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How Individual's Proactive Behavior Helps Construction Sustainability: Exploring the Effects of Project Citizenship Behavior on Project Performance

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Abstract: Sustainable development has been commonly identified as a vital target in the construction industry. Studies have examined different management strategies and procedures to promote resource utilization efficiency, while the human factors in sustainable construction have received far less attention. This paper investigates the influence of Project Citizenship Behavior (PCB) on project performance in the sustainable construction context. After introducing the concept of "relationship sustainability," a moderating model is established. Data are collected from 152 experienced construction project managers in China. The results show positive relationships between most dimensions of Project Citizenship Behavior and construction sustainability performance, in spite of the negative effect of taking charge on relationship sustainability. Moreover, the degree of complexity of projects acts as a moderator in the relationship between Project Citizenship Behavior and construction sustainability performance. This paper endeavors to enrich the knowledge of sustainable construction by regarding human behavioral factors as important resources and explaining their effect on project sustainability, thus shedding light on the theory of sustainable construction by extending it to the micro-level analysis, as well as offering guidelines about how to raise the sustainability level of construction projects.

Keywords: project Citizenship behavior; sustainable construction; relationship sustainability; project performance; project complexity

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1. Introduction

Sustainable development has become a hot topic in both industry and academia in recent years, with more and more attention being paid to sustainability-related research [1–3]. In general, sustainable development involves initiatives and practices to help ensure the continuous development of the economy, society, and ecological environment. In the construction industry, the concept of "sustainable construction" was introduced with a view to reducing the potential adverse impact on the surrounding environment during the implementation of construction projects [4]. Although many significant studies have been conducted in this area, there are still two gaps that need to be analyzed:

1. At present, research on sustainable construction mainly focuses on the planning and designing phase, such as the management strategies [5], framework [6], and practical procedures [7,8]. However, due to the complexity and flexibility of a construction project, unanticipated changes and risks may arise at any moment. Thus, relying on the pre-design to achieve the aim of sustainable development is not sufficient [9]. Research on how to deal with uncertainties and improve sustainability in the implementation and maintenance phase is urgently needed. However, project team members are the direct decision makers and implementers who can react to risks and

changes immediately. Thus, it may help to take the capability and behaviors of project team members as predictors for the construction sustainability.

2. Many studies have been conducted on the sustainable use of resources and materials [10,11], focusing on how to improve the utilization efficiency of land [12], gas [13], and other non-renewable resources [14]. However, even though human resources are a vital resource in construction project management [15], few studies have investigated the sustainable use of human resources. In this paper, the individual's proactive behaviors are regarded as the human resource input in the implementation of construction projects; the project performance and cooperation relationships are the outcomes for evaluating the sustainability performance, while the upcoming cooperation in the future can be considered as the cyclic utilization of human resources.

Unlike manufacturing and other industries, construction projects are usually unique one-off tasks with a high level of complexity, along with higher requirements for efficient utilization of resources. Moreover, as they are embedded in both natural and social environments, with plenty of stakeholders involved, construction projects may encounter various risks and uncertainties during their implementation process. These characteristics may have a substantial impact on how team members perform their intra-role and extra-role duties in the context of job requirements that have a high degree of ambiguity [16], and may stimulate team members' motivation to overcome challenges by volunteering for extra work, even going beyond their job requirements. These spontaneous behaviors are referred to as Project Citizenship Behaviors (PCB) [17]. As mentioned above, PCB may help to deal with uncertainties [18] and changes during project construction, and promote the implementation of the project.

Moreover, the management organization in a construction project is built based on the project. Generally, when the project is complete, the management organization will be dissolved; when there is a new construction project, a new project team will be formed. As the construction project usually involves plenty of participants, the new cooperation of unacquainted participants requires extra negotiation and adaptation, which may cause extra transaction and communication costs [19]. If the project team members can reuse their relationships and have opportunities for repeated cooperation, the transaction costs may effectively be lowered [20]. This conservation of human resources may enhance the overall performance of the project and improve sustainable construction management.

In view of the above problems, this paper first reviews the current literature on sustainable construction, Project Citizenship Behaviors, and the impact of PCB on construction sustainability performance. Next, the original concept of "relationship sustainability" is introduced as an indicator for project sustainability performance, and hypotheses regarding the impact of PCB on construction projects' outcomes are proposed in the sustainable construction context. Next, the methodology is introduced, such as the adoption of scales, selection of respondents, distribution and collection of questionnaires, and testing of hypotheses. Then, the results of our analysis and findings are introduced. The important findings of our research are interpreted in the discussion section. Finally, the theoretical and practical implications, empirical limitations, and future research directions are introduced.

2. Theoretical Background

2.1. Sustainable Construction

As construction projects tend to be large-scale and long-lasting undertakings, they have a profound impact on the economy, environment, and society [21]. Lack of sustainability in construction may result in environmental damage including massive consumption of non-renewable natural resources, production of solid waste, noise, gas, and water pollution. Hence, sustainable construction management is of vital importance.

A large number of sustainable construction studies have focused on sustainable building [22–24], which is mainly concerned with the planning and design phase of construction. Sustainable building refers to architecture designed according to a sustainable development concept that aims to reduce energy consumption and pollution, improve resource conservation, and protect the environment. Merino et al. [25] summarized different alternative uses of demolition waste generated by construction projects and proposed various measures and strategies to improve the processing of this waste. Gutierrez and Lee [26] summarized techniques for optimizing and integrating sustainability-related functions in building design and discussed the advantages and benefits of these functions.

Another group of studies focused on macro-level sustainable construction, including sustainability assessment [27], best practices for sustainable construction [7,8], policy implementation [28], and investigations of driving factors [29]. Pitt et al. [30] explored the best practices and promotion of sustainable construction and suggested that the government or the project owner could promote the implementation of sustainable construction by setting financial rewards or penalties. She et al. [31] investigated the main factors hindering the sustainable development of infrastructure in southwest China and revealed four main hindering factors—"Economic Capacity," "Governance and Management," "Policy Instrument and Public Participation," and "Local Geographic Characteristics."

2.2. Project Citizenship Behavior

In order to capture an individual's work behavior that contributes to organizational effectiveness, "Organizational Citizenship Behavior" (OCB) was initially proposed. Early OCB researchers regarded citizenship behavior as being separate from in-role job performance and emphasized the idea that OCB should be viewed as both extra-role and organizationally functional [32,33]. According to their understanding, the OCB was defined explicitly as "individual behavior that is discretionary, indirectly or not explicitly recognized by the formal reward system, but in the aggregate promotes the effective functioning of the organization." [33] However, Graham [34] argued that previous definitions required scholars to distinguish in-role work from extra-role work, which is an inconsistent distinction that varies across individuals, job types, and organizations. To eliminate the inconsistency, he conceptualized OCB as a global notion that includes all positive in-role and extra-role behaviors of individual members of an organization. As this broader conceptualization provides a more theoretically grounded and comprehensive definition of OCB [35], has been adopted in this paper.

However, studies on dimensions of specific PCB are quite limited [17,36,37]. As PCB is the citizenship behaviors conducted by individuals in projects-based organizations, we reviewed the literature on citizenship behaviors and explored the research trend of its dimensions (see Figure 1). At the very beginning, scholars mainly focused on the general citizenship behavior in permanent organizations, and the initial division into dimensions was not specific. For example, Williams and Anderson [38] divided OCB into two dimensions, namely, organization-directed OCB (OCB-O) and individual-directed OCB (OCB-I). Later, dimensions that were more specific were defined by scholars. Podsakoff et al. [39] examined the literature on the OCB and other related constructs, and divided OCB into seven dimensions: (1) helping behavior, (2) sportsmanship, (3) organizational loyalty, (4) organizational compliance, (5) individual initiative, (6) civic virtue, and (7) self development. These dimensions were later widely used by scholars working in this research area.

As the depth of research went further, interest in organizational citizenship behaviors expanded from the field of organizational behavior to a variety of domains, including network citizenship behavior [17], and inter-organizational citizenship behavior [40]. Considering that citizenship behavior may not only exist in permanent organizations, scholars started to investigate citizenship behavior in some typical provisional organizations, such as projects [17] and teams [41]. One strand of this line of research was studies of project citizenship behavior (PCB) and its potential influence. Considering projects as temporary organizations, Braun and his colleagues [17] originally re-conceptualized OCB as PCB based on their exploratory study, and proposed the definition and dimensions of PCB. Project-specific helping behavior, project loyalty, project compliance, and project-proactive behavior were the four dimensions identified in their research. As these dimensions are similar to the dimensions of general OCB, we can regard PCB as an extension of OCB in the project context. In the same vein, several empirical studies about the antecedents and consequences of PCB were conducted.

Ferreira et al. [36] explored the relationship between citizenship behavior and project managers' performance in a comparative context of German and Portuguese project managers. Xia et al. [37] examined how work–family conflict could influence PCB among Chinese project managers.

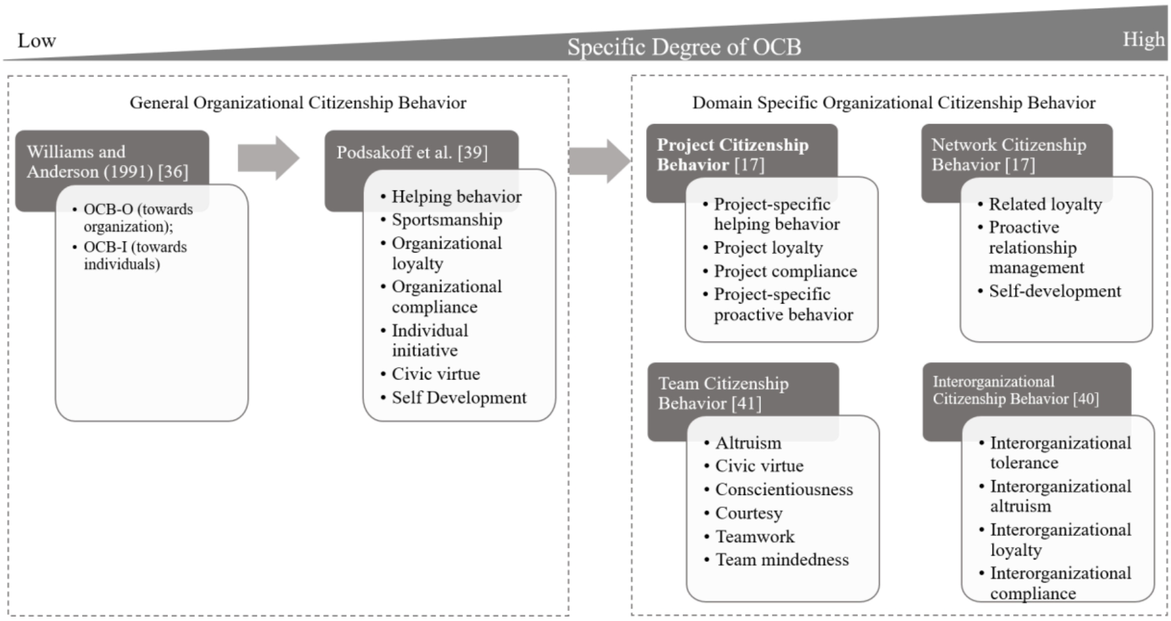

Figure 1. Research trend of organizational citizenship behaviors.

In the present study, we focus on four dimensions of PCB among managers, including helping behavior, project compliance, individual initiative, and taking charge. PCB is a comprehensive construct, with several dimensions consisting of several specific behaviors. However, the most typical dimension of PCB [39] is helping behavior, which has been identified by almost every scholar working in this area, and refers to proactive behavior directed at helping other team members finish their work or solve problems. As a construction project is team–based and time–limited, team members may actively take on work beyond their job responsibilities, or assist other team members who are under time pressure, which may help to improve the project performance. Project compliance is an extension of organizational compliance in the project context. This dimension has been studied for a long time in the citizenship behavior area and was defined as "generalized compliance" by Smith et al. [42], as "organizational obedience" by Graham [34], and as "following organizational rules and procedures" by Borman and Motowidlo [43]. It appears to capture an individual's internalization and acceptance of the rules, regulations, and procedures, which results in scrupulous adherence to them, even when no one is observing or monitoring them. The reason why compliance is regarded as citizenship behavior is that, although everyone is expected to obey regulations, rules, and procedures at all times, many employees simply do not do so. Therefore, an employee who religiously obeys all rules and regulations, even when nobody is watching, is regarded as an especially "good citizen." These two dimensions are identified by many scholars as affiliative behaviors, which are cooperative in nature and generally noncontroversial [35]. Therefore, they have been selected as indicators for PCB in this paper.

In contrast to affiliative behaviors, challenging behaviors are citizenship behaviors through which employees express constructive criticism of the status quo for the purpose of creating improvement via changes [44]. As a typical challenging behavior capturing wide-spread attention, personal initiative refers to behaviors aimed at ensuring the achievement of the project's objectives, which may even exceed formal job requirements and may result in the improvements in processes, products, or services [39]. Another kind of challenging behaviors is "taking charge," which refers to the voluntary and constructive efforts by individual employees to effect organizationally functional change with respect to how work is executed [45]. However, challenging behaviors may be considered aggressive by some team members and may lead to mixed outcomes [46,47]. For example, one experienced team member may discover latent risks and then give advice to the project manager or directly take actions to reduce it, but these actions may be somewhat offensive to his supervisors and colleagues.

2.3. Relationships between PCB and Construction Sustainability Performance

According to present studies in the OCB area, citizenship behaviors serves to promote the productive efficiency of permanent organizations, strengthen the cooperation and communication within the organization, increase organizations' financial performance, and enhance the risk management capability of the organization [39]. As sustainability is a higher expectation for project members, and PCB has something in common with OCB, the same pattern of influence may exist between PCB and project sustainability. In order to measure the sustainability level of a construction project, the concept of sustainability performance should be clarified. It can be defined as implementing the construction project while meeting the needs of all stakeholders and satisfying their aspirations for a better life without compromising the life quality of future generations [48]. Similar to corporate sustainability performance [49–52], construction sustainability performance also requires the balance among social development, economic development, and environmental sustainability.

In the past decades, a great deal of research has been done on the assessment of sustainable performance of construction projects and contractor activities [21,53–55]. Trufil and Hunter [56] developed a framework for small and medium contractors to evaluate their sustainability performance via four dimensions, including economic, environment, social and processes. Chen et al. [57] identified 33 sustainable performance criteria (SPC), based on the triple bottom line and the requirements of different project stakeholders, and grouped SPCs into seven dimensions. Shen et al. [58] divided a project life cycle into five major processes, and developed a project sustainability performance checklist with a total of 112 indicators.

Nevertheless, it might be quite difficult to evaluate the sustainability performance of a construction project on the basis of such large number of indicators [59]. Thus, composite indicators might be a better way to evaluate sustainable performance. Therefore, four composite indicators have been selected to depict the outcomes of a construction project from the perspective of sustainability, with a view to investigating whether PCB can improve sustainability performance in construction projects.

The "iron triangle" (cost, time, quality) is widely acknowledged as the most important goals in the implementation of construction projects. A project is considered successful if it is completed on time, within budget and meeting the required quality standards specified by the client [60].

As mentioned above, the concept of sustainable performance has been extended from purely environmental concerns to also include those related to social and economic issues, which made "cost" an essential indicator of economic sustainability. Almost all studies on sustainability assessment have taken cost as a proxy indicator [61–64]. According to Shen et al.'s checklist [58], indicators related to cost or budget appeared in all the five processes, and accounted for a large proportion of all indicators. Ugwu and Haupt [61] took direct cost and indirect cost as indicators for economic sustainability. Keeble et al. [62] defined the economic sustainability principle as whether the project can generate prosperity and enhance the affected economies and identified investment, tax, and profitability as detailed indicators.

Meanwhile, finishing the project on time will enhance the sustainability performance of the construction project to some extent. As sustainability requires environmental protection, social development, and economic development, we will explain the link between "on-time" and project sustainability performance from these three aspects. According to multiple literature, various kinds of pollution act as important indicators for environmental sustainability [59,65,66]. Wijethilake [65] considered reduced environmental impacts of production processes and reduced waste as indicators for environmental performance, and investigated ways to translate proactive sustainability strategy into corporate sustainability performance. Sixteen indicators, including specific effluent load, specific hazardous waste generation, and average noise level in the periphery, were identified by Singh et al. [59], showing that the environmental sustainability performance level could be evaluated based on these indicators. However, as these pollution and waste are the inevitable product resulting from construction work [66], meeting the pre-set schedule can reduce the duration of different kinds of pollution (noise, air pollution, water pollution, etc.) and waste that may be generated during the process of mechanized construction, and improve the environment protection. Meanwhile, meeting the schedule can also reduce the negative influence of the construction process to nearby residents and communities. The duration of above-mentioned pollution and the inconvenience brought by the construction will both decrease, which may improve the social development. Besides, finishing the project on time can also reduce the amount of overhead cost and provide a higher opportunity for the project to generate revenue at an earlier stage [67] and benefit the economic development.

In the construction industry, the concept of "quality" demands the fulfilment of both explicit and implicit requirements, and needs to be assessed from the perspectives of both the product and the process. In this regard, the scope of quality should extend to more comprehensive level, which also encompasses sustainable performance [68]. Kibert et al.'s study [69] introduced seven principles to evaluate sustainable construction performance, among which providing quality products played a vital role. Chen et al. [57] conducted a factor analysis and revealed that sustainability performance indicators can be grouped into seven dimensions, one of which was "quality." Achieving the quality goal can help to decrease the possibility of the need for future refurbishment and consequent waste of resources, contribute to the quality of human life, and offer long-term benefits to all stakeholders.

Since the "iron triangle" is highly relevant to the issue of sustainable construction, and the objectives of schedule, cost and quality are usually stated clearly, we chose time, cost, and quality as the fundamental indicators to measure the sustainable performance of the construction project.

Besides, as there has been a long absence of the human factors in the debate on sustainability performance [70], the efficiency of human resources is taking into account in this paper, as an indicator of construction sustainability performance. Since construction projects are mostly one-off temporary organizations, the project team only exists for a certain period and will be dismissed after the project. However, the cooperative and personal relationships among team members are a resource that can be "recycled" by cooperation in future projects. Suprapto et al. [71] proposed that another important criterion for evaluating a construction project is whether the participants have the intention to seek for opportunities to cooperate in the future. Therefore, this paper regards cooperation in the future as an important means of resource conservation, and defines relationship sustainability as the indicator. Specifically, the individual's proactive behaviors are regarded as the human resource input in the implementation of construction projects; the project performance and cooperation relationships are the outcomes for evaluating the sustainability performance, while the upcoming cooperation in the future can be considered as the cyclic utilization of human resources.

Based on the above arguments, we propose the following hypotheses:

Hypothesis 1. *Project citizenship behavior—helping behavior (H1a), project-based compliance (H1b), taking charge (H1c), and personal initiative (H1d)—will promote construction sustainability by realizing the objective of quality.*

Hypothesis 2. *Project citizenship behavior—helping behavior (H2a), project-based compliance (H2b), taking charge (H2c), and personal initiative (H2d)—will promote construction sustainability by realizing the objective of cost.*

Hypothesis 3. *Project citizenship behavior—helping behavior (H3a), project-based compliance (H3b), taking charge (H3c), and personal initiative (H3d)—will promote construction sustainability by realizing the objective of completion according to schedule.*

Hypothesis 4. *Project citizenship behavior—helping behavior (H4a), project-based compliance (H4b), taking charge (H4c), and personal initiative (H4d)—will promote construction sustainability by increasing team members' relationship sustainability (desire for future cooperation with team members).*

According to the current research, the repetition of tasks will hinder the generation of citizenship behaviors. Scholars have found that repetitive tasks may seem easy and boring to team members. Thus, if they are asked to perform repetitive tasks, their motivation to engage in proactive behaviors may be low. Similarly, if the task is easy and repetitive, proactive behavior may be less significant in promoting the completion of the task. In the sustainable construction context, construction projects are of different sizes, technical requirements, and levels of complexity, and these differences may act as moderators between PCB and construction sustainability performance. With this in mind, we introduce project complexity into our study, and propose the following hypothesis:

Hypothesis 5. *Project complexity acts as a moderator between PCB behavior and construction sustainability performance.*

The hypotheses we listed above are shown in Figure 2. This model illustrates the relationships among project citizenship behavior, sustainable construction performance, and project complexity.

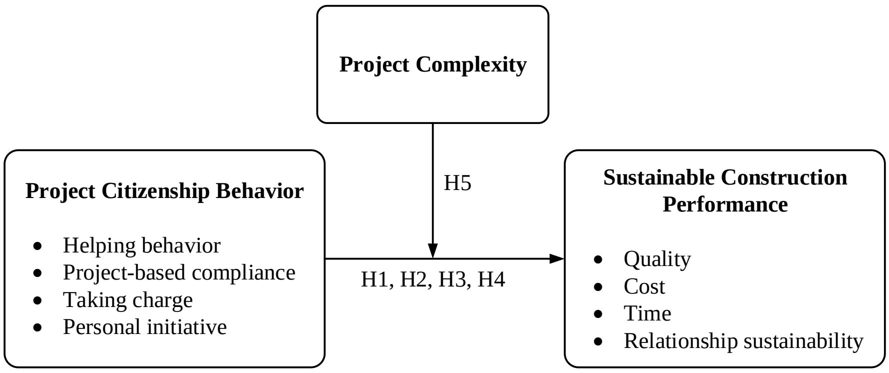

Figure 2. The model of the hypotheses.

3. Methodologies

3.1. Selection of Respondents and Distribution of Questionnaires

The respondents were asked to assess a project in which they had recently participated as the case and to evaluate the level of project citizenship behavior, construction sustainability performance, and the degree of complexity of the project. For our explorative study, we gained access to project managers by cooperating with the China Certified Chartered Builder Management Association and the China National Association of Engineering Consultants, two of the largest associations in the construction industry in China, and asked them for assistance in issuing questionnaires. The associations provided us with the names and e-mail addresses of sectional members from 22 provinces in China, most of whom were experienced project managers or consultants. Moreover, considering that the respondents need to have rich experience in construction projects, we set a threshold of three years of working experience and excluded some members using this filter. A link to our questionnaire was attached in the invitation e-mail that was sent to association members randomly. Members who were interested in this study could fill out the questionnaires online by following the link.

Finally, 350 questionnaires were issued, and 152 valid questionnaires were completed and returned, giving an effective response rate of 43.42%. As shown in Table 1, most of the respondents (64%) were project managers or leaders of the project team; the others were experienced consultants (19%) and project engineers (16%). Nearly two-thirds (65%) of the respondents had more than 10 years of experience in construction projects. The projects that the respondents used as cases were mostly civil engineering projects (37%), infrastructure projects (30%), and residential buildings projects (20%). The average duration of the case projects was 1.8 years.

Table 1. Descriptive analysis of the sample (n = 152).

Characteristics	Items	Frequency	Percentage
Gender	Male	121	80%
	Female	31	20%
Age	19–30	22	14%
	31–40	62	41%
	40–50	50	33%
	Over 50	18	12%
Experience	3–5 years	23	15%
	6–10 years	30	20%
	11–15 years	61	40%
	More than 15 years	38	25%
Type of occupation	Project manager and team leader	97	64%
	Consultant	29	19%
	Engineer	26	17%
Type of project	Infrastructure	46	30%
	Civil engineering	56	37%
	Public building	30	20%
	Commercial building	12	8%
	Industry factory	8	5%

3.2. Measurement

All variables in this study were assessed using a Likert seven-point scale (1 = do not agree at all, 7 = totally agree). All the scales were adopted from prior studies and converted into Chinese by the standard translation and back-translation method before the questionnaires were sent; that is, the original English version was translated into Chinese by a highly experienced native speaker, and another translator was asked to translate the Chinese scales back into English. After comparing the English versions and modifying the Chinese version, potential problems in translating were eliminated in order to make sure that the Chinese version expressed the accurate meaning accurately. Table 2 shows the variables and their dimensions, item numbers of the scales, and the corresponding studies to which we referred.

Table 2. Variables and their dimensions, item numbers of the scales, and corresponding research articles.

Variables		Dimensions	Items	Corresponding Research
Project Citizenship Behavior	ACB	Helping behavior	2	Braun et al. [16]
		Project-based compliance	5	
	CCB	Taking charge	6	Morrison and Phelps [45]
		Personal initiative	7	Frese et al. [72]
Project performance			4	Pheng and Chuan [73]
Project complexity			6	Qureshi and Kang [74]

3.2.1. Affiliative Citizenship Behavior

Respondents were asked to recall the affiliative citizenship behaviors in which they had engaged or with which they were involved in a recently completed project, and to evaluate their degrees. The measurement scales proposed by Braun et al. [16] were applied in this paper. Therefore, helping behavior (HB) and project-based compliance (P-BC) were accessed, with Cronbach's alpha for both above 0.7. Items measuring HB included "I offer the project team members a helping hand if they need it at some stage in the course of the project," and items measuring P-BC included "I conform to all contractual obligations I have in the project with great care."

3.2.2. Challenging Citizenship Behavior

Similarly, respondents were asked to recall the challenging citizenship behaviors in which they had engaged or with which they were involved in a recently completed project, and to evaluate their degrees. As typical examples of challenging behaviors, the two constructs of taking charge (TC) and personal initiative (PI) were assessed, with Cronbach's alpha for both around 0.9. The measurement scale developed by Morrison and Phelps [45] was applied to assess TC, with items including "I often try to correct a faulty procedure or practice." The scale proposed by Frese et al. [72] was adopted to measure PI, with items including "Usually I do more than I am asked to do."

3.2.3. Project Complexity

In this study, the scale developed by Qureshi and Kang [73] was used to measure project complexity. There were four indicators, namely non-linearity, context dependence, uniqueness and uncertainty. One of the sample questions was "the project is context-dependent."

3.2.4. Construction Sustainability Performance

In the project management context, the classical conception of the "iron triangle," including project quality, project time, and project cost [74] is widely used to evaluate project performance. Considering the characteristics of sustainable construction performance, this study used relationship sustainability together with the" iron triangle" to measure sustainable construction performance. The items were "the project met the quality targets," "the project met the time targets," "the project met the cost targets," and "I would prefer to cooperate again with team members in this project."

3.3. *Analysis*

SPSS 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp) and SmartPLS 3 (Ringle, C. M., Wende, S., and Becker, J.-M. 2015. "SmartPLS 3." Boenningstedt: SmartPLS GmbH) were used to finalize the analysis of the data. The data analysis process was divided into three phases. For the beginning, a reliability test was performed using SPSS 23.0. After that, in order to verify the convergent validity, an Exploratory Factor Analysis (EFA) was conducted using SmartPLS 3, and the discriminant validity was tested as well. Finally, the tests of the hypotheses were conducted using hierarchical regression analysis.

3.3.1. Reliability

Cronbach's reliability test was conducted at the beginning of the data analysis. The main purpose of the reliability test was to assess the internal consistency of the variables. Table 3 displays the Cronbach's alphas of the variables. The Cronbach's alpha coefficients of PCB, sustainable construction performance, and project complexity were 0.92, 0.88 and 0.87, respectively, suggesting a nice reliability level. The Cronbach's alpha coefficients of four dimensions in PCB, namely, helping behavior and project-based compliance (two dimensions of affiliative citizenship behavior), taking charge and personal initiative (two dimensions of challenging citizenship behavior), ranged from 0.75 to 0.91, which showed an acceptable reliability level. Moreover, the reliability of each indicator was assessed by checking whether the Cronbach's alpha coefficient of the corresponding variables increased after deleting the indicator, and the results showed that all the indicators passed the reliability test. Thus, the reliability of the variables was assured.

3.3.2. Validity

In order to test the convergent validity of each indicator of the variables, an EFA was conducted first. The four dimensions of PCB and other variables in this study were used to perform the factor analysis, with the varimax rotation in the principal component process. The results showed that all the indicators were strongly loaded on one separate dimension, and their factor lodgings were above 0.50, suggesting that all the indicators showed acceptable validity in measuring the corresponding variables. There was only one exception: the indicator "non-linearity" in the variable "project complexity" failed in loading on any variable with a factor loading above 0.50. As a result, it was removed. After removing "non-linearity," the result of convergent validity was displayed in Table 4. The factor loadings range (0.774–0.917) was above the threshold value of 0.50, the average variance extracted (AVE) values (0.564–0.673) were above the threshold value of 0.50, and the construct reliability (CR) values (0.875–0.967) were above the threshold value of 0.60. Thus, all the variables discussed in this paper exceeded the convergent validity criteria.

Table 3. The results of Cronbach's reliability test.

	Cronbach's Alpha Coefficient
Project citizenship behavior	0.92
Affiliative citizenship behavior	0.89
Helping behavior	0.91
Project-based compliance	0.75
Challenging citizenship behavior	0.90
Taking charge	0.82
Personal initiative	0.89
Sustainable construction performance	0.87
Project complexity	0.88

Table 4. Result of convergent validity.

		FL	**AVE**	**CR**
Project citizenship behavior			0.594	0.967
Affiliative citizenship behavior			0.641	0.926
Helping behavior	HB_01	0.917	0.945	0.972
	HB_02	0.917		
Project-based compliance	P-BC_01	0.839	0.643	0.900
	P-BC_02	0.887		
	P-BC_03	0.830		
	P-BC_04	0.826		
	P-BC_05	0.842		
Challenging citizenship behavior			0.540	0.937
Taking charge	TC_01	0.789	0.672	0.925
	TC_02	0.870		
	TC_03	0.885		
	TC_04	0.882		
	TC_05	0.865		
	TC_06	0.817		
Personal initiative	PI_01	0.855	0.564	0.900
	PI_02	0.776		
	PI_03	0.839		
	PI_04	0.774		
	PI_05	0.761		
	PI_06	0.754		
	PI_07	0775		
Project performance	PP_01	0.879	0.638	0.875
	PP_02	0.872		
	PP_03	0.873		
	PP_04	0.781		
Project complexity	PC_01	–	0.673	0.911
	PC_02	0.863		
	PC_03	0.844		
	PC_04	0.904		
	PC_05	0.817		
	PC_06	0.852		

The square roots of AVEs and the corresponding correlations were then compared to test the discriminant validity of variables. A satisfactory discriminant validity of one variable requires that its square root of AVE should be greater than the corresponding correlations. Table 5 shows the square roots of AVEs (in brackets) and the corresponding correlations among all variables (in the next lines of the square roots of AVEs). It is evident that all the variables' square roots were greater than their corresponding correlations; that is, all the variables passed the discriminant validity test.

Table 5. Result of discriminant validity.

	1	2	3	4	5	6
1. Helping behavior	(0.972)					
2. Project-based compliance	0.731 **	(0.802)				
3. Taking charge	0.685 **	0.709 **	(0.820)			
4. Personal initiative	0.784 **	0.651 **	0.710 **	(0.751)		
5. Project performance	0.694 **	0.663 **	0.633 **	0.715 **	(0.799)	
6. Project complexity	0.588 **	0.655 **	0.787 **	0.631**	0.734 **	(0.820)

** Denotes significance at the 5% level.

3.3.3. Hierarchical Regression Analysis

It should be noted that before the hierarchical regression analysis, a multicollinearity test was first conducted to make sure that there was no redundant information in all independent variables. The variance inflation factor (VIF) was conducted first to establish whether there was a multicollinearity problem in the regression analysis process. The results indicated that all the VIFs ranged from 1.149 to 1.751, and were, thus, below the threshold of 5.0—that is, the independent variables did not correlate with each other [75].

The hypotheses were tested using hierarchical regression. In step 1, gender, age, experience, type of occupation, and type of project were inputted into the model as control variables. In step 2, the four dimensions of project citizenship behavior, the independent variables, were inputted into the model. In step 3, project complexity, the moderator in this study, was inputted into the model to examine whether project complexity has direct effects on sustainable construction performance. Finally, the interactions "PCB × project complexity" were inputted into the model to examine project complexity's moderating effects. Table 6 summarizes the results of the mentioned hierarchical regression analysis described above.

Table 6. The results of hierarchical regression analysis.

	Quality				**Cost**				**Time**				**Relationship Sustainability**			
Step 1																
Gender	−0.01	−0.02	−0.02	−0.02	−0.16	−0.13 *	−0.17	−0.19 *	−0.03	0.02	−0.03	−0.03	0.12	0.07	0.05 ***	0.06
Age	−0.02	0.01	−0.01	−0.02	−0.20	−0.14	−0.13	−0.12	0.17	0.19	0.15	0.14	0.04	0.02	0.02	−0.03
Tenure	0.18 **	0.20 *	0.19	0.17	0.24	0.20 *	0.19 *	0.18	0.07	0.11	0.08	0.09	0.04	0.05	−0.02	0.03
TO	0.08	0.10	0.10	0.09	0.15	0.09	0.10	0.10	0.04	0.03	0.00	−0.01	0.06	0.04	0.02	0.03
TP	−0.22 *	−0.20 *	−0.18 *	−0.24 **	−0.23 *	−0.19 *	−0.19 **	−0.18 **	−0.29 *	−0.25 **	−0.22 *	−0.24	0.07	0.04	0.05	0.03
Step 2																
HB		0.15 **	0.22 **	0.21 **		0.07	0.05	0.03		0.14 *	0.12 *	0.12 *		0.03 *	0.0 2*	0.02 *
P-BC		0.20 ***	0.18 ***	0.17 ***		0.18 **	0.15 **	0.12 **		0.13 *	0.12	0.10		0.14 *	0.15	0.12
TC		−0.09 *	0.13 *	−0.10 *		0.13	0.10	0.06 *		0.06 **	0.09 **	0.04 **		−0.06 **	−0.04 **	−0.07 **
PI		−0.13	−0.15	−0.09		0.13	0.09	0.06		0.06	0.03	0.02		0.19 **	0.22 **	0.15 **
Step3																
PC			−0.04 **	−0.02 **			−0.14 *	−0.08 *			0.03	−0.02			0.10 **	0.07 **
Step 4																
HB × PC				0.07 **				0.03				0.10*				0.03 *
P-BC × PC				0.03				0.09				0.07				0.02
TC × PC				0.06				0.16				0.03 **				0.04
PI × PC				0.13 *				0.33 **				0.04 **				0.03
△R2	0.02	0.07	0.10	0.14	0.05	0.05	0.10	0.06	0.05	0.02	0.03	0.07	0.12	0.05	0.09	0.07
F	1.24	2.33	2.75 **	3.47 **	3.21 *	4.76 *	3.65 *	4.13	3.54 *	2.27 *	4.03 **	4.42 **	1.39	1.77	2.49	2.24 **

* Denotes significance at the 10% level. ** Denotes significance at the 5% level. *** Denotes significance at the 1% level.

4. Test of the Hypotheses

4.1. PCB and Construction Sustainability Performance

The first four hypotheses we proposed in Section 2 concern the correlation between PCB and construction sustainability performance. The analysis shows that all four types of PCB are correlated with more than one indicator of sustainable construction performance at the significant level of $p < 0.05$ (shown in Table 6).

In accordance with the current literature, most affiliative behaviors can help to enhance construction sustainability. As shown in Table 6, the achievement of quality is positively correlated with helping behavior ($\beta = 0.21$, $p < 0.05$), project time ($\beta = 0.12$, $p < 0.1$) and perceived relationship sustainability ($\beta = 0.02$, $p < 0.1$), while there is no significant effect of helping behavior on project cost. Thus, H1a, H3a, and H4a are supported, while H2a is rejected. As for project-based compliance, the influence of project-based compliance on quality ($\beta = 0.17$, $p < 0.01$) and project cost ($\beta = 0.12$, $p < 0.05$) are significantly positive, indicating that project-based compliance can contribute to the achievement of quality and cost objectives. The effects of project-based compliance on project time and perceived relationship sustainability are not significant. Thus, H1b and H2b are supported, while H3b and H4b are rejected.

The results of challenging behaviors seem to be more complicated. Taking charge is positively related to the achievement of cost objectives ($\beta = 0.06$, $p < 0.1$) and time objectives ($\beta = 0.04$, $p < 0.05$) at a significant level, and is negatively related to project quality ($\beta = -0.10$, $p < 0.1$) and perceived relationship sustainability ($\beta = -0.07$, $p < 0.05$). Thus, H2c and H3c are supported, while H1c and H4c are rejected. Personal initiative shows a positive correlation with perceived relationship sustainability ($\beta = 0.15$, $p < 0.01$), while the effects on project quality, cost, and time are not significant. Thus, H4d is supported, while H1d, H2d and H3d are rejected.

4.2. Project Complexity as the Moderator

As proposed in H5, project complexity acts partially as a moderator between PCB and sustainable construction performance, indicating that PCB will be more significant in promoting the completion of projects with higher complexity (shown in Table 6). Specifically, the positive moderating effects of project complexity between helping behavior and project quality ($\beta = 0.07$, $p < 0.05$), project time ($\beta = 0.10$, $p < 0.1$) and perceived relationship sustainability ($\beta = 0.03$, $p < 0.1$) are significant; the positive moderating effect of project complexity between taking charge and project time ($\beta = 0.03$, $p < 0.05$) is significant, and the positive moderating effects of project complexity between helping behavior and project quality ($\beta = 0.13$, $p < 0.1$), project time ($\beta = 0.33$, $p < 0.05$) and project cost ($\beta = 0.04$, $p < 0.05$) are significant. However, other moderating effects were not found to be significant.

5. Discussions

This paper took an individual's proactive behavior and cooperative relationships among team members as important resources in a construction project and examined their effect on project performance in a sustainable construction context. More specifically, different effects of affiliative and challenging project citizenship behaviors on project performance, including quality, cost, time, and relationship sustainability were investigated, respectively, and the moderating role of project complexity on the above relationships was tested. Several findings were made, as follows:

1. Helping behavior, which is the most representative affiliative citizenship behavior, has positive effects on project quality, project time, and relationship sustainability. When helping behavior occurs in the construction project, tasks and problems can be solved more efficiently, and the quality and schedule of the project can be improved. Moreover, a feeling of kindness and friendliness will be generated during the process of helping behavior among team members,

which may trigger the desire for future cooperation and improve relationship sustainability in the construction projects.

2. Project-based compliance, the other dimension of affiliative citizenship behavior, has positive effects on project quality and project cost. A higher level of project-based compliance leads to team members better obeying the operation procedures and regulations, which helps in avoiding a decrease in project quality, and reduces project costs.
3. Taking charge, which is one dimension of challenging citizenship behavior, has positive effects on project cost and project time but showed a negative effect on relationship sustainability. One of the key characteristics of construction projects is ambiguity, which means job requirements or expectations for project team members may not be very clear. Taking charge helps in clarifying the scope of each member's duty and decreases the negative effect of ambiguity, which further promotes the achievement of cost and time goals. However, taking charge is sometimes regarded as aggressive behavior and may cause competition and lead to an unequal status among the team members, and this may be the reason it has a negative effect on relationship sustainability.
4. Personal initiative was tested to have a positive effect on relationship sustainability. Compared with taking charge, personal initiative is less aggressive and may give other team members the impression that the team member displaying this behavior is responsible and aspiring; as a result, others may prefer to cooperate again with team members with higher levels of personal initiative.
5. The degree of complexity of projects acts as a moderator between PCB and construction sustainability performance. Specifically, PCB shows a more obvious promotion degree for construction sustainability performance in projects with higher degrees of complexity. The reason may be that complex projects are more challenging for team members, encouraging them to tackle difficulties and solve problems.

6. Conclusions

In this paper, an individual's project citizenship behavior and the cooperative relationship among team members were deemed as important resources in a construction project, and the effect on project performance in a sustainable construction context was examined. Using a questionnaire survey and hierarchical regression analysis, five hypotheses on the direct effects and moderating effects were tested. The results showed that most effects of PCB on project performance were positive, despite the dimension of taking charge negatively predicting relationship sustainability. These findings indicate the important role of the individual's behavior and interpersonal relationships as special resources in sustainable construction.

The results of this study enrich the literature on both sustainable construction and project citizenship behaviors. Theoretically, for research on sustainable construction, almost all previous research was concerned with macro-level sustainable strategies or technical practices to improve energy utilization efficiency and natural resources recycling; this paper takes the individual's behavior into consideration and extends sustainable construction research to a micro behavioral level. Moreover, this paper introduced the concept of relationship sustainability, which was regarded as an indicator for construction sustainability performance, connecting these two important constructs, sustainability and citizenship behaviors in the project context, and extending the scope of sustainable construction and citizenship behaviors. From the perspective of construction industry practices, this paper may offer guidelines for general construction projects regarding how to promote sustainability. Considering the positive effects of PCB on project performance, the PCB of team members in a construction project should be regarded as promoting project performance, especially in a situation in which most technical measures are not sufficient to achieve the performance goal.

However, this study has certain limitations on account of its measurement and analysis methods, meaning that further discussion and research is needed. First, the common method bias may be a problem because all the data are self-reported. The participants may have misrepresented their level of PCB out of vanity and consideration of social acceptability. However, research has shown that method variance can only weaken the interactions between different variables, rather than creating nonexistent interactions, which means the key to this study is not the common method bias. Second, some other dimensions of PCB mentioned in other studies were ignored in this study. Only four dimensions of PCB were chosen, as they are usually considered as the most representative indicators of PCB. Also, there might be another way to measure sustainable construction performance at the same time. Finally, informants were selected from several provinces in China and the sample was not very large, so the generalizability of conclusions might be limited.

As a consequence, there are several directions for future research. First, more and more indicators have been found to reflect project performance in the project life cycle. Most of the indicators are relevant to sustainability, and the effects of PCB on the factors can be further investigated. Second, not only project complexity, but also other variables, like the scope and duration of project, may also be considered as effective moderators. Future studies can make efforts to explore other moderating variables. Last, better analysis methods, such as bootstrapping and longitudinal studies, may help to confirm the results and gain results that are more reliable.

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