An Analysis of Influencing Factors on Sustainable Construction Behavior Based on Theory of Planned Behavior

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Abstract. Based on the Theory of Planned Behavior and taking leadership support, green demand of employee as regulatory variables, we established a theoretical model of influencing factors on sustainable construction. Structural Equation Model and hierarchical regression analysis were used to test the model. Results show that behavioral attitudes, subjective norms and perceived behavioral control have significant impacts on sustainable construction behavior through the intermediary role of behavioral intention of sustainable construction. Leadership support has a negative regulated effect between behavioral intention of sustainable construction and sustainable construction behavior while green demand of employee has no regulated effect.

1. Introduction
Construction industry is one of the pillar industry of Chinese economy, but construction activities also consume large resources and cause environmental problems. The construction industry must achieve sustainable construction. Sustainable construction means incorporating the concept of sustainable development into construction activities, requiring to reduce the environmental impacts, improve waste management, increase social welfare and enhance economic benefits [1]. However, compared with other industries, construction industry lacks innovation, which makes it hard to change traditional model of production. Thus, how to promote the adoption of sustainable construction in construction industry has drawn widespread attention.

Existing researches investigated the influencing factors on sustainable construction mainly from organization, stakeholders, finance and technology [2, 3]. However, a systematic analysis of internal and external factors on sustainable construction remains rare, therefore, based on the Theory of Planned Behavior, this paper constructs a framework to exam the influencing factors on sustainable construction. Considering leaders and employees play an important role in the decision-making process of construction enterprises, this paper takes the leadership support and green demands of employees as the regulatory variables.

2. Theoretical Background and Hypotheses.

2.1. Theory of Planned Behavior
The Theory of Planned Behavior (TPB) was developed from the Theory of Reasoned Action (TRA) [4]. The TRA emphasizes the impact of behavioral intention on behavior, which in turn, influenced by
behavioral attitude and subjective norm. However, it can be found that most behaviors are not only influenced by individual's intention, but also influenced by the ability and condition of individual to perform their behavior. Therefore, Ajzen added the variable of perceived behavioral control to the TPA and proposed the TPB. The TPB combines internal and external influencing factors of behavior and has been widely used in management, clinical medicine, marketing and other fields. This paper aims to apply the TPB to explore influencing factors on sustainable construction in construction enterprises.

2.2. Hypotheses

(1) Behavioral attitude and behavioral intention of sustainable construction.

Behavioral attitude refers to the preference of a certain behavior. Behavioral attitude of sustainable construction in construction enterprises is mainly affected by internal factors such as organizational culture [5]. Organizational culture is a common model of values and beliefs within enterprises. Research shows that organizational culture not only plays an important role in the operation of construction enterprises but also is an important factor on sustainable construction [6]. Although technical and financial pressures affect the adoption of sustainable construction, organizations can hardly try this behavior if culture has been a barrier in the decision-making process [7]. Organizations that promote the concept of sustainable development will stimulate their internal driving forces and enhance their willingness to carry out sustainable construction. Therefore, we proposed hypothesis 1:

H1: Behavioral attitude has a positive effect on behavioral intention of sustainable construction.

(2) Subjective norm and behavioral intention of sustainable construction.

Subjective norm refers to the external participants that affect construction enterprises to implement sustainable construction. Expectations and pressures from governments, owners, communities and non-government environmental organizations have major impacts on the adoption of sustainable construction. Strict government regulations will significantly improve the construction enterprises' attitude towards sustainable construction [8]. Shen et al. found that if owners consider and require construction project works from a perspective of sustainable development, the driving force can be gained to achieve better sustainability [2]. Public participation is an important part of assisting the government in environmental management. On the one hand, Public supervision can expose the illegal activities in the production process of construction enterprise and inform the government departments. On the other hand, public opinion enables construction enterprises to pay attention to whether their economic activities are conducive to environmental protection, and promotes them to cultivate corporate social responsibility [9]. In addition, the emergence of more and more non-governmental environmental organizations in China have also been influencing the behavior of contractors by articulating environmental concerns and framing alternatives [10]. The expectations and pressures from external stakeholders affect the construction enterprises' willingness to carry out sustainable construction. Therefore, we proposed hypothesis 2:

H2: Subjective norm has a positive effect on behavioral intention of sustainable construction.

(3) Perceived behavioral control and behavioral intention of sustainable construction.

Perceived behavioral control refers to the perceived difficulty of reaching a certain behavior. Sustainable construction requires available advanced technology, qualified workers and green material resources. Research show that incremental cost and time hinder the implement of sustainable construction of construction enterprises [11].Construction enterprises with higher technical level have strong confidence in the adoption of sustainable construction. In addition, construction enterprises are motivated if they think it is easier to get advanced equipment, qualified workers and green materials from market. Otherwise, they will not take risks adopting sustainable construction. Therefore, we proposed hypothesis 3:

H3: Perceived behavioral control has a positive effect on behavioral intention of sustainable construction.

(4) The intermediary role of behavioral intention of sustainable construction
The behavioral intention of sustainable construction reflects the efforts and costs that construction enterprises are willing to pay for the sustainable construction. Recent studies from different fields have proved that behavioral intention has a positive effect on behavior. Construction enterprises with greater willingness will increase the likelihood of the implementation of sustainable construction, therefore, we proposed hypothesis H4:

H4: Behavioral intention of sustainable construction plays an intermediary role between behavioral attitude, subjective norm, perceived behavioral control and sustainable construction.

(5) The regulatory role of leadership support and green demands of employees

The leader’s awareness of environmental protection affect construction enterprises to carry out sustainable construction. If leaders highlight environmental protection, the organization will actively adopt an environmental management strategy [12]. Meanwhile, strong support from leaders in R & D of advanced technologies, personnel training, etc. will enhance the technology capabilities of organizations, which promotes the implementation of sustainable construction. The green demands of employees reflect the employees' appeals to a healthy, safe and comfortable work environment. Ensuring the health and safety of construction workers is the basis for the social sustainability of construction industry. When construction workers perceive their health and safety been compromised by a company’s poor environmental performance, they may refuse to work. In response to employees' health and safety needs, the construction enterprises needs to take measures. Therefore, we proposed hypothesis 5 and hypothesis 6:

H5 leadership support has a regulatory role between behavioral intention of sustainable construction and sustainable construction.

H6 green demands of employees has a regulatory role between behavioral intention of sustainable construction and sustainable construction.

The theoretical model of influencing factors on sustainable construction is shown in Figure.1.

![Figure 1. Theoretical model of influencing factors on sustainable construction](image)

3. Research methods

3.1. Study Sample

In order to ensure the reliability and validity of questionnaire, this paper made appropriate modifications on existing mature items to consist the questionnaire. The measure of questionnaire totally contains 31 items. Each item measure was scored on a 5-point scale from “strongly disagree” to “strongly agree”. Firstly, questionnaires were distributed to several construction enterprises to test its reliability. Results showed that the reliability was qualified. Then, we distributed questionnaires to different construction enterprises from Shanghai. Total 300 questionnaires were collected, and 255 questionnaires were valid. Among these interviewees, the proportion of male was 73.24%; the proportion of senior managers and department heads were 24.43% and 43.78% respectively; the rest proportion was project managers.
3.2. Study Sample
(1) Reliability and validity test
The reliability and validity of the questionnaire were analyzed by using SPSS22.0 and AMOS22.0. Results are shown in Table 1. The coefficients of $\alpha$ are greater than 0.7, indicating that the questionnaire has good reliability. The standardized factor loads (SFLs) meet the requirement of $0.50 < \lambda < 0.95$. The fitting index of $\chi^2/df$ is between 1 to 3. The coefficient of RMSEA is less than 0.08. The coefficient of CFI, TLI and IFI are greater than 0.9. Further, the coefficient of PNFI and PCFI are greater than 0.5. All those indices are accept, which proves that the questionnaire has good reliability and validity.

Table 1. Results of reliability and validity

| Latent variables                  | Items | SFLs | T-value | $\alpha$ | Latent variables                  | Items | SFLs | T-value | $\alpha$ |
|----------------------------------|-------|------|---------|----------|----------------------------------|-------|------|---------|----------|
| Behavioral attitude              | XT1   | 0.79 | 14.19   | 0.86     | Leadership support               | LZ1   | 0.73 | 11.47   | 0.74     |
|                                  | XT2   | 0.74 | 12.98   |          |                                  | LZ2   | 0.69 | 11.03   |          |
|                                  | XT3   | 0.63 | 10.53   |          |                                  | LZ3   | 0.71 | 11.04   |          |
|                                  | XT4   | 0.68 | 11.43   |          | Green demands of employees       | YLR1  | 0.72 | 11.08   | 0.72     |
|                                  | XT5   | 0.62 | 10.28   |          |                                  | YLR2  | 0.68 | 10.97   |          |
|                                  | XT6   | 0.78 | 14.03   |          |                                  | YLR3  | 0.68 | 10.50   |          |
| Subjective norm                  | ZG1   | 0.81 | 14.70   | 0.85     | Behavioral intention of sustainable construction | YY1   | 0.72 | 11.93   | 0.76     |
|                                  | ZG2   | 0.76 | 13.41   |          |                                  | YY2   | 0.74 | 12.21   |          |
|                                  | ZG3   | 0.81 | 14.63   |          |                                  | YY3   | 0.63 | 10.50   |          |
|                                  | ZG4   | 0.68 | 11.53   |          |                                  | YY4   | 0.70 | 12.07   |          |
| Perceived behavioral control     | ZXK1  | 0.61 | 9.63    | 0.80     | Sustainable construction         | XW1   | 0.66 | 10.78   | 0.80     |
|                                  | ZXK2  | 0.64 | 10.35   |          |                                  | XW2   | 0.62 | 9.78    |          |
|                                  | ZXK3  | 0.71 | 11.74   |          |                                  | XW3   | 0.70 | 11.43   |          |
|                                  | ZXK4  | 0.61 | 9.62    |          |                                  | XW4   | 0.60 | 9.32    |          |
|                                  | ZXK5  | 0.63 | 10.04   |          |                                  | XW5   | 0.67 | 10.90   |          |
|                                  | ZXK6  | 0.62 | 9.98    |          |                                  |       |      |         |          |

$\chi^2/df = 1.418$ \hspace{1cm} RMSEA = 0.041 \hspace{1cm} CFI = 0.943 \hspace{1cm} TLI = 0.935 \hspace{1cm} IFI = 0.944 \hspace{1cm} PNFI = 0.730 \hspace{1cm} PCFI = 0.827

(2) Hypothesis test
The AMOS22.0 was used to test the correlation between variables. The modified indices are as follows: $\chi^2/df = 1.403$; RMSEA=0.040; NFI=0.866(greater than 0.85); TLI=0.95, CFI=0.957 and PNFI=0.762, PCFI=0.842. The test results are shown in Table 2.
Table 2. Path coefficient estimation and hypothesis test

| Hypothesis | Path | standardized path coefficient | P-value | Hypothesis test |
|------------|------|-------------------------------|---------|----------------|
| H1         | Behavioral attitude- Behavioral intention | 0.37 | *** | Support |
| H2         | Subjective norm- Behavioral intention | 0.27 | *** | Support |
| H3         | Perceived behavioral control- Behavioral intention | 0.22 | ** | Support |
| H4         | Behavioral intention- Sustainable construction | 0.71 | *** | Support |

In Table 2, behavior attitude has a positive effect on the behavioral intention of sustainable construction at the level of $P < 0.001$. Subjective norm also has a positive effect on the behavioral intention of sustainable construction at the level of $P < 0.01$. Perceived behavioral control has a positive effect on the behavioral intention of sustainable construction at the level of $P < 0.01$. Behavioral intention of sustainable construction has a positive effect on sustainable construction at $P < 0.001$. Therefore, the behavioral intention plays an intermediary role between behavioral attitudes, subjective norm, perceived behavioral control and sustainable construction. The hypotheses H1-H4 are proved.

Hierarchical regression analysis was used to examine the regulatory role of leadership support and green demands of employees. Firstly, centralized processing was applied to variables. Then, we built five models to acquire the coefficients, as shown in Table 3. The testing results of model 2 and model 3 indicated that leadership support has a negative regulated effect between behavioral intention of sustainable construction and sustainable construction. And the testing results of model 4 and model 5 indicated that the green demands of employees has no regulated effect. Therefore, H5 is proved while H6 is not proved.

Table 3. The testing of regulated variables

|                          | Dependent variable: sustainable construction |
|--------------------------|-----------------------------------------------|
|                          | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
| Control variable         |         |         |         |         |         |
| Gender                   | 0.204   | 0.001   | 0.006   | 0.013   | 0.002   |
| Year                     | 0.074   | -0.022  | -0.005  | -0.009  | -0.013  |
| Position                 | 0.114   | 0.025   | -0.005  | -0.011  | -0.001  |
| Mediating variable       |         |         |         |         |         |
| behavioral intention     |         | 0.600** | 0.481** | 0.567** | 0.540** |
|                          |         | *       | *       | *       | *       |
| Regulated variable       |         |         |         |         |         |
| leadership support       | 0.106*  | 0.130** |         |         |         |
| green demands of employees |         | 0.157** | 0.145** |         |         |
| interaction              |         |         |         |         |         |
| leadership support × behavioral intention |         | 0.203** |         |         |         |
| green demands of employees × behavioral intention |         |         | -0.053  |         |         |
| $R^2$                    | 0.016   | 0.406   | 0.453   | 0.416   | 0.420   |
| F-value                  | 1.381   | 4.34*   | 21.42** | 8.71**  | 1.695   |
4. Conclusion
Based on the TPB, this paper systematically studied the internal and external factors of sustainable construction. Results showed that behavioral attitudes, subjective norm and perceived behavioral control influence sustainable construction through the intermediary role of behavioral intention. Leadership support has a negative regulated effect between behavioral intention of sustainable construction and sustainable construction while the green demands of employees has no regulated effect. To promote the adoption of sustainable construction in construction enterprises, the culture of sustainable development should be highlighted within organizations. Pressures from external stakeholders should be exerted. The construction enterprises should also develop advanced production technology to reduce the cost of using green materials and equipment. In addition, leaders of construction enterprises should reinforce their understanding of the concept of sustainable development and actively support sustainable construction.

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