bodies—in developing countries, based on a survey and content analysis of 76 empirical studies. However, our findings tend to partially support the findings from a questionnaire survey on Chinese state-owned companies, whereby Zhu and Zhang [54] found that the normative drivers motivate most CSR practices while competitive drivers only significantly influenced the consumer-related CSR issues.

4.2. Robustness of Mathematical Models

The results in Table 2 present the PE scores obtained for the eight predicted mathematical models, ranging from −205.40% to 85.30%. The PEs registered for constructs GOi, IOi, ENi, CUi, and EMi are all positive, and the MAPEs are the same, at 51.92%, 78.74%, 29.34%, 38.93%, and 23.37%, respectively. This indicates that these models underestimated the corresponding dimensions of CSR implementation of the five interviewees' firms. Of these, the models for GOi and IOi do not yield high levels of accuracy in predicting a firm's CSR practices regarding government commitment and CSR institutional organiza-

tion. However, this does not indicate that the models are not informative, as they still provide useful insights into the influencing factors of a firm's CSR implementation. As the PEs for SHi and LCi contain negative values, the MPEs and MAPEs reveal different values. Collectively, these values indicate that the models relatively overestimated the corresponding dimensions of CSR implementation of the interviewees' firms. However, the relatively small MPEs and MAPEs of LCi (−5.10% and 12.19%) and SPi (12.86% and 25.07%) suggest that these models are relatively robust at predicting the interviewees' firms' CSR implementation that focuses on LCi and SPi. On the other hand, the relative imprecision of the three models (SHi, GOi, and IOi) may be largely caused by the small sample size adopted for the model validation process (n = 5).

Table 2. Comparison of actual and normalized predicted constructs.

Predicted Constructs (CSR Implementation)	Expert Code	Actual Constructs	Predicted Constructs (Normalized)	Percentage Error (%)	Mean Percentage (%)	Mean Absolute Percentage Error (%)
Shareholders' interests (SHi)	E1	3.972	5.425	−36.58%	−75.61%	75.61%
	E2	6.000	7.191	−19.85%		
	E3	7.000	7.863	−12.33%		
	E4	1.000	3.054	−205.40%		
	E5	2.000	4.078	−103.90%		
Government commitment (GOi)	E1	5.467	2.674	51.09%	51.92%	51.92%
	E2	6.272	3.585	42.84%		
	E3	7.000	2.928	58.17%		
	E4	6.246	2.081	66.68%		
	E5	5.030	2.977	40.82%		
CSR institutional arrangement (IOi)	E1	1.650	0.488	70.42%	78.74%	78.74%
	E2	7.000	1.029	85.30%		
	E3	6.650	1.029	84.53%		
	E4	2.647	0.541	79.56%		
	E5	3.000	0.783	73.90%		
Environmental preservation (ENi)	E1	4.364	3.376	22.64%	29.34%	29.34%
	E2	6.583	4.074	38.11%		
	E3	6.034	4.074	32.48%		
	E4	3.623	2.732	24.59%		
	E5	4.896	3.482	28.88%		
Customers' interests (CUi)	E1	5.378	3.659	31.96%	38.93%	38.93%
	E2	7.000	3.871	44.70%		
	E3	7.000	3.871	44.70%		
	E4	5.863	3.559	39.30%		
	E5	5.378	3.550	33.99%		
Employees' interests (EMi)	E1	6.505	4.245	34.74%	23.37%	23.37%
	E2	6.247	5.257	15.85%		
	E3	7.000	5.257	24.90%		
	E4	3.980	2.843	28.57%		
	E5	5.514	4.810	12.77%		
Suppliers' and partners' interests (SPi)	E1	2.275	2.969	−30.51%	12.86%	25.07%
	E2	6.701	4.177	37.67%		
	E3	6.677	4.298	35.63%		
	E4	3.299	2.949	10.61%		
	E5	4.000	3.563	10.93%		
Well-being of the local communities and the public (LCi)	E1	4.515	4.777	−5.80%	−5.10%	12.19%
	E2	6.485	5.714	11.89%		
	E3	6.000	5.651	5.82%		
	E4	3.000	3.641	−21.37%		
	E5	4.000	4.642	−16.05%		

4.3. Expert Interviews

This section presents the external validity of the resulting structural model, assessing the extent to which the structural model is comprehensive and applicable to the real Chinese construction industry.

4.3.1. Eight Dimensions of CSR Implementation

All five interviewees achieved a consensus that CSR implementation could be characterized in eight dimensions, namely, (i) shareholders' interests (SHi); (ii) government commitment (GOi); (iii) CSR institutional arrangement (IOi); (iv) environment preservation (ENi); (v) customers' interests (CUi); (vi) employees' interests (EMi); (vii) suppliers' and partners' interests (SPi); and (viii) well-being of the local communities and the public (LCi). Among these eight dimensions, interviewees E1, E2, E3, and E5 shared the view that fulfilling shareholders' interests should be the highest priority of firms' CSR implementation since construction firms must survive in the industry. In addition, interviewee E2 added that, for many firms, maintaining the sustainable benefits of shareholders is still fundamental to their continued existence and investment attractiveness.

Furthermore, interviewees E2, E3, E4, and E5 indicated that satisfying customers' interests is quite important as well, especially with the intense market competition. Moreover, E4 stated that, in addition to customers' issues, environmental preservation is one of the most important dimensions in contractors' CSR implementation. He highlighted that sustainable construction is becoming increasingly popular in the Chinese construction industry. Furthermore, construction firms should emphasize the environmental and social dimensions of CSR rather than focus only on shareholders' economic benefits.

In terms of the usefulness of developing a weighting system for different dimensions of CSR implementation to measure their impact on firms' CSR performance, all interviewees mutually agreed that it is necessary to develop a weighting system or a decision-supporting system. They stated that different firms might place different emphases on those eight CSR dimensions and, in turn, deploy differing objectives to balance and achieve diverse stakeholders' expectations and needs. Admittedly, there is potential to further explore the relative importance of every CSR dimension and then adopt a weighted scheme to integrate the eight CSR dimensions into one global evaluation system to assess construction firms' CSR performance.

4.3.2. Comprehensiveness and Practicality of the Resulting Structural Model

Concerning the practicality of the resulting structural model, all experts agreed that the resulting model has, to some extent, covered all the key influencing factors of CSR. Nevertheless, interviewee E1 mentioned that the model is sufficient only for providing an overview of the influencing factors and a reference for firms' CSR implementation. Meanwhile, interviewees E3 and E4 added that the situation might be different for small- and medium-sized enterprises (SMEs); they indicated that the influence of firms' annual turnovers on their CSR implementation could be further considered in the model.

All experts noted that it is imperative to consider the inter-relationships among those key influencing factors to understand construction firms' CSR implementation better. Consistent with the institutional and self-determination theories, the interviewees shared that it is necessary to consider both the internal organizational and external institutional factors in implementing CSR. Regarding the comprehensiveness of the resulting structural model, it seems that the experts agreed that the structural model captures the significant inter-relationships among the respective key influencing factors and the key CSR dimensions. However, it might be too complex for application in practice. Interviewee E1 shared that contractors' perceived importance of CSR practices largely influences firms' CSR implementation.

Some discussions arose regarding the resulting inter-relationships. For instance, for the negative influence of organizational resources and capability on contractors' perceived importance of the well-being of the local communities and the public (LCa) and employees'

interests (EMa), three interviewees (i.e., E2, E3, and E4) suggested that this negative impact was expected; here, interviewees E2 and E3 explained that when they have available resources and capabilities, they do not care about implementing CSR practices. They added that most firms would instead focus on market expansion approaches and explore new projects and development opportunities to achieve improved sustainable corporate benefits rather than voluntarily implement CSR practices, which cannot guarantee them potential benefits. Interestingly, interviewee E2 indicated that only when there are limited resources and capabilities do firms focus on implementing CSR for regulatory compliance. However, interviewee E5 expressed that this phenomenon is a little unexpected and highlighted that firms consider implementing CSR only when there are sufficient resources and capabilities. According to her, only the refined strategic layout of the restrained resources can provide construction firms with more opportunities and a better survival environment.

4.3.3. Needs for Construction Firms to Implement CSR Practices

In view of the need for China's construction firms to implement CSR practices over the next five or ten years, four interviewees (i.e., E2, E3, E4, and E5) believed that CSR has gradually attracted the attention of practitioners in China's construction industry, even though the mechanism for CSR implementation and regulation in the construction market is still in its infancy stage and that many barriers hinder effective CSR implementation. Interviewee E3 highlighted that firms should be strategic and seize the opportunity to gain a competitive edge with CSR implementation. Interviewees E3 and E4 explained that firms have a limited and narrow understanding of CSR and primarily confine CSR to donations to charitable causes. They added that small- and medium-sized enterprises (SMEs) would follow these practices if large firms took the lead in doing so within the industry. In response to this, E5 mentioned the following:

CSR is something that is beneficial to strategic development and corporate stakeholders. The main trend must be that the Chinese construction industry will pay more attention to environmental protection, carbon emissions, and water pollution. Thus, if consumers pay special attention to a specific dimension of CSR practices, and if a firm does well in this dimension, they will win the favor of customers. Besides, private firms are more aware of the role that CSR plays in the development of firms and businesses than state-owned firms. Compared with those state-owned firms, private firms have stronger demand for a "good reputation". Few private firms can have market dominance sufficient to make them ignore social evaluation, so they will pay more attention to the social effects and repercussions of CSR implementation and will pay more attention to the post-mortem evaluation of CSR projects. In this way, they can improve the reputation of the firm.

On the other hand, interviewee E1 argued that the overall prevailing environment of the construction industry is not optimistic, and that survival remains the primary organizational goal. She highlighted the need to implement more CSR practices but that the government and professional bodies should play a more active role in promoting CSR and educating firms on the benefits of its implementation. She added that firms' CSR efforts should not exceed the minimum requirements of the existing building standards, laws, and regulations and should consider customers' expectations and needs since any additional efforts might bring unnecessary burdens on effective business operation.

In addition, interviewees E2 and E4 indicated that it is critically important to improve the consciousness of CSR implementation among construction firms, the public, and society. They agreed that using industry advocation and education on CSR and improving awareness among clients might help to promote CSR implementation within construction firms. Three interviewees (i.e., E2, E3, and E4) pointed out the need to establish a comprehensive CSR performance evaluation system in the construction industry, through which construction firms can report the direct and indirect economic, social, and environmental dimensions of CSR implementation to their stakeholders. For government authorities, this might help improve contractors' perceived importance of CSR practices and standardize and supervise construction firms' CSR implementation.

4.4. Model Application

In this study, the developed structural model provided helps top management in construction firms to better understand which factors influence their organizational CSR implementation and to what extent. Theis allows construction firms to obtain valuable insights into the improved implementation of different dimensions of CSR practices and informs the government and professional bodies of the current status of CSR implementation in order to propose strategies to promote CSR development in the industry accordingly. Eight checklists were established to help construction firms link internal organizational and external institutional factors to the eight dimensions of CSR implementation.

For illustration purposes, the application of the checklist for contractors' CSR practices that focus on the shareholders' interests (SHi) is discussed here. Figure 3 presents the checklist for contractors' configuration and implementation of CSR practices that focus on shareholders' interests (SHi). It can be seen that SHa and LCa are the key factors that influence SHi. The weights (ω) assigned indicate the importance of individual measurement items within their respective constructs. In this way, top management can obtain valuable insights into the critical features of the CSR practices that focus on the shareholders' interests (SHi) and thus enable them to prioritize their concerns.

Figure 4 examines the relationships between the perceived importance of SHa and LCa in conjunction with the implementation of CSR that focus on SHi based on the results from the correlation analysis (Pearson's) that determined the strength of associations between the measurement items of corresponding constructs (dimensions). The rule of thumb for evaluating Pearson's correlation coefficient (r) indicates 0.10–0.29 as a weak, 0.30–0.49 as a moderate, and 0.50–1.0 as a strong correlation [55]. Following this, top management can configure and implement appropriate CSR practices to fulfill shareholders' interests (SHi). Taking an example in which top management seeks to optimize corporate governance and guarantee shareholders' participation in corporate decision making on major corporate affairs and income distribution (SHi3) for better fulfillment of shareholders' interests (SHi), they should assess their attitude toward the importance of SHa1, SHa2, LCa2, LCa5, LCa6, LCa7, and LCa8, as shown in Figure 4. Of these, top management should consider the weights of individual measurement items' absolute effects (i.e., the magnitude of influence) of their attitude toward the importance of SHa (0.839) and LCa (0.311) on their implementation of the SHi dimension of CSR. These magnitudes of influence indicate that top management should place greater emphasis on the importance of shareholders' interests (SHa), followed by the importance of the well-being of the local communities and the public (LCa).

Next, top management should consider balancing the inter-relationships between the perceived importance of SHa, organizational culture (OC), and external institutional competitiveness-related mimetic factors-1 (MI1) toward increasing the organizational perceived importance of SHa. These perceptions, in turn, may promote contractors' CSR practices that focus on the shareholders' interests (SHi). Figure 5 summarizes the relationships among the perceived importance of SHa, OC, and MI1. Consistent with the aforementioned example, in the event that top management considers improving the perceived importance of SHa1 and SHa2 (in addition to LCa2, LCa5, LCa6, LCa7, and LCa8) in their attempts to improve SHi3, they might be less driven by IN6 and instead largely driven by the desired benefits of enhanced interpersonal harmony (MI9), credibility and networking opportunities (MI11), investment attractiveness (MI12), and business opportunities (MI13). Similarly, Figure 6 summarizes the relationships between contractors' perceived importance of SHa, LCa, and CNO. When considering increasing contractors' perceived importance of SHa, top management and government authorities should pay attention to the critical role of external factors. These external coercive and normative forces might include pressures from the customers (CU4), shareholders (CO5), and local communities (NO4); the increased social responsibility awareness and expectations of society and the public (NO1); pressures from the media to focus on and disclose contractors' CSR practices (NO2); and CSR globalization and social culture (NO3). On the other hand, government authorities

can leverage external coercive and normative forces to improve contractors' perceptions of the importance of CSR practices that focus on LCa. Doing so can ultimately promote their implementation of the shareholders' interests dimension of CSR practices (SHi).

The above describes the application of the checklist for the shareholders' interests (SHi) dimension of CSR implementation in contractors. The assessment of other dimensions of CSR implementation can follow a similar procedure discussed previously, whereby practitioners would need to cross-reference the proposed guide, as highlighted in every checklist, to gain additional information on the relationships between the measurement items of respective constructs.

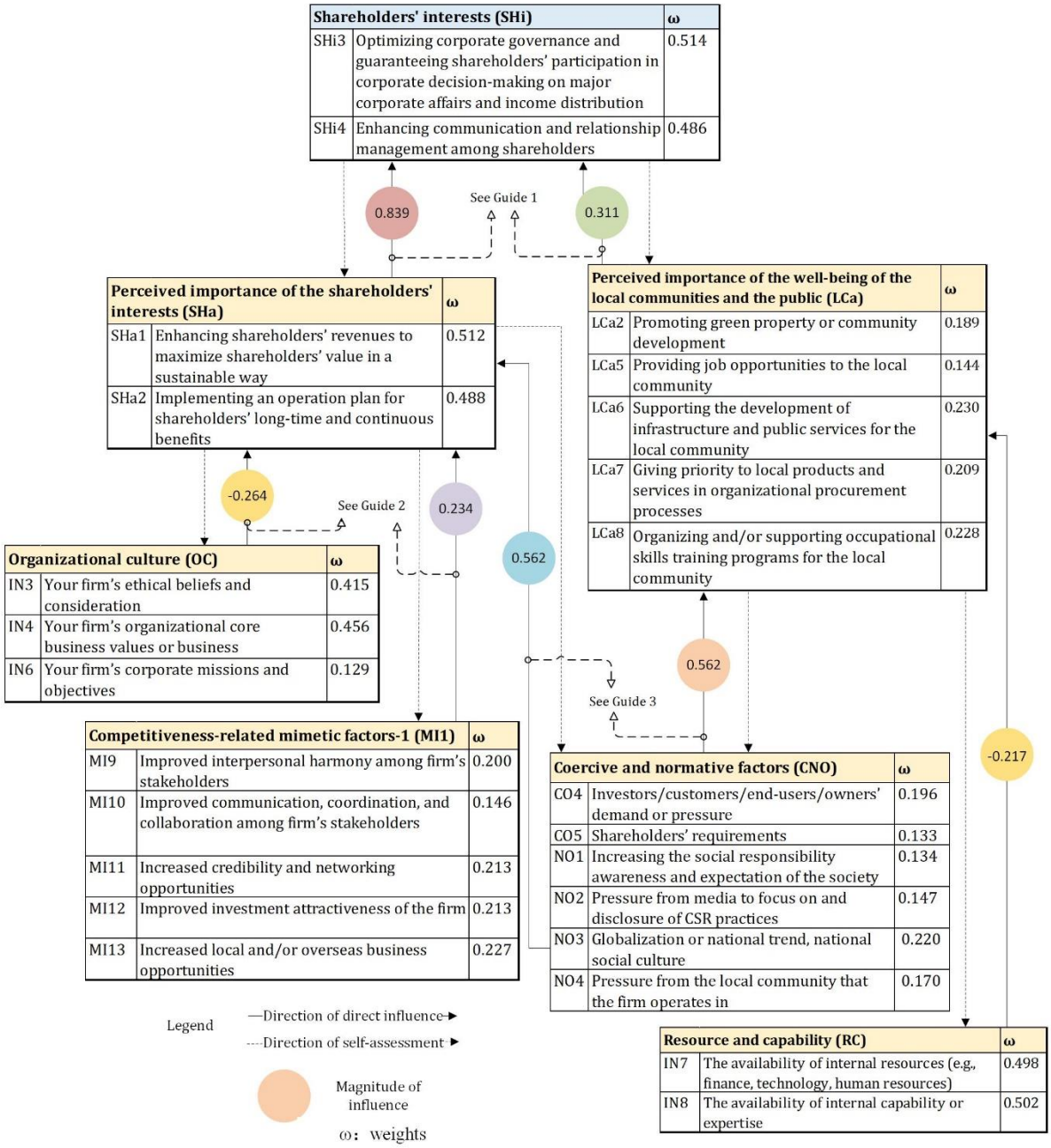

Figure 3. Checklist for firms' CSR implementation regarding the shareholders' interests (SHi).

			Shareholders' interests (SHi)	
	Item code / description		Optimizing corporate governance and guaranteeing shareholders' participation in corporate decision-making on major corporate affairs and income distribution	Enhancing communication and relationship management among shareholders
			SHi3	**SHi4**
Shareholders' interests (SHa)	**SHa1**	Enhancing shareholders' revenues to maximize shareholders' value in a sustainable way	↑↑↑ (0.734**)	↑↑↑(0.690**)
	SHa2	Implementing an operation plan for shareholders' long-time and continuous benefits	↑↑↑ (0.805**)	↑↑↑ (0.716**)
Well-being of the local communities and the public (LCa)	**LCa2**	Promoting green property or community development	↑↑ (0.315**)	↑(0.208*)
	LCa5	Providing job opportunities to the local community		
	LCa6	Supporting the development of infrastructure and public services for the local community	↑↑ (0.342**)	↑↑ (0.319**)
	LCa7	Giving priority to local products and services in organizational procurement processes	↑ (0.296**)	
	LCa8	Organizing and/or supporting occupational skills training programs for the local community	↑ (0.291**)	↑ (0.227*)

Notes: *↑ = significant weak positive correlation between two measurement items; ↑↑ = significant moderate positive correlation between two measurement items; and ↑↑↑ = significant strong positive correlation between two measurement items. ** and * denote significance at the 0.01 and 0.05 levels, respectively. Results were extracted from the correlation analysis. The grey cells denote that there are no significant correlations between the two measurement items, similarly hereafter.*

Figure 4. Relationship guide 1 for checklists of corporate social responsibility I implementation.

			Organizational culture (OC)			**Competitiveness-related mimetic factors-1 (MI1)**				
	Item code / description		Your firm's ethical beliefs and consideration	Your firm's organizational core business values or business imperatives	Your firm's corporate missions and objectives	Improved interpersonal harmony among the firm's stakeholders	Improved communication, coordination, and collaboration among the firm's stakeholders	Increased credibility and networking opportunities	Improved investment attractiveness of firm	Increased local and/or overseas business opportunities
			IN3	**IN4**	**IN6**	**MI9**	**MI10**	**MI11**	**MI12**	**MI13**
Shareholders' interests (SHa)	**SHa1**	Enhancing shareholders' revenues to maximize shareholders' value in a sustainable way			↓ (−0.256*)	↑ (0.264*)		↑ (0.235*)	↑↑ (0.300**)	↑ (0.294**)
	SHa2	Enhancing communication and relationship management among shareholders			↓ (−0.262*)				↑ (0.258*)	↑ (0.226*)
Employees' interests (EMa)	**EMa12**	Supporting the existence of trade unions and their functions	↑ (0.274**)	↑ (0.257*)						
	EMa13	Maintaining communication and dialog with trade unions	↑ (0.285**)	↑ (0.227*)						
	EMa14	Caring for employees and their families		↑ (0.294**)		↑ (0.208**)		↑ (0.260*)		
	EMa15	Providing support to help employees to achieve work-life balance	↑↑ (0.302**)	↑ (0.268*)				↑ (0.266*)		

Notes: *↑ = significant weak positive correlation between two measurement items; ↑↑ = significant moderate positive correlation between two measurement items; and ↑↑↑ = significant strong positive correlation between two measurement items. ↓ = significant weak negative correlation between two measurement items. ** and * denote significance at the 0.01 and 0.05 levels, respectively. Results were extracted from the correlation analysis. The grey cells denote that there are no significant correlations between the two measurement items, similarly hereafter.*

Figure 5. Relationship guide 2 for checklists of corporate social responsibility implementation.

	Item code / description		Coercive and normative factors (CNO)					
			Investors/customers/end-users/owners' demand or Pressure	Shareholders' requirements	Increasing social responsibility awareness and expectation of the society and public	Pressure from media to focus on and disclosure of CSR practices	Globalization or national trend, national social culture	Pressure from the local community that the firm operates in
			CO4	**CO5**	**NO1**	**NO2**	**NO3**	**NO4**
Shareholders' interests (SHa)	**SHa1**	Enhancing shareholders' revenues to maximize shareholders' value in a sustainable way	↑↑ (0.342**)	↑ (0.289**)	↑ (0.274**)		↑↑ (0.431**)	↑ (0.256*)
	SHa2	Enhancing communication and relationship management among shareholders	↑↑ (0.343**)	↑ (0.269*)			↑↑ (0.359**)	↑ (0.241*)
Well-being of the local communities and the public (LCa)	**LCa2**	Promoting green property or community development	↑↑ (0.314**)	↑↑ (0.314**)	↑↑ (0.328**)	↑ (0.296**)	↑↑ (0.366**)	↑↑ (0.354**)
	LCa5	Providing job opportunities to the local community	↑↑ (0.426**)			↑↑ (0.413**)		
	LCa6	Supporting the development of infrastructure and public services for the local community	↑↑ (0.448**)			↑↑ (0.353**)	↑ (0.291**)	↑↑ (0.424**)
	LCa7	Giving priority to local products and services in organizational procurement processes	↑↑↑ (0.504**)			↑↑ (0.418**)	↑↑ (0.331**)	↑↑ (0.404**)
	LCa8	Organizing and/or supporting occupational skills training programs for the local community	↑↑ (0.355**)	↑ (0.248*)		↑↑ (0.309**)	↑↑ (0.312**)	↑↑ (0.330**)

Notes: *↑ = significant weak positive correlation between two measurement items; ↑↑ = significant moderate positive correlation between two measurement items; and ↑↑↑ = significant strong positive correlation between two measurement items. ** and * denote significance at the 0.01 and 0.05 levels, respectively. Results were extracted from the correlation analysis. The grey cells denote that there are no significant correlations between the two measurement items, similarly hereafter.*

Figure 6. Relationship guide 3 for checklists of corporate social responsibility implementation.

5. Conclusions

Owing to external impetus and internal motives, CSR practices and their associated factors exhibit complex relationships. Leveraging such relationships can help construction practitioners to better configure their CSR practices, thereby attaining superior business performance and competitiveness. This study validates and applies eight mathematical models for predicting CSR implementation based on the empirical evidence from China's construction industry. These eight mathematical models involved the key CSR areas, whereby each dimension of CSR can be affected by distinguished sets of influencing factors characterized by various key measurement items. Results from the expert interviews further demonstrated the robustness, comprehensiveness, and practicality of the developed models. Accordingly, eight checklists were established to help construction firms link the various influencing factors to implementing the eight dimensions of CSR practices.

Theoretically, this study contributes to the current CSR in construction knowledge base by developing, validating, and applying the mathematical models for predicting CSR implementation that emphasizes the collective efforts of firms' strategies, cultural orientation, and resources and capabilities toward achieving CSR goals in pursuit of legitimacy in the institutional field. This is the first known study that systematically investigates the concept of CSR in construction and empirically demonstrates and validates the collective effects of various factors toward achieving CSR.

Practically, our findings contribute to the practice of construction industry practitioners who desire to be socially responsible leaders and attain superior competitive advantages. The proposed mathematical models provide means for the top management of firms to assess the levels of their firms' eight key CSR-focused areas. The predictive mathematical models together with the established checklists for the different key dimensions of CSR are also informative and valuable application tools for top management to assess and predict their CSR practices. For government authorities, these models and corresponding checklists also shed light on how to promote different dimensions of CSR implementation among practitioners in the construction industry in general.

However, it is acknowledged that this study has some limitations, primarily owing to its exploratory nature and the relatively small sample sizes of 90 and 5 used in model development and validation, respectively. The results of this study thus need to be carefully interpreted within the specific empirical context and offer only an indicative, rather than definitive, implementation of CSR in construction. In particular, we believe that different sizes and types of firms in different institutional fields could have different emphases on their CSR practices. This, thus, points to promising avenues for further comparative studies.

Author Contributions: Conceptualization, Q.Z.; methodology, Q.Z.; software, Q.Z.; formal analysis, Q.Z.; investigation, Q.Z.; writing—original draft preparation, Q.Z.; writing—review and editing, Q.Z., B.L.O. and B.T.H.L.; visualization, Q.Z.; supervision, B.L.O. and B.T.H.L.; project administration, Q.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the ethical standard of the Human Research Ethics and obtained Ethics Approval (HC 180938, 26 November 2019) from the University of New South Wales.

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

Data Availability Statement: Some or all data, models, or codes that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest: The authors declare that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Appendix 1. Interview Guide Questions

1. What is your opinion about the eight dimensions of the corporate social responsibility (CSR) implementation identified in the developed models (see below):
   - i. shareholders' interests;
   - ii. government commitment;
   - iii. CSR institutional organization;
   - iv. environmental preservation;
   - v. customers' interests;
   - vi. employees' interests;
   - vii. suppliers' and partners' interests; and
   - viii. well-being of the local community and the public.
2. Out of the eight dimensions of the CSR implementation in the developed model, which dimension(s) do you think has the largest impact on a firm's CSR performance?
3. Are there any other dimensions of CSR implementation that the developed model should have considered?
4. What do you think about the practicability of the developed model for Chinese construction firms?
5. Do you think that it would be useful for developing a weighting system for different dimensions of CSR implementation to measure their impact on a firm's CSR performance? How and why (or why not)?
6. Are there any other factors influencing CSR practices that the developed model should have considered?
7. Do you have any suggestions on promoting CSR implementation among Chinese construction firms?
8. What do you think about the needs or trends of the Chinese construction firms' CSR implementation in the next 5 to 10 years?

References

1. Lu, W.S.; Ye, M.; Flanagan, R.; Ye, K.H. Corporate Social Responsibility Disclosures in International Construction Business: Trends and Prospects. *J. Constr. Eng. Manag.* **2016**, *142*, 14. [CrossRef]
2. Ghosh, A.; Edwards, D.J.; Hosseini, M.R. Patterns and trends in Internet of Things (IoT) research: Future applications in the construction industry. *Eng. Constr. Archit. Manag.* **2021**, *28*, 457–481. [CrossRef]
3. Qi, J.D.; Ding, L.; Lim, S. Ontology-based knowledge representation of urban heat island mitigation strategies. *Sustain. Cities Soc.* **2020**, *52*, 101875. [CrossRef]
4. Qi, J.D.; Ding, L.; Lim, S. Planning for cooler cities: A framework to support the selection of urban heat mitigation techniques. *J. Clean. Prod.* **2020**, *275*, 122903. [CrossRef]
5. National Bureau of Statistics of China, 2021. Construction Enterprise Workforce 2021 Statistics. Available online: http://www.stats.gov.cn/english/ (accessed on 22 April 2022).
6. Statista Research Department, 2022. Construction Industry in Europe-Statistics & Facts. Available online: https://www.statista.com/statistics/1195197/employment-by-sector-in-europe/ (accessed on 22 April 2022).
7. US Census Bureau, 2021. Current Employment Statistics. Available online: https://www.bls.gov/ces/publications/highlights/2022/current-employment-statistics-highlights-01-2022.pdf (accessed on 22 April 2022).
8. Lim, H.W.; Zhang, F.; Fang, D.; Peña-Mora, F.; Liao, P.-C. Corporate Social Responsibility on Disaster Resilience Issues by International Contractors. *J. Manag. Eng.* **2021**, *37*, 04020089. [CrossRef]
9. Zhu, W.; Zheng, Y.; Ye, K.; Zhang, Q.; Zhang, M. Deterrence of Punitive Measures on Collusive Bidding in the Construction Sector. *Complexity* **2021**, *2021*, 9913413. [CrossRef]
10. Loosemore, M.; Sunindijo, R.Y.; Zhang, S. Comparative Analysis of Safety Climate in the Chinese, Australian, and Indonesian Construction Industries. *J. Constr. Eng. Manag.* **2020**, *146*, 10. [CrossRef]
11. Karakhan, A.A.; Gambatese, J.A.; Simmons, D.R.; Al-Bayati, A.J. Identifying pertinent indicators for assessing and fostering diversity, equity, and inclusion of the construction workforce. *J. Manag. Eng.* **2021**, *37*, 04020114. [CrossRef]
12. Xia, B.; Olanipekun, A.; Chen, Q.; Xie, L.L.; Liu, Y. Conceptualising the state of the art of corporate social responsibility (CSR) in the construction industry and its nexus to sustainable development. *J. Clean. Prod.* **2018**, *195*, 340–353. [CrossRef]
13. Manne, H.G.; Wallich, H. *The Modern Corporation and Social Responsibility*; American Enterprise Institute for Public Policy Research: Washington, DC, USA, 1987.

14. Jones, P.; Comfort, D.; Hillier, D. Corporate social responsibility and the UK construction industry. *J. Corp. Real Estate* **2006**, *8*, 134. [CrossRef]
15. Zhang, Q.; Oo, B.L.; Lim, B.T.H. Linking corporate social responsibility (CSR) practices and organizational performance in the construction industry: A resource collaboration network. *Resour. Conserv. Recycl.* **2022**, *179*, 106113. [CrossRef]
16. Guo, H.; Lu, W. Measuring competitiveness with data-driven principal component analysis: A case study of Chinese international construction companies. *Eng. Constr. Archit. Manag.* 2022, *ahead-of-print*.
17. Chang, R.D.; Zuo, J.; Zhao, Z.Y.; Zillante, G.; Gan, X.L.; Soebarto, V. Evolving theories of sustainability and firms: History, future directions and implications for renewable energy research. *Renew. Sustain. Energy Rev.* **2017**, *72*, 48–56. [CrossRef]
18. Loosemore, M.; Lim, B.T.H. Mapping corporate social responsibility strategies in the construction and engineering industry. *Constr. Manag. Econ.* **2017**, *36*, 67–82. [CrossRef]
19. Loosemore, M.; Lim, B.T.H.; Ling, F.Y.Y.; Zeng, H.Y. A comparison of corporate social responsibility practices in the Singapore, Australia and New Zealand construction industries. *J. Clean. Prod.* **2018**, *190*, 149–159. [CrossRef]
20. Zhang, Q.; Oo, B.L.; Lim, B.T.H. Drivers, motivations, and barriers to the implementation of corporate social responsibility practices by construction enterprises: A review. *J. Clean. Prod.* **2019**, *210*, 563–584. [CrossRef]
21. Loosemore, M.; Phua, F. *Corporate Social Responsibility in the Construction Industry: Doing the Right Thing*; Routledge: London, UK, 2011.
22. Bowen, H.R.; Johnson, F.E. *Social Responsibility of the Businessman*; Harper: New York, NY, USA, 1953.
23. Carroll, A.B. A three-dimensional conceptual model of corporate performance. *Acad. Manag. Rev.* **1979**, *4*, 497–505. [CrossRef]
24. Saeidi, S.P.; Sofian, S.; Saeidi, P.; Saeidi, S.P.; Saaeidi, S.A. How does corporate social responsibility contribute to firm financial performance? The mediating role of competitive advantage, reputation, and customer satisfaction. *J. Bus. Res.* **2015**, *68*, 341–350. [CrossRef]
25. Van Marrewijk, M. Concepts and definitions of CSR and corporate sustainability: Between agency and communion. *J. Bus. Ethics* **2003**, *44*, 95–105. [CrossRef]
26. Elmualim, A. CSR and sustainability in FM: Evolving practices and an integrated index. In *International High-Performance Built Environment Conference—A Sustainable Built Environment Conference 2016 Series*; Ding, L., Fiorito, F., Osmond, P., Eds.; Elsevier Science Bv: Amsterdam, The Netherland, 2017; pp. 1577–1584.
27. Haigh, N.; Griffiths, A. The Natural Environment as a Primary Stakeholder: The Case of Climate Change. *Bus. Strateg. Environ.* **2009**, *18*, 347–359. [CrossRef]
28. Ciliberti, F.; Pontrandolfo, P.; Scozzi, B. Logistics social responsibility: Standard adoption and practices in Italian companies. *Int. J. Prod. Econ.* **2008**, *113*, 88–106. [CrossRef]
29. Wuttke, M.; Vilks, A. Poverty alleviation through CSR in the Indian construction industry. *J. Manag. Dev.* **2014**, *33*, 119–130. [CrossRef]
30. Barthorpe, S. Implementing corporate social responsibility in the UK construction industry. *Prop. Manag.* **2010**, *28*, 4. [CrossRef]
31. European Commission. *GREEN PAPER: Promoting a European Framework for Corporate Social Responsibility*; Office for Official Publications of the European Communities: Brussels, Belgium, 2001.
32. Carroll, A.B. The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders. *Bus. Horiz.* **1991**, *34*, 39–48. [CrossRef]
33. Liao, P.C.; Liao, J.Q.; Wu, G.D.; Wu, C.L.; Zhang, X.L.; Ma, M.C. Comparing international contractors' CSR communication patterns: A semantic analysis. *J. Clean. Prod.* **2018**, *203*, 353–366. [CrossRef]
34. Xie, L.; Xu, T.; Le, Y.; Chen, Q.; Xia, B.; Skitmore, M. Understanding the CSR Awareness of Large Construction Enterprises in China. *Adv. Civ. Eng.* **2020**, *2020*, 8866511. [CrossRef]
35. Liao, P.C.; Xia, N.N.; Wu, C.L.; Zhang, X.L.; Yeh, J.L. Communicating the corporate social responsibility (CSR) of international contractors: Content analysis of CSR reporting. *J. Clean. Prod.* **2017**, *156*, 327–336. [CrossRef]
36. Duman, D.U.; Giritli, H.; McDermott, P. Corporate social responsibility in construction industry A comparative study between UK and Turkey. *Built Environ. Proj. Asset Manag.* **2016**, *6*, 218–231.
37. Lin, X.; Ho, C.M.F.; Shen, G.Q.P. Research on corporate social responsibility in the construction context: A critical review and future directions. *Int. J. Constr. Manag.* **2017**, *18*, 394–404. [CrossRef]
38. Xiong, B.; Lu, W.S.; Skitmore, M.; Chau, K.W.; Ye, M. Virtuous nexus between corporate social performance and financial performance: A study of construction enterprises in China. *J. Clean. Prod.* **2016**, *129*, 223–233. [CrossRef]
39. Deci, E.L.; Ryan, R.M. Self-Determination Theory: A Macrotheory of Human Motivation, Development, and Health. *Can. Psychol. -Psychol. Can.* **2008**, *49*, 182–185. [CrossRef]
40. Mayr, S. Corporate social responsibility in SMEs: The case of an Austrian construction company. *Int. J. Bus. Res.* **2015**, *15*, 61–72. [CrossRef]
41. Zhang, Q.; Oo, B.L.; Lim, B.T.H. Mapping Perceptions and Implementation of Corporate Social Responsibility for Construction Firms via Importance–Performance Analysis: Paths of Improvement. *J. Manag. Eng.* **2021**, *37*, 04021061. [CrossRef]
42. Brown, J.; Parry, T.; Moon, J. Corporate responsibility reporting in UK construction. *Proc. Inst. Civ. Eng.-Eng. Sustain.* **2009**, *162*, 193–205. [CrossRef]
43. Barnes, L.R.; Croker, N. The Relevance of the ISO26000 Social Responsibility Issues to the Hong Kong Construction Industry. *Constr. Econ. Build.* **2013**, *13*, 37–50. [CrossRef]

44. Loosemore, M.; Lim, B.T.H. Linking corporate social responsibility and organizational performance in the construction industry. *Constr. Manag. Econ.* **2017**, *35*, 90–105. [CrossRef]
45. Huang, C.F.; Lu, W.H.; Lin, T.T.; Wu, E.J. The Current Conditions of Csr Implementation in Construction Industry: A Lesson from Taiwan. *Appl. Ecol. Environ. Res.* **2017**, *15*, 67–80. [CrossRef]
46. Zhang, Q.; Oo, B.L.; Lim, B.T.-H. Modeling Influence Mechanism of Factors on Corporate Social Responsibility Implementation: Evidence from Chinese Construction Firms. *Eng. Constr. Archit. Manag.* 2022, *ahead-of-print*. [CrossRef]
47. Zhang, Q.; Oo, B.L.; Lim, B.T.H. Corporate social responsibility practices by leading construction firms in China: A case study. *Int. J. Constr. Manag.* **2020**, *22*, 1420–1431. [CrossRef]
48. Zhang, Q.; Oo, B.L.; Lim, B.T.-H. Key practices and impact factors of corporate social responsibility implementation: Evidence from construction firms. *Eng. Constr. Archit. Manag.* 2022, *ahead-of-print*. [CrossRef]
49. Jiang, W.Y.; Wong, J.K.W. Key activity areas of corporate social responsibility (CSR) in the construction industry: A study of China. *J. Clean. Prod.* **2016**, *113*, 850–860. [CrossRef]
50. Robson, C. *The Analysis of Qualitative Data*; Blackwell: Oxford, UK, 2002.
51. Lim, B.T.; Ling, F.Y.; Ibbs, C.W.; Raphael, B.; Ofori, G. Mathematical models for predicting organizational flexibility of construction firms in Singapore. *J. Constr. Eng. Manag.* **2011**, *138*, 361–375. [CrossRef]
52. Upton, G.; Cook, I. *A Dictionary of Statistics*; Oxford University Press: Oxford, UK, 2006.
53. Ali, W.; Frynas, J.G.; Mahmood, Z. Determinants of Corporate Social Responsibility (CSR) Disclosure in Developed and Developing Countries: A Literature Review. *Corp. Soc. Responsib. Environ. Manag.* **2017**, *24*, 273–294. [CrossRef]
54. Zhu, Q.H.; Zhang, Q.Z. Evaluating practices and drivers of corporate social responsibility: The Chinese context. *J. Clean. Prod.* **2015**, *100*, 315–324. [CrossRef]
55. Mukaka, M.M. Statistics Corner: A guide to appropriate use of Correlation coefficient in medical research. *Malawi Med. J.* **2012**, *24*, 69–71. [PubMed]