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An Exploratory Study on the Impact of Cross-Organizational Control and Knowledge Sharing on Project Performance

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Abstract: In order to study how cross-organizational control and knowledge sharing affect project performance during a whole process engineering consulting project, this paper constructs a theoretical model of cross-organizational control, knowledge sharing, and project performance and uses a structural equation model (SEM) to conduct an empirical analysis of questionnaire data. The results showed that trust can promote two types of project performance, while contractual control stimulates basic performance but does not significantly impact value-added project performance. The mediation results showed that tacit knowledge plays an intermediary role between trust and two types of project performance, while explicit knowledge plays an intermediary role between contractual control and basic project performance. The results of this paper will further enrich the application of knowledge sharing in the field of project management, open the "black box" of project performance in whole process engineering consulting, and provide owners with guidance to achieve value-added project performance.

Keywords: whole process engineering consulting; cross-organization control; knowledge sharing; project performance; empirical analysis

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1. Introduction

The general contracting model of engineering procurement and construction (EPC) remains one of the main models adopted in domestic and foreign project contracts. In EPC projects, the owner entrusts the general contractor to be responsible during the entire process of the project [1]. Throughout this process, the owner gives the contractor the right to fully operate the project, which makes it difficult for the owner to obtain tacit information about the project. In order to avoid opportunistic behavior by the contractor, the owner needs to introduce a whole process engineering consulting team to control and supervise the contractor's behavior. The concept of the whole process engineering consulting organization model was mentioned in the "Opinions on Promoting the Sustainable and Healthy Development of the Construction Industry" document issued in 2017 [2]. Whole process engineering consulting refers to the concept that relevant consulting units can be combined using integrated, consortium-based, and other methods to provide engineering consulting services for the entire life cycle of the project, including decision-making, design, and construction. Proposing whole process engineering consulting has an obvious effect on the formation of a new "owner–consultant–contractor" governance structure with clear rights and responsibilities, which is prominently reflected in the effective supervision and control of contractors. The new governance structure not only includes the owner's control of the consulting team, based on the principal agent theory, but it also includes the owner and the consulting team uniting to effectively supervise and control the contractor. In this structure, the owner's inter-organizational control over the consulting party will directly affect the contractor's performance, which in turn has an impact on project performance.

At present, the relevant research mainly focuses on the definition of the concept of whole process engineering consulting [3,4], research on the lead subject [5], commission mode, organizational structure, and the improvement of service capabilities and levels [6,7]. However, research about how cross-organizational control impacts project performance under whole process engineering consulting remained limited. In addition, the whole process consulting team is a knowledge-intensive enterprise, and the organization's knowledge management capability is an important issue that affects project performance. Existing studies have shown that knowledge management is becoming an important organizational capability in the engineering field. Knowledge sharing is one of the biggest problems related to organizational capability [8], and knowledge can only be applied and created through sharing [9]. Existing studies have proven that contractual and relationship governance between different organizations has a certain impact on the willingness to share knowledge [10,11]. Some scholars believe that knowledge sharing has a positive effect on product R&D performance by reducing R&D costs [12]. Hou et al. stated that knowledge sharing not only reduces the cost of acquiring knowledge resources, but it also helps to increase knowledge reserves and effectively respond to emergencies, which is more conducive to the realization of project goals [11]. Therefore, knowledge sharing is an important contextual variable between inter-organizational control and project performance, but little attention has been paid to research on this topic in the current project management field.

In summary, this article is based in a background of whole process engineering consulting and explores how cross-organizational control and knowledge sharing affect project performance under the new organizational model. By establishing a theoretical model of cross-organizational control, knowledge sharing, and project performance, this article used a structural equation model (SEM-PLS) to conduct an empirical analysis of questionnaire data. The research results will enrich research in the field of project governance, open the "black box" related to performance in whole process engineering consulting projects, and provide guidance for owners to achieve value-added project performance.

2. Theoretical Analysis and Research Hypotheses

2.1. Theoretical Analysis

2.1.1. Cross-Organization Control

The transaction cost theory holds that the design of cross-organizational control mechanisms is the result of a series of rational choices. Organizations face enormous governance dilemmas based on bounded rationality and opportunistic assumptions. Various governance strategies adopted to suppress the self-interested behaviors of both parties have resulted in huge transaction costs, including the costs of drafting contracts in the early stage of cooperation, the costs of contract execution during mid-stage cooperation, the costs of contract errors in the later stage of cooperation, and the costs of resolving disputes between the two parties. Appropriate control mechanisms can also help reduce the costs of organizational governance and ensure the smooth operation of the project in the end. From this theoretical perspective, a large number of studies have shown that appropriate inter-organizational control is beneficial for reducing the opportunistic behaviors of partners [13], promoting active cooperation between organizations [10], and improving the performance of cooperative organizations [11]. Among the research on cross-organizational control modes, most scholars believe that governance is carried out through effective formal and informal controls in different organizations [14], of which formal governance mainly comprises contractual control and informal governance is most commonly based on trust [15,16].

2.1.2. Knowledge Sharing

Knowledge sharing research has always been a hot issue in the field of knowledge management. The resource dependence theory points out that an organization cannot produce all the resources it needs, and these needs are provided by the outside world most of the time and depend on the external environment or the organization's knowledge

resources. Good control mechanisms between different organizations can facilitate knowledge sharing and the occurrence of innovative behaviors between organizations, promote long-term cooperation between organizations, and help to create and maintain sustainable competitive advantages [17].

From the perspective of expression, knowledge can be divided into explicit and tacit knowledge [18]. Explicit knowledge refers to more formal documents shared with partners, which are mostly described and expressed in the form of documents, reports, demonstrations, etc. Tacit knowledge mainly refers to various indescribable experiences and intuitions, such as expert experience and knowledge, existing cases of structured processing, etc. [19]. At present, explicit knowledge sharing is relatively mature in terms of disseminated content and methods, while tacit knowledge is not easily transferred between organizations due to differences in knowledge structure and difficulty in expression among partners [20].

2.1.3. Project Performance

In the field of engineering management, project performance is generally divided into two types: project performance based on a behavioral perspective and project management performance based on results [21]. In whole-process consulting projects, the most direct object of cooperative governance between the owner and the consulting unit is the contractor, and the contractor's performance behavior directly affects the performance of the project. There are two types of contractor performance: perfunctory and perfect [22]. Similarly, project performance should also be divided into two categories according to the contractor's behavior: basic and value-added. Basic project performance refers to the relevant goals agreed upon in the contract, while value-added project performance refers to the corresponding value added after the completion of the project, which prompts the two parties to continue to cooperate in the future, etc. Based on the behavioral perspective, this paper studied the impact of joint control by the owner and consultant on the behavior of the contractor, which will then have a certain impact on the performance of the entire project.

2.2. Research Hypotheses

2.2.1. Cross-Organization Controls and Project Performance

Contractual control is the most common control method adopted by both parties to suppress opportunistic behavior and ensure the success of the project during the transaction process. The formal contract stipulates the distribution of rights, responsibilities, and duties between both parties and details the goals that the consulting party needs to achieve and the procedures that need to be performed in the event of disputes. In the context of this study, contractual control refers to the owner's control over the consulting team through the drafting of contract documents. Specifically, it includes effective coordination and supervision at all stages, from project decision-making to operation, so as to achieve the project goals [23]. By signing the contract, the owner's most basic interests of can be protected by realizing the basic objectives of the project. Existing studies have shown that moderate contracts can improve transaction performance by reducing uncertainty through providing instructions on what is and is not allowed and by minimizing opportunistic behavior through legal constraints [23]. However, in the event of uncertain events, an overly strict contract design forces the partners to strictly implement contract procedures, which increases the transaction costs of both parties and is not conducive to the realization of the project's value-added project performance [24]. Accordingly, this paper proposes the following assumptions:

H1a: *Contractual control between owners and consultants inhibits value-added project performance.*

H1b: *Contractual controls between owners and consultants promote basic project performance.*

Trust occurs when the communicated information is reliable; trust increases when people fulfill their commitments, but trust is at risk when results do not meet expectations [25]. In this paper, trust refers to the owner entrusting the consulting unit to be responsible for the management of the project, the two parties conducting governance based on an

informal trust relationship, and the consulting party managing the project based on experience with similar projects in the past so as to realize value-added project performance. Trust is the core content of informal governance. From the perspective of transaction cost theory, Du pointed out that a good relationship model between the two parties can help reduce transaction costs in the process of cooperation, speed up the efficiency of dealing with uncertainties, and significantly improve the project's performance level [26]. Many scholars have studied the relationship between trust and project performance, and the results show that monitoring of the partner is reduced as the relationship between the two parties deepens, which reduces transaction costs in the process of cooperation and thereby significantly improves project performance [11,27,28]. However, in this process, the relationship between the two parties can become irreversible once serious opportunistic behavior occurs [27]. Accordingly, this paper proposes the following assumptions:

H2a: *Trust between owners and consultants promotes value-added project performance.*

H2b: *Trust between owners and consultants promotes basic project performance.*

2.2.2. Cross-Organizational Control and Knowledge Sharing

The organizational learning theory states that organization-level governance mechanisms can promote organizational learning and strengthen effective knowledge sharing while managing the relationship between the two parties [29]. In the context of this study, explicit knowledge sharing refers to the regular progress reports and project documents submitted by the consultant. Tacit knowledge sharing refers to the sharing of experience and knowledge from similar projects and intuitive solutions that the consultant provides in emergencies.

Appropriate contractual control is beneficial to improving the occurrence of knowledge sharing by consultants. On the one hand, the existence of the contract clarifies the amount of knowledge transfer that the consulting party needs to complete within the specified time, and the contract has serious penalties for breach of contract, which enables the consulting party to submit the corresponding project's report documents as scheduled during cooperation between the two parties. On the other hand, strict contractual control always monitors the behavior of the consulting party, prevents and controls potential opportunism, restricts the opportunistic behavior of the partner, and promotes the willingness to transfer knowledge. However, some scholars have pointed out that contractual control can also promote the occurrence of knowledge sharing hostility among knowledge subjects or lead to strong defensiveness among all parties involved, which makes parties only exchange explicitly agreed upon knowledge and strictly monitor the process of knowledge exchange. This reduces trust between the two parties, and the other party reserves some knowledge in the process of knowledge transfer [30]. Therefore, contractual control may promote the sharing of explicit knowledge but inhibit the sharing of tacit knowledge [31]. This led to the following assumptions:

H3a: *Contractual control between owners and consultants can facilitate explicit knowledge sharing between the parties.*

H3b: *Contractual control between owners and consultants can inhibit tacit knowledge sharing between the two parties.*

Inter-organizational trust is based on subjective beliefs and predictions of the partner's willingness to fulfill their obligations. It is the basis for organizations maintaining strategic alliances and promoting inter-organizational communication and interaction. Scholars generally believe that the key to improving inter-organizational knowledge sharing is building an inter-organizational trust mechanism [32], and mutual trust promotes the transfer and sharing of knowledge among members [33]. Based on trust, project partners determine the scope and nature of knowledge sharing. At present, studies hold that trust is an important prerequisite for knowledge sharing between organizations, and trust between organizations remains an important factor in promoting knowledge sharing between both

parties [24]. In addition, the research of Chen et al. confirmed that knowledge transfer between partners occurs more willingly when there is trust in the supply chain [34]. This is because trust can reduce uncertainty in the process and increase the willingness to transfer knowledge. This led to the following assumptions:

H4a: *Trust between owners and consultants can promote explicit knowledge sharing between the two parties.*

H4b: *Trust between owners and consultants can promote tacit knowledge sharing between the two parties.*

2.2.3. Knowledge Sharing and Project Performance

The resource dependence theory points out that an organization cannot produce all the resources it needs, which forces it to frequently obtain resources from the external environment. As an important resource shared among organizations, knowledge can not only alleviate the constraints of an organization due to its own knowledge structure defects, but effective knowledge sharing can reduce transaction costs and risks. Additionally, knowledge sharing can avoid the accumulation of single problem-solving perspectives [35].

The main reason that explicit knowledge can significantly promote project performance is that it can be clearly expressed and easily transmitted between organizations in the form of code. In addition, explicit knowledge sharing is conducive to the repeated use of written knowledge during the cooperation process, which can promote more efficient cooperation between the two sides and improve project performance [36]. Tacit knowledge is rooted in the process of interaction between the two parties. Generally, when encountering emergencies, tacit knowledge sharing is more likely to be revealed. Its acquisition channel relies on frequent and continuous interactions between organizations, which provides a necessary condition for forming a consensus to resolve emergencies [37]. Through explicit knowledge sharing, the owner can obtain the detailed progress content of each stage of the project, and these progress reports can be retained for repeated proofreading. Through the sharing of tacit knowledge, both parties can reach consensus on the handling of uncertain problems. Therefore, this paper proposes the following assumptions:

H5a: *Explicit knowledge sharing promotes basic project performance.*

H5b: *Explicit knowledge sharing promotes value-added project performance.*

H6a: *Tacit knowledge sharing promotes basic project performance.*

H6b: *Tacit knowledge sharing promotes value-added project performance.*

The theoretical model diagram based on the above assumptions is shown in Figure 1.

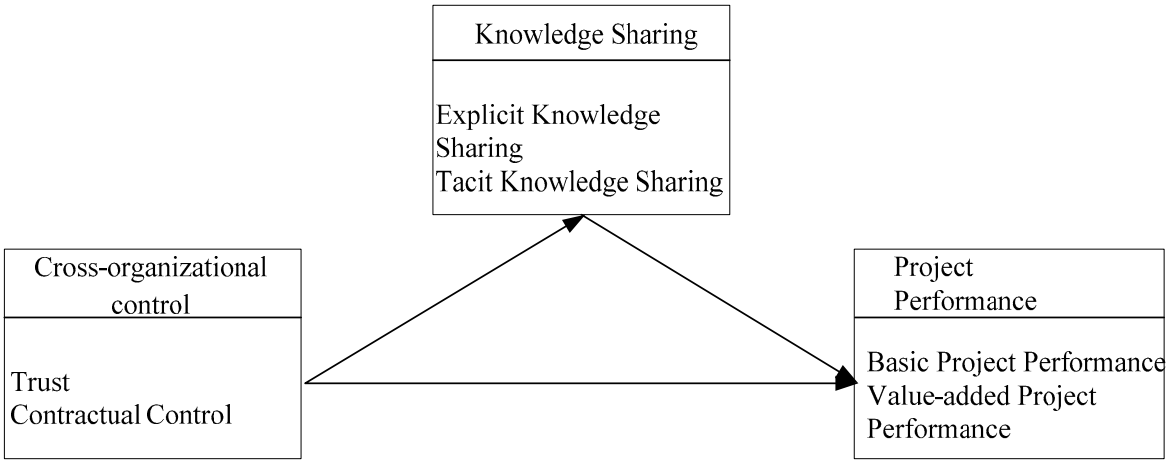

Figure 1. Research framework.

3. Empirical Research Design

3.1. Measurement

The relevant variables involved in this paper were: contractual control, trust, explicit knowledge sharing, tacit knowledge sharing, basic project performance, and value-added project performance. The relevant measures were generated from the existing, mature measures at home and abroad. In addition, the scale was appropriately revised according to the research content. For the trust scale, this paper adapted the research by Lou and Huang [38]. The knowledge sharing scales were obtained from the research by Bock et al. and Chang and Yang [39,40]. The scale of contractual control was obtained from the research by Liang and Huo et al. [41,42]. The project performance items were generated from research by Kashyap and Sivadas [43]. The questionnaire design adopted a Likert 7-point type scale, with 1 meaning completely non-conforming and 7 meaning fully conforming. The specific questions are shown in Table 1.

Table 1. The measurement and the factor load.

Variable	Measurement and Notation Used in the Model	Factor Load
Trust	The owner does not take advantage of the consultant's weaknesses to obtain improper benefits	0.799
	The owner often communicates and negotiates related issues	0.641
	The owner provides you with some support frequently	0.732
	The owner is considered to be fair to other party	0.690
	The owner is considered not to violate commitment	0.719
	The owner does not hurt the other party's benefits in the project management process	0.798
Contractual Control	The rights, responsibilities and obligations of all parties are stipulated in the contract	0.764
	The contract has a strong legal binding force during the implementation of the project	0.784
	During the project process, contract parties are allowed to negotiate according to major events and discuss the situation to sign a supplementary agreement	0.690
	Clear goals and standards are agreed in the contract	0.772
	The contract stipulates the contingency measures in the event of an accident	0.780
	The contract provides the strict penalties for failure to perform	0.644
	The contract stipulates the reward for making extra contributions	0.717
Explicit Knowledge Sharing	You often provide the owner with project production standards, methods, and modes	0.773
	You often provide the owner with statistics of resources related to completed projects	0.690
	You share some specific information and data with the owner	0.728
	You often provide project work reports and official documents to the owners	0.732
Tacit Knowledge Sharing	You share the know-how or secrets to solve the problem with the owner	0.775
	You share some opinions with the owner that you do not want to tell others	0.703
	In case of emergency, you can provide the owner with the existing work experience and knowledge	0.684
	You often communicate with the owner about professional knowledge of education or training	0.663
Basic Project Performance	You can complete the required work stipulated in the contract after the completion of the project	0.712
	The results of the project can meet owner's expectation	0.789
	You can complete the project according to the engineering schedule	0.686
	The results of the project can meet the predetermined technical specifications and functional requirements	0.755
Value-added project Performance	After the project, the reputation of both parties was improved, and the market competitiveness was gained	0.767
	The result not only realize the Specific function of the project, but also realize the higher need of the project	0.808
	After the project, the success of the early construction provided convenience for the later operation and maintenance	0.825
	After the project, the cooperation between the two parties has been enhanced and you want to continue to cooperate in the future	0.782

3.2. Sampling and Data Collection

In order to ensure the effectiveness and accuracy of the results, 25 managers from Henan and Hebei who had participated in whole process engineering consulting projects were first contacted, and they objectively scored the questionnaire according to their actual situation. Later, a pre-examination was conducted according to 25 samples in order to verify whether the questionnaire was reasonable. Further, the 25 managers recommended individuals involved with the corresponding projects who had participated in whole process engineering consulting to conduct a large range of data collection. The participants had the following characteristics: (1) they had participated in a whole process consulting project and had relevant experience in whole process consulting; (2) they participated in whole process consulting projects, which were divided into absolute and relative whole process consulting (absolute whole process consulting covered all consulting activities, while relative whole process consulting included two or more consulting activities).

The questionnaire survey covered Henan, Hebei, and other locations. The questionnaire survey was collected and distributed through various convenient methods. A total of 185 questionnaires were collected, and 157 valid questionnaires were obtained after excluding invalid questionnaires. The effective rate of the questionnaire data was 84.86%. Descriptive statistical analysis was conducted on the collected samples, and the results are presented in Table 2.

Table 2. Demographic characteristics of the sample (N = 157).

Demographic Variable	Value	%	Demographic Variable	Value	%
Type of service	Absolute full process	41.4%	Delivery mode	EPC	48.4%
	Relative full process	58.6%		DBB	31.8%
Position	Department manager	13.4%		DB	26.1%
	project manager	38.9%		PPP	10.8%
	General management staff	44.6%	Business item type	Early consulting	75.2%
	Others	3.2%		engineering design	68.8%
educational background	Master	28.7%		Tendering agent	65.6%
	Undergraduate	44.6%		Cost consulting	72.6%
	Junior college student	26.8%		project management	66.2%
Working experience	<3 years	21.7%		Project Supervisor	65.0%
	3–5 years	37.6%		Others	3.2%
	6–10 years	21.0%			
	Above 10 years	19.7%			

Note: Because the delivery mode and business item type are multiple topics, the total is more than 1.

3.3. Statistical Approach and Measurement Validation

3.3.1. Reliability Test

In this paper, SPSS20.0 was used to conduct exploratory factor analysis on the questionnaire scale and data. Cronbach's alpha was used as the scale reliability measurement index to test each factor. The results showed that Cronbach's alpha coefficients were greater than 0.7, which implied high internal consistency.

3.3.2. Validity test

In this paper, Amos26.0 was used to conduct confirmatory factor analysis (CFA) of the model, including its structure validity, convergent validity, and discriminative validity. The final model fitting diagram established in this paper is shown in Figure 2.

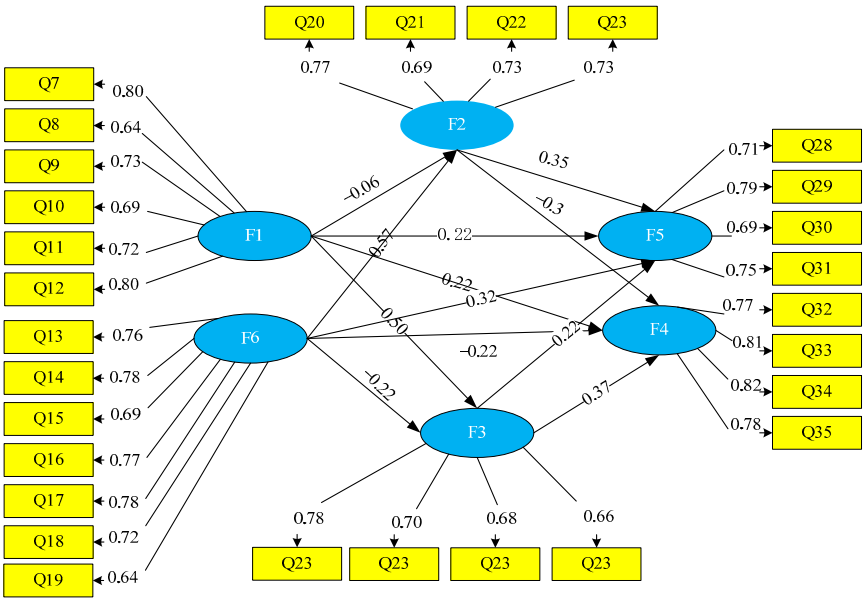

Figure 2. Results of the structural model analysis. Note: F1 is trust; F2 is explicit knowledge; F3 is tacit knowledge; F4 is value-added project performance; F5 is basic project performance; and F6 is contractual control. As is the Figure below.

The results of model fitting are shown in Table 3. According to Table 3, the fitting results of this paper met the critical requirements of the academic circle for the indicators, indicating that the overall degree of fit between the model and data was good and that the measurement model constructed through the above measurement dimensions and indicators was relatively ideal [44].

Table 3. Model goodness of fit test.

Measurement Index	χ2/df	RMSEA	CFI	IFI	TLI
Index	1.243	0.039	0.958	0.958	0.953
Modern	χ2/df < 3	<0.08	>0.9	>0.9	>0.9

The combined reliability (CR) was used for reliability analysis, and the results showed that the CR values were greater than 0.7, indicating good scale quality (See Table 4). The AVE value and factor load of each item were used to judge the convergence validity of the model. The results showed that the load of each factor was higher than 0.5 (see Table 1) and the AVE values were greater than 0.5 (see Table 4), which met the standard. The AVE value method was used for testing and analyzing discriminant validity. The diagonal values were all greater than the standardized correlation coefficients of the other variables (see Table 4), indicating that there was good discriminant validity among the variables.

Table 4. Pearson correlation matrix and test value.

Variable	CR	α	AVE	F1	F6	F2	F3	F5	F4
F1	0.873	0.873	0.536	0.732					
F6	0.893	0.892	0.544	−0.175 *	0.731				
F2	0.821	0.822	0.535	−0.156	0.505 **	0.708			
F3	0.780	0.798	0.501	0.456 **	−0.270 **	−0.072	0.796		
F5	0.826	0.825	0.543	0.175 *	0.348 **	0.381 **	0.162 *	0.737	
F4	0.874	0.872	0.633	0.410 **	−0.360 **	−0.212 **	0.462 **	−0.027	0.738

Note: ** indicates $p < 0.01$; * indicates $p < 0.05$; F1 is trust; F2 is explicit knowledge; F3 is tacit knowledge; F4 is value-added project performance; F5 is basic project performance; and F6 is contractual control. As is the table below.

3.3.3. Hypothesis Analysis

This study used Amos26.0 to test the hypotheses proposed above. The results showed that contractual control had a significantly positive impact on basic project performance but had no significant impact on value-added project performance, which indicated that H1a and H1b were verified. Trust had a positive impact on both basic and value-added project performance, showing that H2a and H2b were verified. Contractual control had a positive impact on explicit knowledge but a negative impact on tacit knowledge; thus, H3a and H3b were proven to be true. Trust was positively correlated with tacit knowledge but had no significant relationship with explicit knowledge. Thus, H4b was verified, while H4a failed to pass verification. There was a positive correlation between explicit knowledge and basic project performance, but no significant relationship between explicit knowledge and value-added project performance. Thus, H5a was verified, but H5b failed to pass verification. Tacit knowledge sharing was positively correlated with basic and value-added project performance. Thus, H6a and H6b were verified. The test results are shown in Table 5.

Table 5. Path test.

Path	Path Coefficient	t	*p*
F1 → F2	−0.065	−0.782	0.434
F1 → F3	0.503	4.958	***
F6 → F2	0.572	5.285	***
F6 → F3	−0.215	−2.423	*
F1 → F5	0.216	2.054	*
F1 → F4	0.225	2.290	*
F6 → F5	0.323	2.771	**
F6 → F4	−0.221	−2.100	*
F2 → F5	0.350	3	**
F2 → F4	−0.027	−0.268	0.789
F3 → F5	0.224	1.959	*
F3 → F4	0.374	3.321	***

Note: *** indicates $p < 0.001$; ** indicates $p < 0.01$; * indicates $p < 0.05$.

3.3.4. Intermediary Effect Test

To verify the mediating role of explicit and tacit knowledge between cross-organizational control and project performance, this paper used the bootstrapping method in Amos26.0 to sample 5000 times for verification. The results are shown in Table 6.

Table 6. Analysis of the mediation effects.

Path	Estimate	SE	Upper	Lower
F1 → F3 → F5	0.069	0.040	0.017	0.149
F1 → F3 → F4	0.137	0.058	0.057	0.247
F6 → F2 → F5	0.192	0.075	0.091	0.339
F6 → F3 → F4	−0.091	0.044	−0.173	−0.029
F6 → F3 → F5	−0.046	0.030	−0.113	−0.010

4. Discussions

This study makes significant contributions to the current literature review. The main contributions are in the following five areas: (I) Further refinement of the project performance scale in a whole process engineering consulting project; (II) confirmation of the effect of cross-organizational control on project performance through structural equation modeling; (III) confirmation of the effect of cross-organizational control on knowledge sharing; (IV) confirmation of the effect of knowledge sharing on project performance; (V) confirmation of the mediating role of knowledge sharing between cross-organizational control and project performance. The following discussion will be developed specifically.

4.1. Project Performance Measures

The existing research measures project performance mostly as a whole and lacks effective measurement of the performance of whole process engineering consulting projects. Therefore, this paper will combine the existing scales to divide the project performance into basic project performance and value-added project performance for scale improvement. Where basic performance means that upon project completion, you can complete the work specified in the contract; the project results can also meet the owner's expectations; the project can be completed according to the engineering schedule; and the project results can meet the predefined technical specifications and functional requirements. Value-added project performance means that after the project is completed, both parties' credibility and market competitiveness improve. The results achieve not only the project's specific functions but also the project's higher demand, and the success of early construction facilitates later operation and maintenance after the project is completed. For example, if only the basic performance of the project is achieved after the project is completed, the owner and the consultant will rarely be in contact again; the so-called value-added performance is demonstrated by the fact that the owner will introduce other projects to the consultant after the project is completed, and both parties maintain a good relationship afterwards.

4.2. The Influence Mechanism of Cross-Organizational Control on Project Performance

H1a, H1b, H2a, and H2b were verified, and their path coefficients were −0.221, 0.323, 0.225, and 0.216, respectively. Contractual control significantly promoted basic project performance but inhibited value-added project performance to some extent. Trust promoted both basic and value-added project performance. From the perspective of path coefficients, the promotion effect of contractual control on basic project performance was higher than that of trust because the basic project objectives to be achieved by both parties have been clearly defined when the contract is signed. During the project process, the consultant needs to perform the corresponding roles and behaviors according to the content agreed upon in the contract in order to achieve the basic project objectives. Contract control inhibited value-added project performance, which was interpreted by Yan and Zhang [25]. Since excessively strict contractual control may weaken trust among partners and encourage rather than hinder opportunistic behavior, the owner should make reasonable use of contractual control and contract coordination in the process of contract implementation. In addition, trust significantly promoted value-added project performance. Based on the trust between the two parties, the consultant could avoid the occurrence of opportunistic behavior when solving the problems created by emergency situations in the project.

4.3. Impact Mechanism of Cross-Organizational Control on Knowledge Sharing

The hypotheses of H3a, H3b, and H4b proposed in this paper were verified. The owner's contractual control over the consultant significantly promoted explicit knowledge sharing, and its path coefficient was 0.572. This was because the cooperation objectives and procedures of both parties are regulated in the contract. In the process of the project, both parties need to communicate according to the contract, and the consultant also needs to provide some documents stipulated in the contract. In addition, contractual control inhibited tacit knowledge sharing, and the path coefficient was −0.215. Husted's opinions can be used to explain these results. This author suggested that contractual control could hinder the willingness of both parties to share knowledge and induce a strong sense of alertness to the communication between the two parties, making partners only communicate on the agreed-upon items in the contract and thereby inhibiting the generation of tacit knowledge sharing [30].

The owner's trust of the consultant was conducive to the occurrence of the consultant's tacit knowledge sharing; H4b was verified, and its path coefficient was 0.503. This was because trust promotes continuous communication between the two sides, thus shortening the relationship between them and enabling the consultant to share some experience from previous projects during the communication process. The effect of trust on explicit

knowledge sharing was not significant because explicit knowledge exchange is mainly based on program and structure, which are under contractual control. Trust plays a prominent role in tacit knowledge sharing [22], so the effect of trust on explicit knowledge sharing was not significant.

4.4. Impact Mechanism of Knowledge Sharing on Project Performance

This paper presented the assumptions H5a, H5b, H6a, and H6b; except for H5b, the other three paths were verified. Explicit knowledge sharing effectively promoted the basic project performance, and its path coefficient was 0.350. Tacit knowledge sharing could promote basic and value-added project performance, and the path coefficients were 0.224 and 0.374, respectively. This was because sharing tacit knowledge can promote cooperation and exchange between the two sides and generate new ideas. The consultant's sharing of tacit knowledge enables the owner to understand the progress of the project and solutions to emergencies in a timely manner. Explicit knowledge sharing had no impact on value-added project performance because explicitly sharing knowledge content is mainly specified in the contract, which is based on the work needed to complete the contract requirements. Therefore, it is difficult to affect value-added project performance by only relying on explicit knowledge sharing.

4.5. Analysis of the Influence Mechanism of the Mediation Effect

The mediation effect was verified by sampling 5000 times with the bootstrap method in Amos26.0. The upper and lower limits of the test results of three intermediary paths (trust → tacit knowledge sharing → basic project performance; trust → tacit knowledge sharing → value-added project performance; and contractual control → explicit knowledge sharing → basic project performance) do not include 0. The results showed that trust not only directly affects the basic project performance and value-added project performance but also indirectly affects the basic project performance and value-added project performance through tacit knowledge sharing. Contractual control not only directly affects the basic project performance of the project but also indirectly affects it through explicit knowledge sharing. In addition, The indirect effect value of path (contractual control → tacit knowledge sharing behavior → project value-added project performance; contractual control → tacit knowledge → project basic project performance) are <0, while the direct effect value is >0. The two signs are opposite. According to the judgment methods of Wen and Ye on intermediary effect and "masking effect", we can see that tacit knowledge does not play an intermediary role in the relationship between "contract control → project performance", but produces some "suppressing effects" [45]. The assumption H6b is not valid.

5. Conclusions and Future Work

This paper constructed a theoretical model of whole process engineering consulting with cross-organizational control (contractual control, trust) as the antecedent, knowledge sharing as the intermediary, and project performance as the dependent variable. Through empirical study of the structural equation model and the theoretical model of cross-organizational control, knowledge sharing, and project performance, trust can promote basic and value-added performance, while contractual control is conducive to basic performance but inhibits value-added performance. In addition, tacit knowledge sharing plays a partial intermediary role in cross-organizational control and project performance, while explicit knowledge sharing plays a partial intermediary role between contract control and basic performance.

The findings of this study provide insights into management practices for whole process engineering consulting projects. The study's findings shed light on the practice of whole-process engineering consulting project management. First, in the whole process of consulting projects, cross-organizational control is critical to project management. Contractual control can be used in the early stages of cooperation to agree on both parties' rights, responsibilities, and benefits, as well as risk sharing. The terms and conditions specify what

is and is not permitted between the two parties, effectively reducing opportunistic behavior during the cooperation process. Second, developing a trusting relationship between the owner and the consultant can significantly reduce the cost of supervision during the collaboration process, thereby improving project performance. Finally, this paper validates the path of explicit knowledge sharing as a mediating influence between contractual control and basic project performance and the path of tacit knowledge sharing as a mediating influence between trust and two types of project performance.

Furthermore, this research has important practical implications. Contractual control in cross-organizational control improves basic project performance by facilitating explicit knowledge sharing; the impact of trust on two types of project performance is achieved primarily through tacit knowledge sharing mediation. The whole process engineering consulting project is more difficult to deliver under the influence of COVID-19 because it requires rapid and comprehensive changes in safety, health, and sanitation requirements, which necessitate friendly and close partnerships between owners and consultants. For example, when uncertainty events and risk situations occur, the owner and the consultant must communicate quickly, and these uncertainty events cannot be specified in the contract terms, so the cooperation between the two parties is primarily dependent on the relationship of trust to be maintained. When the owner gives the consultant the authority to communicate, trust in the consultant is established, and the consultant will voluntarily return to the owner more tacit knowledge resources, such as solutions from previous experience with similar projects, in order to solve uncertainty events and improve the organization's ability to deal with crises. In conclusion, these findings can alert owners to the occurrence of relational trust and consultant knowledge sharing when collaborating on a project, ultimately improving overall project performance. The owner's ability to cope with uncertainty-related risk events improves when consultant knowledge sharing behavior is effectively stimulated.

This study also has the following flaws: it reveals a static path of the impact of cross-organizational control and knowledge sharing on project performance, and the level of control exercised by both parties in actual projects is likely to vary with the depth of cooperation. As a result, the next paper will consider the impact of cross-organizational control on project performance from a dynamic perspective in the future; second, this paper only reveals the net effect of different antecedent variables on project performance, ignoring the fact that the factors influencing project performance are complex. As a result, the next study will look into the group configuration of the effects of various antecedent variables on project performance from a group perspective in order to identify equivalence paths to improve project performance.

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