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# Drivers of Professional Service Model Innovation in the Chinese Construction Industry

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**Abstract:** Professional service in China is facing challenges due to the rapidly changing built environment. The environment forces the construction industry to reconsider professional service model for thriving, while the life cycle professional service model has significant implications for value addition in professional system. However, literature that provides quantifiable information for practitioners and researchers to better understand drivers of professional service model innovation (PSMI) is scarce. Based on innovation diffusion literature and institutional theory, this study examines how PSMI is influenced by institutional pressures (including coercive, mimetic, and normative pressures) in the construction industry. The researchers conducted an industry-wide survey in China using structural equation modeling to analyze the acquired data. Data analyzing demonstrates that both coercive and mimetic pressures prominently influence the life cycle of PSMI. However, this study reveals that normative pressure does not significantly influence PSMI. Results indicate that the owner's cognition plays an important mediating role between institutional pressures and PSMI. The findings contribute to understanding how different types of institutional pressures can be better steered to facilitate PSMI in the construction industry and furthering knowledge on PSMI mechanisms for new professionalism cultivation in the industry to realize sustainable development of professional system.

**Keywords:** life cycle; professional service; innovation; drivers; professionalism

## 1. Introduction

With the rapid changes of built environment, professional development has been attracting increasing attention in recent decades. The traditional notion of professionalism prevailed in Western countries in the 1960s and 1970s is under pressure to change due to cognitive change (i.e., information technology), immediate context (i.e., business values and client attitudes), and wider social change (i.e., economic pressures, legislation, and national policy) [1]. Rapid changes in external environments of the construction industry cause a shift in how it is executed [2,3]. Professional service as part of the construction industry is facing challenges with regard to how its business model can be changed to adapt to the changing environment, as EDGE (Edge was established in 1995–1996 in England as the result of an initiative by Jack Zunz, former Chair of the Ove Arup Foundation, with the purpose of improving connections among professional institutions working in the construction industry) reported:Few in the industry believe that it is organized in a way that works well for clients and the full depth of the supply chain. There is little or no integration between design, product manufacture, construction, operation and asset management; no feedback loop that increases the chances of a completed asset performing as it should, and of future projects learning from the past; and no

alignment of interests both within the supply chain and between the supply chain and the client. This fragmentation of interests destroys value [4] (p. 8).

The forces that continuously shape services and work are considered to be professional as a result of the rapid changes in today's business and technology environment [5]. Professional services termed as knowledge intensive service that is client-tailored service based on sound professional judgement which can be interpreted as the owners' project management or organizational project management [6]. Owing to a lack of professional knowledge, owners hire professional service firms to manage projects. Initially, Project management was expected to "get the job done", however, in the 21st century, it is viewed as a competitive weapon [2] and is under continual pressure from pure value-seeking to achieving cheaper, better and more efficient services [5]. Project management is a complex undertaking, involving many kinds of professional services in different stages and processes, which makes it difficult to close feedback loops and apply these to briefing, design, and construction [7]. Meanwhile, all the built environment professions must be considered as a whole when judging the outcomes of their combined performance [7]. Therefore, professional service model innovation (PSMI) demands the integration of the life cycle of professional services as well as all professional institutes. The new service model provides a number of advantages over traditional professional service, including (1) providing a feedback loop, (2) one entity being fully responsible for owners in the life span of projects, and (3) realizing improved synergistic effects between individual professionals for better value addition. In China, the central government and local authorities have been active in promoting the implementation of this professional service model. For example, the Ministry of Housing and Urban–Rural Development of the People's Republic of China (MOHURD) has issued a statute to publicize 40 units to pilot the model in public projects.

In recent years, the status and role of professionals and their service in society, as well as in business, have been the focus of increased scrutiny by academics, policymakers, and professional practitioners [8]. The construction consulting sector is facing PSMI challenges caused by ongoing project management inefficiency [3,9] and value fragmentation [4]. As argued by Shi [10], methods of implementing and improving project management in the "right way" remains a relatively important research subject. Fernandes et al. [11] developed a framework contributing to embedding useful project management improvement initiatives (PMIIs) in organizations, the framework was specifically developed to identify key factors and PMIIs for facilitating the embedding of these initiatives on an organizational level. Ross [12] discussed professional service innovation at a strategic perspective from the firm level. Despite growing academic interest in the professional service sector in construction, mainstream economics and management literature has tended to concentrate more on firms and their clients [3,13–16] than on industry efficiency or professionalism.

Innovation uptake is not only promoted by itself efficiency but may also be motivated by the external environment according to previous study on other innovations in the construction industry [17,18]. Research on other industries' innovations further indicates that industry nature and innovation characteristics influence organizational behavior in responding to the external environment [19]. PSMI is a relatively complex innovation, and its performance has yet to be ascertained [3,9]. The related innovation characteristics and the construction industry nature may make the relationship between PSMI and external environment complicated. To date, however, little empirical literature has been provided to help understand whether different types of external pressures exert an influence on PSMI in the construction industry, and if so, how. Literature on professional service in construction within a well-established theoretical framework during a technological shift is also limited.

## 2. Theoretical Framework and Hypothesis Development

Business model innovation (BMI) was especially helpful for the present research. BMI is an important business strategy to maintain commercial values in a new way by re-engineering existing business models [20,21]. The technological revolution in the 21st century in the construction industry,

especially BIM, offers a fresh approach to redefining the construction industry and its business models [21,22]. As a main part of the construction industry, the professional service sector should redefine its model to achieve sustainability in the context of technological change and decreasing project management efficiency due to fragmentation. Gaining a deeper understanding of the external drivers and internal mechanisms of PSMI is the most critical part of PSMI research [23] (Figure 1).
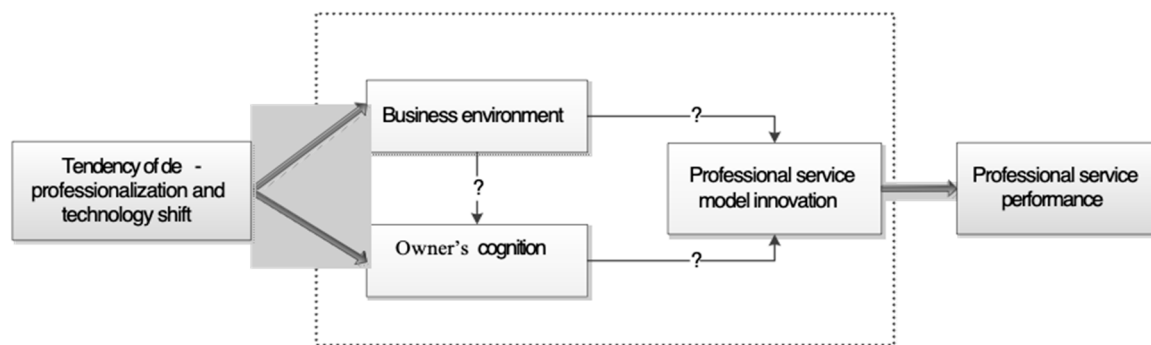


**Figure 1.** The research scope of hypothesized professional service model innovation (PSMI) model.

In transaction cost economic theory, organizational behavior is with the purpose of rationally minimizing the total production and transaction costs based on an efficiency-seeking logic [24]. By contrast, institutional theory underscores the decisive role of rules and belief systems prevailing in the external institutional environment in propelling organizations to conduct structural and procedural changes aimed at gaining organization legitimacy [25,26]. Through regarding organizations as open systems subject to external environments, institutional theory provides a solid theoretical basis for several model or organizational innovations and diffusion in other industries [19,27]. Few published studies have applied institutional theory to professional service issues in the context of technological shift. The present study presumes that the institutional theory could also provide an important angle on how PSMI is driven in the construction industry. On the basis of institutional theory [25], this study frames a hypothesized model and empirically validates it to explain how three types of institutional pressures (including coercive, mimetic, and normative pressures) influence PSMI in the construction industry in China.

PSMI is a systemic and complex innovation whose successful promotion needs accompanying processes and organizational changes. If innovated successfully, the model can generate a series of advantages [11,28]. These advantages include the added value result from integrated solutions for owners and industry competitive advantages in international markets as an internationally popular service model. However, at present, some of the value is not easily measured or hard to realize [3,9]. As a consequence, the life cycle of the professional service model has not been adopted in the whole industry.

Owners can play a crucial role in a project as triggering construction activities [29,30], and the practices demonstrated by project owners or clients can significantly impact innovation adoption [31]. Therefore, the owner's cognition is also considered to explore its mediating role between institutional pressures and PSMI. In conclusion, to fill the gap of PSMI research for the consulting sector, the authors frame a model by four hypotheses (H1–H4) to examine the correlations between PSMI and its drivers in the background of professionalism shift and technological shift (Figure 2). The four hypotheses are described as follows.
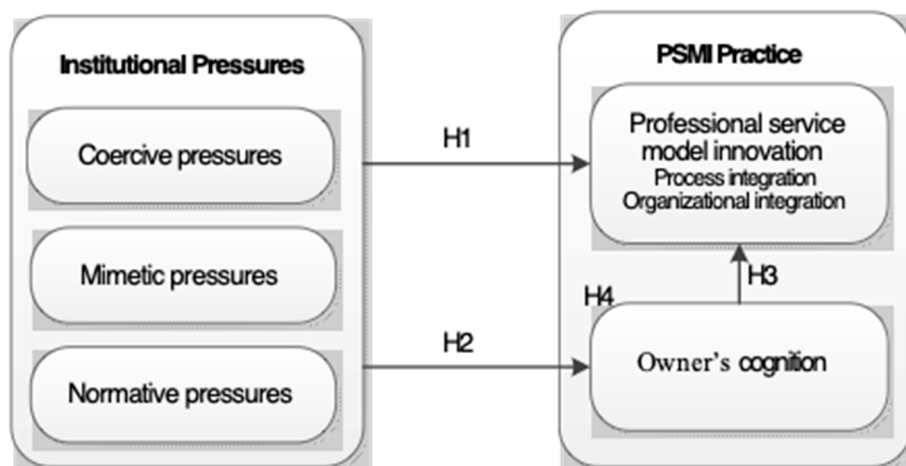
**Figure 2.** Research framework.

**Hypothesis 1 (H1).** *Institutional pressures have a positive impact on PSMI for the consulting sector in the Chinese construction industry.*

Demil and Lecocq [32] found that business model may potentially be impacted by the change of business environment in terms of macro-sociology, macro-economy, or competitors. Reuver et al. [33] stated that changeable regulatory environment propel organizations to re-engineer their business models. Institutional pressures, as a core component of institutional theory, are defined as an institution of organizations to be procedurally and structurally consistent with their corresponding business environment by conforming to socially identified rules and belief systems [25,30]. To sum up, the present study adopts institutional theory [25], which concludes three types of institutional pressures framing the professional organization service model: coercive, mimetic, and normative. Therefore, the following set of hypotheses is proposed.

**Hypothesis 1a (H1a).** *Coercive pressures (CPs) have a positive impact on PSMI for the consulting sector in the Chinese construction industry.*

**Hypothesis 1b (H1b).** *Mimetic pressures (MPs) have a positive impact on PSMI for the consulting sector in the Chinese construction industry.*

**Hypothesis 1c (H1c).** *Normative pressures (NPs) have a positive impact on PSMI for the consulting sector in the Chinese construction industry.*

**Hypothesis 2 (H2).** *Institutional pressures have a positive impact on the owner's cognition.*

CPs by definition are "formal and informal pressures exerted on organizations by other organizations upon which they are dependent" [25]. According to the definition, coercive pressures can mainly derive from rules and regulations enacted by regulatory agencies. Given the potential benefits of the life cycle professional service, China has issued nationwide regulations mandating utilization of the life cycle professional service, though the actual value is difficult to measure [34]. Moreover, some local governments have already established official life cycle professional service promotion initiatives or publicly supported the new model in large public-funded projects. These official activities, whether project-specific requirements or authoritative purpose, may prominently influence owners' cognition on the life cycle professional service model, and thus result in PSMI adoption. Accordingly, the following set of hypotheses is suggested.

**Hypothesis 2a (H2a).** *CPs are positively correlated with the owner's cognition on PSMI for the consulting sector in the Chinese construction industry.*

MPs are those that force organizations to imitate other structurally similar organizations with successful performance to cope with uncertainty [25]. The uncertainty performance of the new model makes project owners be more easily impacted by other successful projects with similar business environments and project characteristics.

**Hypothesis 2b (H2b).** *MPs are positively correlated with the owner's cognition on PSMI for the consulting sector in the Chinese construction industry.*

NPs consist of social pressures which are mainly derived from industry norms or professionalization [25,30]. Professional institutions are responsible for shared norms and industry expectation. Through constant contact with professionals, project owners can better understand industry expectations and the values concerning the life cycle professional service model and thus advocate the model's innovation. Therefore, these discussions lead to H2c.

**Hypothesis 2c (H2c).** *NPs are positively correlated with the owner's cognition on PSMI for the consulting sector in the Chinese construction industry.*

**Hypothesis 3 (H3).** *Owner's cognition has a positive impact on PSMI for the consulting sector in the Chinese construction industry.*

There is sufficient evidence in technical literature demonstrating the significance of the owners' influence on business, such as the influence of managerial cognition on organizational change [35], more extensive involvement of the customer in promoting professional service innovation and purchasing knowledge-intensive business services and effective solutions [36,37], business models based on cognitive mechanisms [21,38], owner commitment to the delivery performance of green building projects [39], and client requirements on renewal in construction projects [40]. Project owners or clients also have a significant impact on innovation adoption [31]. The owner's or customer's cognition has a direct influence on the adoption of PSMI. By arguing that PSMI is a behavior, the authors are underscoring the significance of cognition. This study assumes that owner's cognition and, consequently, their attitudes toward innovation strongly influence the creation and development of the professional organization service model and play a crucial role in the dynamics of PSMI. Therefore, this study combined H1, H2, and H3 and established the following hypothesis.

**Hypothesis 4 (H4).** *The owner's cognition mediates the relationship between institutional pressures and PSMI for the consulting sector in the Chinese construction industry.*

## 3. Research Method

In accordance with the suggestions of Liu et al. [21], the present work adopted the following research design and process to ensure the validity and reliability of the research (Figure 3). In steps 1 and 2, the conceptual framework of professional service innovation model and four hypotheses are developed through literature review and analysis. The results are reported in Section 2, entitled "Theoretical Framework and Hypothesis Development." In step 3, an instrument development is conducted that includes 17 indicators (termed as items) to test the conceptual model. The instrument development is based on literature review and interviews with academic professionals, which will be described later in detail in this section. In step 4, the authors conducted an industry-wide survey and short semi-structured interviews to collect data. In step 5, the authors employed the PLS technique to analyze data and test the hypotheses. The PLS technique includes an exploratory factor analysis (EFA),

a confirmatory factor analysis (CFA), and a mediating effect test. The following sections elaborate on the instrument development, data collection, and tools for data analysis.
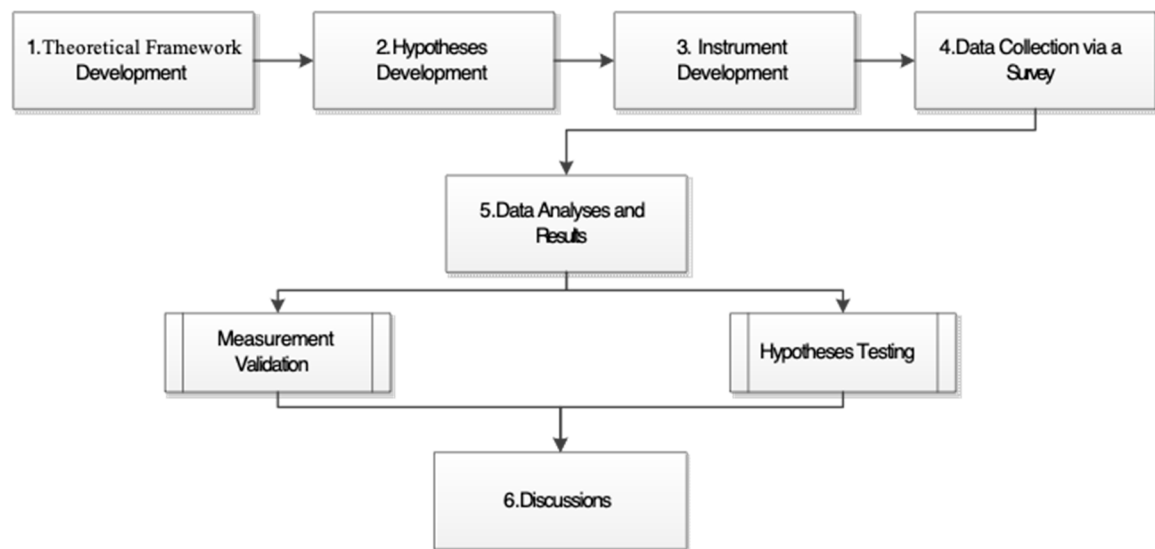


**Figure 3.** Research design and flowchart.

### 3.1. Instrument Development

Table 1 lists the 3 constructs, 8 subconstructs, and 17 measure items, all of which constitute the instrument used in this study. The eight items for measuring the external environment of PSMI (i.e., items 1–8 in Table 1) were extracted from established studies, such as Cao et al. [30] and Wang et al. [41]. The item owner's cognition is measured by the three items (i.e., items 9–11), which were developed depending on literature and the context of de-professionalization, such as D'Antone [36] and Olanipekun et al. [39]. The six items for measuring the construct of PSMI (i.e., items 12–17) were designed by the authors from the studies, such as Ding et al. [42], Enberg [43], Kleinschmidt et al. [44], Vickery et al. [45], and Kirsilä et al. [46]. In the questionnaire, a Likert scale is used for measuring 17 items, where from "1" to "7" represents respectively strongly disagree to strongly agree.

### 3.2. Data Collection

The instrument was developed via literature review and short semi-structured interviews, based on which data collection was conducted by a questionnaire survey. Then a pilot study consisting of 10 professionals was conducted to further evaluate the suitability of the questionnaire scope, identify the vague expressions of measurement constructs, and verify the rationality of related items. Thereof, 3 out of 10 professionals were found to possess both theoretical knowledge and practical experience. The questionnaire was further revised based on feedback and the final version was formed.

Only Chinese mainland construction projects adopting the life cycle professional service and professionals who were directly involved in the service were considered for the formal survey because they were expected to be familiar with the related laws and regulations. As the utilization of the service is still relatively scarce in China, a completely random sampling method could not be used. Instead, typical life cycle professional service projects and suited project respondents were selected through several kinds of methods, such as by choosing from pilot construction projects issued by MOHURD, referring to related industry publications, and interviewing pilot projects in model innovation. In order to enlarge the sample size, a snowball sampling approach was also applied, with the first-round respondents required to introduce other knowledgeable practitioners or professionals in other life cycle professional service projects. To enhance the reliability and validity of

the samples, a diverse array of projects with different geographic locations was chosen, thus provided a broader vision of industry practices.

**Table 1.** Summary of constructs, subconstructs, and measurement variables.

| Construct | Subconstruct | Measurement Variables |
|---|---|---|
| Institutional pressures | Coercive pressures | The government requires our construction project to use the life cycle professional service.<br>Industry associations require our construction project to use the life cycle professional service.<br>The owner requires the adoption of the life cycle professional service in our types of projects. |
| | Mimetic pressures | Peer projects that have adopted the life cycle professional service have benefited greatly.<br>Peer projects that have adopted the life cycle professional service have gained good reputations in the industry.<br>Peer projects that have adopted the life cycle professional service are preferred by others in the industry. |
| | Normative pressures | Industry associations strongly propagate the value of the life cycle professional service in our types of projects.<br>Society advocates the adoption of the life cycle professional service in our types of projects. |
| Owner's cognition | Attitude to model innovation | The service model can provide us more advantages than disadvantages.<br>Life cycle professional service is the trend of the future.<br>We consider that the consulting sector has the capability to conduct the service model. |
| PSMI | Process integration | Cohesion and coherence between professions are good and results in an integral consulting effect.<br>In the project, we participate in all the processes from planning to facility management.<br>In the project, professions in each phase can share knowledge and information with one another. |
| | Organization integration | Teams working in different phases are coordinated well and organized as a dynamic alliance.<br>In the project, it is easy for all participants to communicate because of reduced interfaces.<br>In the project, it is easier to adjust and respond to a change of environment. |

To enhance the rate and quality of responses, all respondents were notified the aim of the survey. Considering the low response rate of the questionnaire, each respondent was activated by several methods, for example, by giving out some souvenirs to respondents on site (i.e., notebook, and gel pen) or offering a cash gift by internet WeChat. In the questionnaire, respondents were required to fill in according to their most typically experienced life cycle professional service project. In addition, when selecting respondents, the authors and friends helping to give the questionnaires out assured that the respondents were those knowledgeable practitioners and professionals directly involved in the life cycle professional service. A forced-choice response was prevented by the inclusion of an option [41,47].

Data collection was conducted by various ways, including an online invitation system, a training course, and personal visits. After a survey was conducted from April 2018 to September 2018, a total of 132 responses were taken back. In order to get better understand of the finished questionnaire, some respondents were also asked to further explain their responses after completing the questionnaires and offer other detailed information about surveyed projects. The inter-rater agreement by the interclass correlation coefficient (ICC) was gained to evaluate the reliability of the questionnaire for projects with more than one response [30,48]. In the survey, most ICC values were larger than the suggested criterion of 0.6. After deleting those responses with incomplete information

concerning key variables, a total of 106 questionnaires were ultimately analyzed in the research. The demographics of the investigated projects and respondents are shown in Table 2.

**Table 2.** Demographic information of the surveyed projects.

| Parameter | Category | Frequency | Percentage |
|---|---|---|---|
| Year [a] | Before 2017 | 16 | 15.1 |
| | After 2017 | 90 | 84.9 |
| Location | North China | 19 | 17.9 |
| | Northeast China | 2 | 1.9 |
| | East China | 66 | 62.3 |
| | South Central China | 8 | 7.5 |
| | Southwest China | 6 | 5.7 |
| | Northwest China | 2 | 1.9 |
| | South China | 3 | 2.8 |
| Project nature | Public | 60 | 56.6 |
| | Private | 46 | 43.4 |
| Project size | Below ¥50 million | 25 | 23.6 |
| | ¥50–200 million | 37 | 34.9 |
| | ¥200–1000 million | 17 | 16.0 |
| | Above ¥1000 million | 25 | 23.6 |

Note: [a] Year for the commencement of construction activities.

### 3.3. Tools for Data Analysis

EFA and CFA were utilized to verify the validity and reliability of the measurement model. EFA combining with principal component analysis (PCA) was employed to verify the factor structure and improve the measurement items, while CFA was performed to further validate the consequences of EFA [41,49].

The structural equation modeling (SEM) approach was adopted in data analysis, where measurement items and hypothesized research model were tested by partial least squares (PLS), a component-based SEM technique. Because of minimum requirements on the sample size and residual distribution PLS is preferred in this research in order to achieve the expected statistical power and robustness [41,50]. Contrasted with other SEM techniques such as LISREL, PLS allows for the concurrent estimation of multiple dependent variables and is thus well-applicable for the assessment of mediation effects [30,50]. According to Hair et al. [50], PLS-SEM is suitable for identifying key "driver" constructs or predicting key target constructs. The study stresses its prediction-oriented nature [51,52]. Moreover, the non-parametric PLS-SEM approach is suitable for the data from the perception-based measurement items [53] and the nature can maximize the explained variance of endogenous latent variables [54].

## 4. Data Analyses and Results

### 4.1. Factor Analysis

EFA was performed for institutional pressures consisting of the eight items. The Kaiser–Meyer–Olkin (KMO) value is 0.774, which exceeds the 0.6 threshold, suggesting satisfactory sample adequacy [55]. The Bartlett test of sphericity (BTS) with an approximation of $\chi^2 = 429.971$ (df = 28, $p = 0.000 < 0.001$), which indicates that the variable correlation is sufficiently strong for PCA [56]. As shown in Table 3, all the rotated factor loadings of all eight indicators are significant at the 5% level and the values are all beyond the minimum loading criterion of 0.5 [57]. Consequently, three factors are extracted to reflect the CPs, MPs constructs and two factors are extracted to reflect the NPs constructs. These outputs validate the fitness of measurement for institutional pressures using the eight listed items to reflect the three constructs, CPs, MPs, and NPs. Table 4 shows that all the

rotated factor loadings of the six items for PSMI on their intended constructs exceed the minimum loading criterion of 0.5 and are higher than the loadings with other constructs. These outputs validate the fitness of measurement of PSMI by the six listed items to reflect the process integration (PI) and organizational integration (OI) constructs. In other words, the factor analysis shows that the item of institutional pressures is a three-dimensional construct, the owner's cognition is a one-dimensional construct, while the PSMI is a two-dimensional construct.

**Table 3.** Rotated factor analysis results for institutional pressures.

| Measurement Items | Factor Loadings | | | Communalities |
|---|---|---|---|---|
| | **Factor 1** | **Factor 2** | **Factor 3** | |
| MPs1 | **0.881** | 0.247 | 0.065 | 0.841 |
| MPs2 | **0.875** | 0.186 | 0.168 | 0.829 |
| MPs3 | **0.848** | 0.275 | 0.180 | 0.828 |
| CPs1 | 0.173 | **0.895** | 0.035 | 0.833 |
| CPs2 | 0.257 | **0.782** | 0.255 | 0.742 |
| CPs3 | 0.274 | **0.750** | 0.150 | 0.660 |
| NPs1 | 0.107 | 0.026 | **0.916** | 0.851 |
| NPs2 | 0.207 | 0.378 | **0.754** | 0.754 |
| Variance explained (%) | 31.079 | 28.619 | 19.519 | - |
| Variance cumulatively explained (%) | 31.079 | 59.698 | 79.217 | - |

Note: All the significant factor loadings are in bold text. The factors represent; coercive pressures (CPs), (2) mimetic pressures (MPs), and (3) normative pressures (NPs).

**Table 4.** Rotated factor analysis results for PSMI.

| Measurement Items | Factor Loadings | | Communalities |
|---|---|---|---|
| | **Factor 1** | **Factor 2** | |
| OI2 | **0.840** | 0.120 | 0.719 |
| OI3 | **0.763** | 0.198 | 0.621 |
| OI1 | **0.710** | 0.154 | 0.527 |
| PI1 | 0.020 | **0.896** | 0.803 |
| PI2 | 0.305 | **0.680** | 0.587 |
| PI3 | 0.483 | **0.595** | 0.555 |
| Variance explained (%) | 35.278 | 28.260 | - |
| Variance cumulatively explained (%) | 35.278 | 63.538 | - |

Note: All the significant factor loadings are in bold text. The factors represent (1) organizational Integration (OI) and (2) process Integration (PI).

## 4.2. Measurement Validation

Measurement validation was evaluated according to internal consistency, convergent validity, and discriminant validity. Internal consistency could be obtained through the measure of composite reliability and Cronbach's Alpha. As shown in Table 5, most values of composite reliability for the surveyed constructs are higher than the recommended criterion of 0.70. Only OC is between 0.60 and 0.70, indicating that the internal consistency reliability is sufficient. Convergent validity measures the degree to which the items underlying a specific construct that theoretically should be related are in fact related. In the research, convergent validity is analyzed by average variance extracted (AVE) and the factor loadings. The first index of convergent validity is the values of AVE. As reported in Table 5, each value of AVE exceeds the minimum criterion of 0.5, indicating that more than 50% of the variance in the items can be explained by their corresponding construct. Another index reflecting convergent validity can be obtained by the factor loadings of each construct. The cross-loading of the item on their respective constructs are all above the 0.5 threshold (Table 6). In addition, the square root of AVE for each construct in the diagonal of Table 5 is greater than the absolute value of inter-construct correlations (off-diagonal values) [50], suggesting that discriminant validity is confirmed to be satisfactory.

**Table 5.** Measurement validity and construct correlations.

| Constructs | Mean | S.D. | CR | Cronbach's $\alpha$ | AVE | Correlation Matrix | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | CPs | MPs | NPs | OC | PSMI |
| CPs | 4.47 | 1.587 | 0.898 | 0.829 | 0.746 | **0.864** | | | | |
| MPs | 5.09 | 1.229 | 0.930 | 0.887 | 0.816 | 0.512 | **0.903** | | | |
| NPs | 4.475 | 1.130 | 0.859 | 0.708 | 0.754 | 0.456 | 0.353 | **0.868** | | |
| OC | 4.75 | 1.326 | 0.805 | 0.637 | 0.581 | 0.455 | 0.362 | 0.358 | **0.762** | |
| PSMI | 5.145 | 1.130 | 0.842 | 0.762 | 0.535 | 0.545 | 0.566 | 0.363 | 0.484 | **0.688** |

Sources: Smart-partial least squares (PLS). Note: Bold values on the diagonal represent the square root of AVE.

**Table 6.** Cross-loadings for Measurement Items.

| Code | Item Loadings | | | | |
| --- | --- | --- | --- | --- | --- |
| | CPs | MPs | NPs | OC | PSMI |
| CPs1 | **0.889** | 0.418 | 0.324 | 0.367 | 0.477 |
| CPs2 | **0.862** | 0.437 | 0.440 | 0.391 | 0.440 |
| CPs3 | **0.839** | 0.469 | 0.416 | 0.417 | 0.491 |
| MPs1 | 0.448 | **0.904** | 0.270 | 0.307 | 0.505 |
| MPs2 | 0.442 | **0.897** | 0.311 | 0.321 | 0.524 |
| MPs3 | 0.498 | **0.909** | 0.374 | 0.353 | 0.506 |
| NPs1 | 0.224 | 0.225 | **0.797** | 0.235 | 0.208 |
| NPs2 | 0.508 | 0.363 | **0.935** | 0.364 | 0.388 |
| OC1 | 0.423 | 0.321 | 0.331 | **0.819** | 0.370 |
| OC2 | 0.295 | 0.325 | 0.354 | **0.800** | 0.388 |
| OC3 | 0.319 | 0.162 | 0.101 | **0.658** | 0.353 |
| OI1 | 0.377 | 0.510 | 0.452 | 0.494 | **0.842** |
| OI2 | 0.439 | 0.478 | 0.395 | 0.404 | **0.881** |
| OI3 | 0.286 | 0.466 | 0.384 | 0.478 | **0.865** |
| PI1 | 0.140 | 0.368 | 0.238 | 0.412 | **0.865** |
| PI2 | 0.394 | 0.372 | 0.277 | 0.449 | **0.818** |
| PI3 | 0.132 | 0.327 | 0.235 | 0.457 | **0.791** |

Sources: Smart-PLS. Note: Bold values represent standardized factor loadings of the items on their respective constructs.

## 4.3. Hypothesis Testing

Standard errors were computed by a bootstrapping procedure with 5000 resamples and thus the statistical significance of path coefficients was tested. Figure 4 and Table 7 present the results of the bootstrap-based PLS analyses. The structural model's assessment $R^2$ is a measure of the model's predictive accuracy and accounts for variances of dependent variable. The $R^2$ value of PSMI is 0.455, indicating that considerable variances in PSMI can be accounted for the research model, thus the model does have predictive accuracy. As shown in Figure 4, the effect of CPs on PSMI ($\beta = 0.242$, $p < 0.01$) is significant. It is also shown that the effect of MPs on PSMI ($\beta = 0.341$, $p < 0.001$) is significant and the influence of CPs is much stronger than that of MPs, whereas the NPs–PSMI link is nonsignificant ($\beta = 0.049$, $p > 0.05$). Therefore, Hypothesis 1a and Hypothesis 1b are supported, whereas Hypothesis 1c is not supported.

**Table 7.** Results of Hypothesis Testing.

| Path | Standardized Path Coefficient ($\beta$) | T Statistics | Inference |
| --- | --- | --- | --- |
| H1a: CPs→PSMI | 0.242 | 3.165 | Supported |
| H1b: MPs→PSMI | 0.341 | 3.894 | Supported |
| H1c: NPs→PSMI | 0.049 | 0.575 | Not supported |
| H2a: CPs→OC | 0.302 | 2.583 | Supported |
| H2b: MPs→OC | 0.148 | 1.675 | Not supported |
| H2c: NPs→OC | 0.168 | 1.571 | Not supported |
| H3: OC→PSMI | 0.233 | 2.707 | Supported |

The mediating role of OC was also assessed by performing PLS analysis. Firstly, considering the relationships between CPs, MPs, NPs, and OC respectively, only the effect of CPs is significant ($\beta = 0.302$, $p < 0.01$); therefore, Hypothesis 2a is supported, whereas the MPs–OC link ($\beta = 0.148$, $p > 0.05$) and NPs–OC link ($\beta = 0.168$, $p > 0.05$) are nonsignificant. Therefore, Hypothesis 2b and Hypothesis 2c are not supported. Furthermore, the OC–PSMI link ($\beta = 0.233$, $p < 0.01$) is significant, hence, Hypothesis 3 is supported. Considering the significant effect of MPs on OC and influence of OC on PSMI, it can be inferred that OC plays a partially mediating role between MPs and PSMI. To further understand the influences of institutional pressures on PSMI in construction projects, the authors conducted an alternative model without the inclusion of OC based on the collected data (Figure 5). While the intermediating effect of OC is excluded, the direct effects of CPs ($\beta = 0.308$, $p < 0.001$) and MPs ($\beta = 0.355$, $p < 0.001$) on PSMI are both significant. Together with the results shown in Figure 4 with an original full model, these findings demonstrate that the effect of CPs on PSMI is fully mediated by OC, while the influences of MPs and NPs on PSMI are not significant. Hence, coupling with all above results indicates that the construct of owner's cognition partially mediates the effects of institutional pressures on PSMI, thus, Hypothesis 4 is also supported.
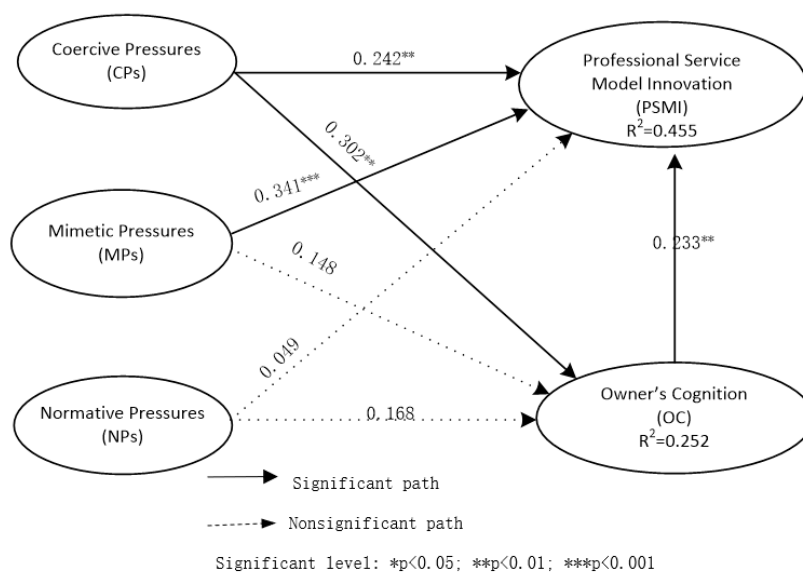


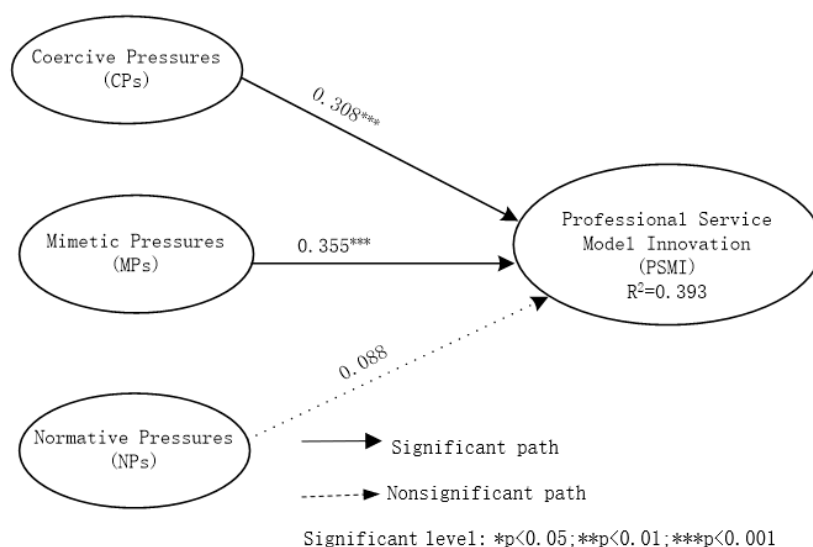**Figure 4.** Results of PLS-based analysis for the full research model.



**Figure 5.** Results of PLS-based analysis for the alternative research model.

## 5. Discussions and Implications

*5.1. Discussions*

Results from this research confirm the relationship between institutional pressures and PSMI during technological shift and professionalism shift. The validated model provides quantifiable information that may guide the Chinese construction industry in bolstering the trend of whole life cycle professional service. A better understanding is that institutional pressures play a significant role during life cycle professional service model innovation. Importantly, the study provides a measurement tool for construction practitioners to assess their business environment and owner's cognition and improve PSMI.

CPs are significant influencing factors for PSMI, where the construct of the owner's cognition plays a fully mediating role. Among the effect of three types of pressures on owner's cognition, the effect of CPs on owner's cognition is most significant (Figure 4). These findings jointly prove that project owners, who are nonprofessionals, may be more easily affected by external mandates than by less compulsory forces such as normative proposal. Prior research shows that authoritative pressures may not materially influence innovation activities in other industries or may only give rise to some superficial changes [30,58]. The current study reveals that the effect of coercive pressures on PSMI seems to be more significant. This is probably because the professionalization process is subject to statutory order rather than self-discipline, which is different from other Western countries [1]. Regulatory agencies play a crucial role in the development of the construction industry. Accordingly, clients, mostly from public projects, are highly interrelated with government agencies, thus tend to be faithfully in compliance with the requirements of regulatory agencies.

Results by PLS show that MPs have a significant effect on PSMI. Though not specifically based on institutional theory, some prior studies on other innovations in the construction industry have explored the effect of MPs on innovation uptake, and have uncovered relatively inconsistent results because of the differing natures of innovation. For instance, administrative safety innovations in the United States conducted by Esmaeili and Hallowell [59] and Cao's study [30] on BIM diffusion in China indicate that competitor behavior is a relatively important factor for the diffusion of these innovations [30,60]. For PSMI, the innovation process often involves project process change, intangible benefits, and social network change. This finding further confirms that pilot projects using whole life cycle consulting exert an important influence on other projects in the construction industry. However, peer projects do not severely influence owner's attitudes to PSMI, probably because of ROI uncertainty and distrust in the capability of professionals and the owner's past experience. Therefore, the construct of owner's cognition does not significantly play a mediating role between MPs and PSMI. This finding precisely explains that whole life cycle professional service model innovation in many early projects was actually driven by authoritative agency and successful pilot projects. Thus, in the future, government agencies should foster pilot projects to show the advantages of the professional service mode.

With regard to NPs, the present study demonstrates that they have no significant influence on PSMI. In contrast to the result of Toole [60], whose findings indicate that whether construction innovations are adopted by participants or not is dependent on information provided by outside professionals, the present study is different from the prior studies. This nonsignificant effect of NPs on PSMI is probably not because professional institutions or societies have not yet endeavored to propagandize the advantage of whole life cycle professional service in the industry, which can be confirmed by the collected data of the mean value of recognized normative pressures in the survey (Table 5, mean = 4.475). However, because of being one-off participants in the construction industry, it seems that decision-making about innovation activities may not be easily affected by the normative influences, such as professional institutions and industry professionals (Figure 4, $\beta_{NP-OC} = 0.168$; $\beta_{NP-PSMI} = 0.049$). This is probably because the third party in China is a top-down approach, so professionalism in China's building sector is characterized by strong links to governmental control and patronage [61,62]. Without independence, both professional institutions and building professionals

are incapable of fully playing the role of self-regulation in the building sector. This inability impairs the professional body's quality or effectiveness [61], thus losing credibility and contributing to a less convincing appearance.

*5.2. Implications*

Based on institutional theory, this study empirically validates the drive model of PSMI in the context of technology change and professionalism shift in the construction industry. Through incorporating the effect of external institutional pressures and owner's cognition on PSMI into the research framework, the findings contribute to understanding how different types of institutional pressures can be better developed to motivate PSMI in the construction industry. The research also explains reasons of the results and thus contributes to better understand theory diversification of professionalism.

The findings from the research have some practical implications. First, the findings intensify the point that, as a complex socialized activity, PSMI may not only be driven by proactive economic benefit needs but also by institutional pressures, especially CPs and MPs. The study provides the direction that policies should take to encourage the development of the life cycle professional service and its associated practices. Second, the results indicate that the effect of institutional pressures on PSMI is partially mediated by owner's cognition, thus participants in the industry should make owners realize the advantages of life cycle consulting activities. Third, based on community governance theory, professional bodies should exert overwhelming influence on the process of professionalization, however, the study results in conflict outcomes. So it seems to suggest that impartiality and integrity of the industry's professional bodies should be restored to change the imbalanced relationship between professionals and public clients [61].

Theoretically, this study contributes to providing a way to understand PSMI mechanisms for professionalism cultivation in the industry. The proposed framework explains the drivers of PSMI in the initial stage of the life cycle professional service in China. Researchers can utilize the framework to study the effect of institutional pressures on other innovations. Although the framework is developed in the Chinese construction industry, the theoretical model can be validated in other countries.

## 6. Conclusions

As a fundamentally professional service model to provide comprehensive service for the owner, in recent years industrial and academic circles increasingly concern about life cycle professional service in China. However, its adoption is not yet expanded in the whole industry. This study validated empirically the relationships between PSMI and its drivers for the Chinese construction industry in the context of technological shift and the tendency of de-professionalization. A nationwide survey was distributed to the projects adopting life cycle professional service. Collected data were analyzed and validated through PLS analyses. Results confirm that external institutional pressures can significantly influence PSMI, and owner's cognition is a crucial mediator for the effects of coercive pressures and mimetic pressures on PSMI. This study also explains how different types of institutional influences could be better conducted to facilitate the adoption of the life cycle professional service in the construction industry, which enriches the theory system of professionalism.

This study has several limitations. First, the relatively small sample size may omit other important factors. Thus, a larger-sized sample may strengthen the validity of the model. Second, the model considers only the external factors driving PSMI. Internal factors in the professional system or consulting sector may be the other important drivers of PSMI. Nevertheless, the limitations provide opportunities for future research.

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