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Published in:
Sustainability (Switzerland)

Published: 01/11/2017

Document Version:
Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record

Published version (DOI):
10.3390/su9112060

Publication details:
Wu, X., Yin, W., Wu, C., & Luo, X. (2017). The spillover effects on employees' life of construction enterprises' safety climate. *Sustainability (Switzerland)*, *9*(11), [2060]. https://doi.org/10.3390/su9112060

sustainability

Article

The Spillover Effects on Employees' Life of Construction Enterprises' Safety Climate

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Received: 29 September 2017; Accepted: 7 November 2017; Published: 10 November 2017

Abstract: Organizational safety climate will produce spillover effects and thus affect the individuals' performance in their family life. As a mainstay industry in many countries, the construction industry has a considerable number of employees and the research on the spillover effects from the safety climate of construction enterprises has important theoretical and practical significance to improve the safety behavior of construction employees in their family life. In this study, we thoroughly reviewed the literature to identify the dimensions of the safety climate spillover, obtain empirical data of the construction employees through a questionnaire survey, and use the data analysis method to study the spillover effects of the safety climate of the construction enterprises from the perspective of work–family integration, and reveal its influence mechanism. This study developed a questionnaire to measure the safety climate spillover of the construction enterprises including two dimensions, namely values and behaviors, with nine measured items. Management commitment and safety attitude in the safety climate were positively related to the spillover, and management commitment had the greatest impact on the spillover, while the other components were not significantly related to the spillover. The two forms of spillover, values and behaviors, were mutually influential, and the safety climate had a more significant impact on the values. This paper contributes to the current safety research by developing a factor structure of spillover effects of the safety climate on the lives of construction employees, thus providing a more profound interpretation of this crucial construct in the safety research domain. The spillover effects of the safety climate's measurement questionnaire serve as an important tool for spillover among construction enterprises. Findings can facilitate improvement in both theories and practices related to the spillover effects of the safety climate on the lives of employees. This paper studies the spillover effects of construction enterprises' safety climate, to reveal its influencing mechanism, and can thus provide theoretical guidance for preventing safety accidents in employees' life.

Keywords: safety climate; spillover; construction enterprises; values; behaviors

1. Introduction

In recent years, there have been many types of accidents in family life, and the number of these accidents is much higher than those of production safety accidents [1]. These safety incidents in family life are seemingly unprotected, but safety science research has now been incorporated into this field of research. Safety accidents in family life are caused by unsafe behavior in life, and in two areas, work and family are interdependent [2,3], with familial behavior inevitably affected by factors at work. One of the most important theories to describe the relationship between work and family is spillover [4]. Spillover is the individuals' pass affect, behaviors, and values acquired in either work or family to another domain in some way [5]. Edwards and Rothbard defined work–family spillover as "the effects of work and family on one another that generate similarities between the two domains" [2]. Furthermore, the safety climate of the organization raised will affect the individual's safety behaviors in another area [6].

In the literature, we can find that there have been some basic studies on spillover such as the relationship between work–family spillover and satisfaction [7]; the study of the relationship between gender differences and spillover [8]; and climate spillover in the organization [9]. Ragins [10] studied the spillover of racial diversity and found that the perceived racial diversity of employees had an impact on the turnover of employees in the workplace. Singh and Selvarajan [9] proved that the racial diversity of the climate will significantly affect the tendency of the staff to stay in the workplace. Naveh and Navon [6] studied the spillover effects of the road safety climate, and their results showed that the road safety climate of the employees' enterprises had a positive impact on the safety driving behavior of the employees in the family. However, given that domestic research began relatively late in China, there is almost a complete lack of safety climate spillover research. As different industry characteristics and management models lead to different dimensions of safety climate, the study of the spillover of the safety climate has to be specific to a particular industry to start with. The construction industry, as China's basic industry, has a large number of employees with a large social impact. Therefore, this study is of great practical significance for the safety climate spillover in China's construction enterprises, so that measures to enhance positive spillover can be proposed to improve the safety behaviors of construction employees in the family.

2. Theoretical Basis and Research Hypothesis

In this section, a literature review was conducted to explore the structural dimensions of the safety climate of construction enterprises, to enable the development of an appropriate safety climate measurement questionnaire.

Through the literature review and interview process, we explored expressions of the safety climate spillover of the construction enterprises and designed the spillover measurement questions. Next, we interviewed the construction employees to verify the reliability of the items in the spillover questionnaire. The data on the safety climate and spillover of the construction enterprises were obtained through the questionnaire survey. Finally, we used the data analysis method to study the influence of the dimensions of the safety climate on life spillover. This section will present a number of hypotheses to be tested in subsequent empirical studies.

2.1. The Measurement of the Safety Climate

To reveal the impact of safety climate on life spillover effects, we needed to measure the enterprises' safety climate. Safety climate is made up of shared perceptions among employees concerning the procedures, practices and behaviors of work safety in organization environment [11]. The safety climate questionnaire was an important tool for measuring this impact; however, different safety climate dimensions lead to differences in the variables for measurement questionnaires. The existing safety climate questionnaires are designed for the manufacturing, construction, energy, aviation, and health care industries [12–14]. The earliest safety climate questionnaire was designed by Zohar, and was based on the characteristics of the manufacturing industry, with forty items, which have also been widely used in many subsequent studies [15]. The Nordic Occupational Safety Team researchers developed a questionnaire containing seven dimensions with 50 items. The Nordic Safety Climate Questionnaire (NOSACQ-50) is also a reliable tool for measuring the safety climate [16]. For the oil and gas industry, Health & Safety Executive (HSE) developed a safety climate measurement scale that included a total of 71 items and 10 dimensions [17].

Research on the safety climate of the construction enterprises is mature in China, where the research of Fang et al. on the construction enterprises form the main pillar, and the structure of the safety climate is also in the process of continuous development and improvement. In this study, we used the questionnaire designed by Zhou and Fang et al. [18], which contains a total of 24 questions in four dimensions: management commitment; safety regulations; safety supervision, safety training and workers' support; and safety attitude.

Management commitment is a dimension recognized in the vast majority of safety climate research [19,20], and contained six questions. Safety regulations covered the perception and attitudes of employees to safety rules, compliance, or breaches of regulations. This dimension contained five questions. Safety supervision can be seen as an indirect way for managers to focus on safety, and safety training is the most effective way for management and employees to communicate on safety issues. Workers' support can reflect the impact of co-workers on the impact of the situation. Safety supervision, training, and workers' support contained nine questions. Safety attitude encompassed a staff-level survey that reflected the employee's risk identification and risk attitude at work, as well as personal safety priorities and safety needs, and included four questions.

2.2. The Measurement of the Spillover Effects of Safety Climate

Work and family are the two most important domains of workers' personal life [1]. The family life in this paper refers to workers' life domain other than issues related to their occupational domain. Spillover was first raised by the sociologist Rosabeth Kanter in the study of work and family issues and correlations, and pointed out that these two fields would influence each other [3]. There are two main types on work and family relations: negative and positive. Hanson et al. [5] defined the positive spillover of work–family as a positive effect, where behaviors, skills, and values were transferred between the two areas, thus demonstrating a positive impact. This definition is also universally recognized. In further studies, scholars found that accumulated experience in the field of work or family could spill from one field to another. Edwards and Rothbard [2] put forward four types of spillover: affect, behaviors, values, and skills. Williams [21] proved a positive affect spillover of a role to another character such as excitement, enthusiasm, and happiness. Other studies have also pointed out that the skills that employees learn in a role can make them more efficient when dealing with tasks in another role [22].

Through the study of the previous literature, we found that the study of spillover is rare, and that there is no mature questionnaire. Early spillover questionnaires contained an incomplete type of spillover such as the questionnaire designed by Hammer [23], which only contained the affect dimension. Grzywacz et al. [24–26] designed a spillover questionnaire containing behaviors, affect, and skills, but did not include values. Either the impact of the various fields was included, or some of the items and the definition of positive spillover did not meet [1]. Based on previous studies, Hanson developed a work–family positive spillover questionnaire that contained 11 questions divided into three dimensions: affect, values, and behaviors [5]. The questionnaire was validated with good reliability and validity, and the items of the questionnaire reflected the connotation and structure of the work–family positive spillover more accurately, and have been applied to later research works. The safety climate spillover questionnaire is less used in China, where it has only been used for coal mining and university laboratory's safety climate spillover, and is still being developed.

Based on the spillover effects questionnaires designed by Hanson [5] and Gao [1], we developed the safety climate spillover effects questionnaire used in this study. The questionnaire designed by Hanson [5] contained three dimensions, i.e., affect, values, and behaviors. Gao [1] designed a questionnaire for laboratory safety climate spillover effects in China containing three dimensions: values, behaviors, and skills. Some researchers in Western countries applied the spillover factor structure with the dimension "affect". However, in China, researchers tended to use only three dimensions in the spillover factor structure. Thus, we also applied the three-dimension factor structure to make our questionnaire more applicable to its specific setting. Finally, we developed a spillover effects questionnaire with three dimensions, behaviors, values, and skills, and combined the characteristics of the construction enterprises to design the measurement items, where each dimension had five items, with a total of 15 items.

2.3. Hypotheses

In the study of spillover of the construction enterprises' safety climate, this paper mainly discusses the positive spillover of the construction employees' perceived safety climate on their daily life. In establishing the theoretical model to study the effect of each safety climate dimension on spillover, safety climate is the cause of changes to construction employees' lives as the independent variable, i.e., the exogenous latent variable. The change in life is the result of the safety climate as the dependent variable, i.e., the endogenous latent variable. Considering previous research works, the following hypotheses were proposed. The first hypothesis is related to the influence of the exogenous latent variable ζ on endogenous latent variable η:

Hypothesis 1 (H_1). *The dimensions of safety climate influence the spillover positively and significantly.*

Management commitment in safety is the most important factor of a satisfactory safety level [19]. It is related to management attitudes and actions towards safety, and represents managers' safety values. Values learned in one role may have a socializing influence on one's general life values [5]. Thus, this dimension may influence employees' values and behaviors in their life.

Safety regulations are linked to work behaviors [27]. These regulations may influence employees' behavior to a large extent. Regulations are also behavior guidance, which may help develop employees' skills.

Langford et al. [28] indicate that the more supervisors are, the more likely that operatives will perform safely. Safety training can develop employees' safety skills and may influence their behaviors to a certain extent. Co-workers always stay with employees in the workplace, so their support may influence employees' behaviors and skills directly.

Safety attitudes include attitudes to promote the safety skill [29]. Safety attitude reflect employees' safety values to a significant extent.

Thus, based on the above interpretation, H1 can be further divided into the following three sub-hypotheses:

Hypothesis 1a (H_{1a}). *Three dimensions of safety climate (i.e., management commitment $\zeta1$; safety regulations $\zeta2$; and safety supervision, training and workers' support $\zeta3$) influence the behaviors spillover positively and significantly.*

Hypothesis 1b (H_{1b}). *Three dimensions of safety climate (i.e., management commitment $\zeta1$; safety supervision, training and workers' support $\zeta3$; and safety attitude $\zeta4$) influence the values spillover positively and significantly.*

Hypothesis 1c (H_{1c}). *Three dimensions of safety climate (i.e., safety regulations $\zeta2$; safety supervision, training and workers' support $\zeta3$; and safety attitude $\zeta4$ influence the skills spillover positively and significantly.*

The second hypothesis addresses the interaction between endogenous latent variables η:

Hypothesis 2 (H_2). *The three dimensions of spillover (behaviors, values and skills) have positive and significant influences on each other.*

3. Methods

3.1. Measures and Instruments

3.1.1. The Measurement of the Safety Climate

In this study, we used the questionnaire designed by Zhou and Fang et al. [17]. The questionnaire contained four dimensions: (1) management commitment; (2) safety regulations; (3) safety supervision, safety training, and workers' support; and (4) safety attitude, with a total of 24 questions.

3.1.2. The Measurement of the Spillover Effects of Safety Climate

To measure the safety climate spillover effects, there are few mature measurement questionnaires. Based on the work of Hanson [5] and Gao [1], we developed the safety climate spillover effects questionnaire used in this study. The questionnaire designed by Hanson [5] contained 11 questions which were classified into three dimensions, i.e., affect, values, and behaviors. Gao [1] designed a questionnaire containing three dimensions, values, behaviors, and skills, which was originally designed for laboratory safety climate spillover effects in China. Therefore, in this study, the spillover effects questionnaire contained three dimensions, behaviors, values, and skills, combined with the characteristics of the construction enterprises to design the measurement items, where each dimension had five items, with a total of 15 items.

3.2. Procedure and Participants

The questionnaire consisted of three parts. The first part was the questionnaire description to introduce the purpose and content of the questionnaire, so that the study object could understand the background behind the survey. The second part was to obtain demographic information such as the employees' gender, age, length of service, education level, and other basic information. The third part measured the safety climate and the safety climate spillover effects of the construction enterprises, including the safety climate questionnaire and safety climate spillover effects questionnaire.

The questionnaire items were rated on a five-point Likert questionnaire ranging from 1 = "strongly disagree" to 5 = "strongly agree". The higher the scores, the better the safety climate of the enterprises, and the stronger the positive safety climate spillover effects.

The questionnaire survey was divided into two stages. In the first stage, the preliminary spillover effects questionnaire built above was distributed to a sample of the population. Exploratory factor analysis (EFA) was then used to analyze the responses received to improve the preliminary spillover effects questionnaire. In the second stage, the improved spillover effects questionnaire and safety climate questionnaire was adopted by a wider sample of the population. To confirm the reliability of the questionnaires, confirmatory factor analysis (CFA) was used to analyze the responses. In the first stage, we distributed the safety climate spillover effects questionnaire to construction sites in Hunan and Beijing, where safety managers explained the questionnaire to their employees. After the construction employees completed the survey, the safety managers recycled the questionnaire and returned it. In the second stage, some were also published online. In the first stage, 200 questionnaires were collected, and 111 were valid. The age of the valid respondents ranged 21–57 years old, and working years ranged 1–35 years. For education background, 9.9% had a primary education, 42.3% had secondary education, 32.4% had a senior high school education, and 8.1% had a Bachelor's degree. Of the sample population, 109 samples were male and 2 were female.

A total of 308 valid questionnaires were collected in the second stage. The age of the valid respondents ranged 19–58 years old, and working years ranged 0.5–38 years. For education background, 1.9% had primary education, 9.1% secondary education, 36.4% had senior high school education, 48.7% had a Bachelor's degree, and 3.5% held a Master's degree. A total of 286 samples were male, and 26 were female.

3.3. Data Analysis Methods

Confirmatory factor analysis (CFA) is an important analytic tool for the estimation of scale reliability [30]. Internal consistency and reliability of the latent constructs were assessed. CFA was conducted to test the correlation of the conceptual model with the survey data [29]. Confirmatory factor analysis attempts to verify a hypothesized factor structure of observed variables and test a relationship between observed measures and their underlying latent factors. The conducted CFA may not be acceptable with insignificant indicators or other reasons, so it should to be modified and improved. Thus, the adequacy of the initial CFA model should be determined, and the model's fit to the data must be evaluated [31]. The goodness of fit was examined to evaluate the acceptability of the initial CFA model [29]. As the safety climate questionnaire used in this study was an existing mature questionnaire, only confirmatory factor analysis was required. While the safety climate spillover questionnaire was designed based on an existing questionnaire, to determine the validity of this questionnaire, this paper conducted a pre-survey, and explored the exploratory factor analysis of the sample data before conducting a confirmatory factor analysis. Finally, the structural equation model (SEM) was used to test the reliability and validity of the research model to verify the above-mentioned hypotheses. SEM allows the researchers to statistically examine the relationships between theory-based latent variables and their indicator variables by measuring directly observable indicator variables. Covariance-based SEM (CB-SEM) is the more widely used approach in SEM. CB-SEM, follows a maximum likelihood (ML) estimation procedure and aims at "reproducing the covariance matrix, without focusing on explained variance" [32]. The data were analyzed by SPSS v22.0 and AMOS v22.0.

4. Results

4.1. Questionnaire Analysis

All criteria in the following tests are based on the work of Wu [33], Hair et al. [34], and Schreiber [35] unless specified otherwise. The significance level was set as 0.05.

4.1.1. Exploratory Factor Analysis

To measure the spillover effects of safety climate, there was no mature questionnaire. Therefore, the questionnaire used to measure the spillover effects of safety climate in construction in this study was based on the work of Hanson [5] and Gao [1]. Since the safety climate spillover effects questionnaire used in this study was based on an existing questionnaire, it had a certain self-compiled nature. To determine the effectiveness of the questionnaire, we conducted a small pre-investigation, and used exploratory factor analysis to analyze the sample data to ensure the effectiveness of the final measurement questionnaire.

First, we conducted item analysis for the initial questionnaire, and the scores of all items were added together to obtain the total scores of the questionnaire, which were ranked from high to low. The first 27% were chosen as the highest score group, and the last 27% were chosen as the lowest score group. An independent sample T-test was used to analyze the empirical data. The t value was viewed as a critical ratio (CR) and those items whose t values were less than three ($p > 0.05$) were deleted. Eventually, item four was deleted. Next, factor analysis was used to obtain the common factors. Furthermore, the Kaiser–Meyer–Olkin (KMO) coefficient and Bartlett's test were used to assess whether the data from the whole questionnaire were suitable for factor analysis. The KMO coefficient was 0.820 (>0.6), and the chi-square statistic was significant ($\chi^2 = 455.389$, df = 55, $p < 0.001$), which demonstrated the suitability of the data set for factor analysis.

To minimize the number of variables with high loadings, principal component analysis (PCA) was used in EFA, and Varimax rotation method was performed to facilitate interpretation of factors. Principal component analysis, a frequently used component extraction technique, provides an orthogonal representation of the multivariate dataset and maximizes the variance explained by successive components. However, the interpretability of the second and higher components may be limited [36]. Thus, a Varimax rotation was often performed to enhance factor interpretability [14]. PCA and Varimax rotation are most commonly used in factor analysis currently [33]. Common factors whose eigenvalue were greater than 1 were retained and, according to Screen Plot, common factors were obtained. However, the factor loading values of Item 5 and Item 14 were less than 0.5, and Item 13 had a cross load, so we deleted these items. After the deletion, factor analysis was performed for the remaining 11 items. The results showed that three common factors could be obtained, and their eigenvalues were 4.671, 1.355 and 1.130. These common factors accounted for 65.048% of the variance in total.

Items 1–3 of the values dimension fell on the first factor, and the factor loading of each item was higher than 0.5. Items 6–10 of the behaviors dimension fell on the second factor, and the factor loading of each item was higher than 0.5. Items 11 and 12 of the skills dimension fell on the third factor, and the factor loading of each item was higher than 0.5. Item 15 was expected as the skills dimension to fall on the first factor, which was not in line with our expectation.

The correlation coefficients of these dimensions ranged from 0.000 to 0.555, which demonstrated that they were independent from each other to a certain extent. The correlation coefficient between each dimension and the entire questionnaire ranged from 0.647 to 0.876 ($p < 0.01$), which demonstrated that each dimension corresponded with the whole questionnaire. The dimension of behaviors had the largest correlation with the whole questionnaire. The correlation coefficients are provided in Table 1.

Table 1. The result of the correlation analysis and the Cronbach's α of safety climate spillover effects questionnaire.

Variable	Values	Behaviors	Skills	Questionnaire
Questionnaire	0.857 **	0.876 **	0.647 **	1
Cronbach's α	0.769	0.822	0.590	0.872
Number of items	4	5	2	11

Note: ** indicate $p < 0.01$.

After factor analysis, a reliability test was required. As different scholars' views on the minimum acceptable reliability coefficient is inconsistent, it is generally considered that 0.7 is the minimum acceptable reliability value; therefore, if the Cronbach's α is lower than 0.6, the questionnaire should be redesigned. The Cronbach's α of the entire questionnaire was 0.872 and that of the dimensions range from 0.590 to 0.822, as shown in Table 1.

The Cronbach's α of the values and behaviors dimensions were 0.769 and 0.822, respectively (>0.7). While the Cronbach's α of the skills dimension was 0.590 and had only two items, we considered deleting this dimension. After deleting the skills dimension, the Cronbach's α of the whole questionnaire was 0.851, as shown in Table 2, which was acceptable.

Table 2. The Cronbach's α of safety climate spillover effects questionnaire after deletion.

Variable	Values	Behaviors	Questionnaire
Cronbach's α	0.769	0.822	0.851
Number of items	4	5	9

Therefore, using the EFA, an improved questionnaire was developed with nine questions to measure the safety climate spillover effects of construction enterprises. The questionnaire consisted of two dimensions, i.e., values containing four questions and behaviors containing five questions.

4.1.2. Confirmatory Factor Analysis

The second research questionnaire consisted of two parts: the measurement of the safety climate, and the measurement of the safety climate spillover effects. The data collected were further analyzed by CFA to verify the questionnaire.

(1) Confirmatory factor analysis of safety climate questionnaire

The safety climate questionnaire used in this study is an existing questionnaire, and the questionnaire has been used, verified, and matured in many studies. Therefore, only the reliability analysis and the confirmatory factor analysis were needed.

First, the reliability analysis was used to analyze the internal consistency of each dimension and questionnaire. The Cronbach's α of the entire questionnaire was 0.894 and each dimension was 0.748, 0.731, 0.844, and 0.666. The items of safety attitude dimension were less, only four, so the Cronbach's α just needed to be higher than 0.6. The reliability of each dimension and the total questionnaire were ideal, as shown in Table 3.

Table 3. Cronbach's α of safety climate questionnaire.

Variable	MC	SR	SS	SA	Questionnaire
Cronbach's α	0.748	0.731	0.844	0.666	0.894
Number of items	6	5	9	4	24

MC: management commitment; SR: safety regulations; SS: safety supervision, safety training and workers' support; SA: safety attitude.

After the reliability analysis of the construction enterprises' safety climate questionnaire, a verification factor analysis of the questionnaire was conducted to verify the structural validity of the questionnaire. In this study, AMOS v22 was used for the analysis and the fitting indexes of each variable were obtained.

The commonly used indicators were χ^2/d.f., comparative fit index (CFI), Tacker-Lewis index (TLI), adjusted goodness-of-fit index (AGFI), goodness-of-fit index (GFI), normed fix index (NFI) and root mean square error of approximation (RMSEA). χ^2/d.f. refers to the value of the chi-square degree of freedom. In general, a value less than three is acceptable, although some scholars believe that less than five is acceptable. Hair [34] indicated that GFI, AGFI, and CFI should be greater than 0.90, and RMSEA should be less than 0.08. Schreiber et al. indicated that TLI, CFI, and RMSEA were important fit indicators to confirm the validity of a model [35], and thought that TLI should be greater than 0.95, CFI should be greater than 0.95, and RMSEA should be less than 0.08. Both of these studies indicated that χ^2/d.f. should be less than 3.

When Maximum Likelihood was adopted to analyze the data, the variances of the four dimensions were seen as one. It was found that the CR of the path coefficient was between 3.739 and 15.786. The measure of the significance level, p, was less than 0.001 and the path coefficient was significant, indicating that these path coefficient parameters were significantly different. The coefficient values are provided in Table 4.

Table 4. The coefficient values of safety climate questionnaire.

Items			Unstandardized Path Coefficients	Standardized Path Coefficients	Mean Standard Deviation	CR
a4	←	MC	0.516	0.656	0.043	12.114
a5	←	MC	0.267	0.315	0.051	5.235
a6	←	MC	0.604	0.641	0.051	11.751
a1	←	MC	0.230	0.239	0.060	3.849
a2	←	MC	0.493	0.594	0.046	10.689
a3	←	MC	0.746	0.794	0.048	15.571
a7	←	SR	0.613	0.563	0.066	9.350
a8	←	SR	0.517	0.511	0.062	8.340
a9	←	SR	0.485	0.447	0.067	7.272
a10	←	SR	0.681	0.666	0.058	11.770
a11	←	SR	0.774	0.670	0.067	11.605
a12	←	SS	0.665	0.679	0.051	13.018

Table 4. *Cont.*

Items			Unstandardized Path Coefficients	Standardized Path Coefficients	Mean Standard Deviation	CR
a13	←	SS	0.518	0.565	0.050	10.327
a14	←	SS	0.684	0.723	0.048	14.167
a15	←	SS	0.182	0.233	0.046	3.971
a16	←	SS	0.477	0.588	0.043	11.078
a17	←	SS	0.723	0.781	0.046	15.786
a18	←	SS	0.634	0.701	0.047	13.574
a19	←	SS	0.594	0.670	0.046	12.781
a20	←	SS	0.476	0.617	0.041	11.496
a21	←	SA	0.691	0.698	0.056	12.455
a22	←	SA	0.289	0.223	0.077	3.739
a23	←	SA	0.669	0.813	0.045	14.781
a24	←	SA	0.629	0.733	0.048	13.171

Note: a1–a24 are the codes of items in the safety climate questionnaire (a1–a6 belong to MC; a7–a11 belong to SR; a12–a20 belong to SS; a21–a24 belong to SA).

The fit indicators were as follows: χ^2/d.f. = 2.818 < 3, RMSEA = 0.077< 0.08, while GFI, AGFI and TLI did not reach 0.9, but was higher than 0.8, and there was little difference with the acceptable value. It indicated that the safety climate structure model could match the data. The results are shown in Table 5.

Table 5. The CFA of safety climate questionnaire.

Model	χ^2(d.f.)	χ^2/d.f.	GFI	TLI	CFI	RMSEA
Ideal model		<3	>0.90	≥0.90	≥0.90	<0.08
Measurement model	693.187 (246) ***	2.818	0.846	0.806	0.828	0.077

*** Indicates $p < 0.001$.

Based on the above analysis, the safety climate questionnaire had good internal consistency, and the safety climate structure was a good match with the data, so the questionnaire could effectively measure the safety climate of construction enterprises.

(2) Confirmatory factor analysis of safety climate spillover effects questionnaire

After the second questionnaire survey, the Cronbach's α of the entire questionnaire was 0.942 and each dimension was 0.884 and 0.895. Reliability was very good; the analysis results are shown in Table 6.

Table 6. Cronbach's α of safety climate spillover effects questionnaire.

Variable	Values	Behaviors	Questionnaire
Cronbach's α	0.884	0.895	0.942
Number of items	4	5	11

When Maximum Likelihood was adopted to analyze the data, the variances of the two dimensions were seen as one. The factor loading of the items were higher than 0.6. The measure of the significance level, p, was less than 0.001 and the path coefficient was significant, indicating that these path coefficient parameters were significantly different. The coefficient values are provided in Table 7.

The structural model fitness indicators are shown in Table 8. The indicators have reached the requirements of the ideal model; therefore, the structural model has very good validity. The final safety climate spillover effects questionnaire is provided in Appendix A Table A1.

Table 7. The coefficient values of safety climate spillover effects questionnaire.

Items			Unstandardized Path Coefficients	Standardized Path Coefficients	Mean Standard Deviation	CR	P
b5	←	behaviors	0.849	0.683	0.035	15.514	***
b4	←	behaviors	0.994	0.742	0.038	15.186	***
b3	←	behaviors	0.997	0.837	0.032	18.448	***
b2	←	behaviors	0.911	0.772	0.032	17.231	***
b1	←	behaviors	1.000	0.837	0.034	17.545	***
b9	←	values	1.021	0.687	0.039	15.279	***
b8	←	values	1.187	0.825	0.034	18.369	***
b7	←	values	1.064	0.788	0.032	17.852	***
b6	←	values	1.000	0.705	0.035	14.201	***

Note: b1–b9 are the codes of items in the safety climate spillover effects questionnaire (b1–b5 belong to behaviors; b6–b9 belong to values); *** indicates $p < 0.001$.

Table 8. The CFA of safety climate spillover effects questionnaire.

Model	χ^2(d.f.)	χ^2/d.f.	TLI	CFI	GFI	RMSEA
Ideal model		<3	≥0.95	≥0.95	>0.90	<0.08
Measurement model	75.193(26) ***	2.893	0.957	0.969	0.945	0.079

*** Indicates $p < 0.001$.

4.2. The Influence of Safety Climate on Life Spillover

4.2.1. Establish Initial Model between Safety Climate and Spillover

When constructing the structural model of the impact of safety climate on life spillover, the safety climate and the life spillover are used as potential variables, the four dimensions of the safety climate are analyzed as the index variables, and behaviors and values are used as indicators of the life spillover variable. Based on previous research on the safety climate spillover, we used Amos v22.0 to draw the initial model where safety climate was used as an extrinsic variable, and behaviors and values as an exogenous variable.

4.2.2. Evaluation of the Relationship between Safety Climate and Spillover

(1) "Violation of the estimate" test

The initial structure model was analyzed using the maximum likelihood method, and the path coefficient between each potential factor and one of the observed indicators was defined as one. The results showed that all error variance was positive and the normalized path coefficient was less than one. All indicators of the error variance were significant ($p = 0.000$), and the normalized path coefficients of the initial structural model are shown in Table 9, and the model did not have a "violation estimate".

Table 9. Normalized regression coefficient.

Items			Estimate
values	←	MC	0.446
values	←	SA	0.415
values	←	SS	0.003
values	←	SR	−0.211
behaviors	←	SS	0.012
behaviors	←	SA	0.360
behaviors	←	MC	0.381
behaviors	←	SR	−0.229

(2) Evaluation of the overall model fit

According to the analysis results, χ^2/d.f. = 2.271 was an acceptable value (<3), and RMSEA = 0.064 also met the acceptable value, but CFI, NFI and other indicators had less than acceptable values. The overall evaluation results of the initial model of the safety climate and the two spillover effects are shown in Table 10. Most data were acceptable, but not ideal. Thus, the model could be amended.

Table 10. The result of the CFA.

Model	χ^2(d.f.)	χ^2/d.f.	NFI	TLI	CFI	RMSEA
Ideal model		<3	>0.90	>0.90	>0.90	<0.08
Measurement model	1092.202 (480) ***	2.275	0.780	0.848	0.862	0.064

*** Indicates $p < 0.001$.

4.2.3. Modification of the Model of Safety Climate and Spillover Effects

According to the above analysis, we could see that although the internal structure of the initial structure of the degree of fit to be tested, the initial structural model of the overall fitness of the index value still did not meet the requirements. As the path coefficient CR value reached the significance level, this study was mainly based on the modified index (MI) value to adjust the initial model. The MI values for the initial model are shown in Table 11.

Table 11. The modified index (MI) value.

Items			MI	Par Change
o7	↔	o6	24.040	0.076
o4	↔	o5	7.321	0.044
o4	↔	o8	12.708	0.053
e16	↔	e22	11.971	−0.167
e16	↔	e15	24.793	0.146
e17	↔	e15	7.283	−0.076
e8	↔	e7	11.411	0.157
e1	↔	e15	68.504	0.334
e1	↔	e8	7.387	−0.125
e2	↔	e1	11.184	0.119
e5	↔	e15	14.918	0.136
e6	↔	e5	8.518	0.099

e: exogenous latent variable' s residual; o: endogenous latent variable's residual.

According to the revised index table, since each path can only add one path, in this study, we first added the path relations e1 and e15, which increased the chi-square value to the maximum in the initial model of the safety climate and the spillover effects. The value of CFI, GFI, TLI, had not yet reached an acceptable level, so this study increased the residual relationship between the other path through continuous correction, and TLI = 0.900, CFI = 0.912 reached an acceptable level. Although the NFI = 0.828 did not reach the ideal value, it had an acceptable value of little difference, so the model was acceptable, as shown in Table 12. The modified structural model is shown in Figure 1.

Table 12. The result of the CFA.

Model	χ^2(d.f.)	χ^2/d.f.	NFI	TLI	CFI	RMSEA
Ideal model		<3	>0.90	>0.90	>0.90	<0.08
Measurement model	855.311 (465) ***	1.839	0.828	0.900	0.912	0.052

*** Indicates $p < 0.001$.

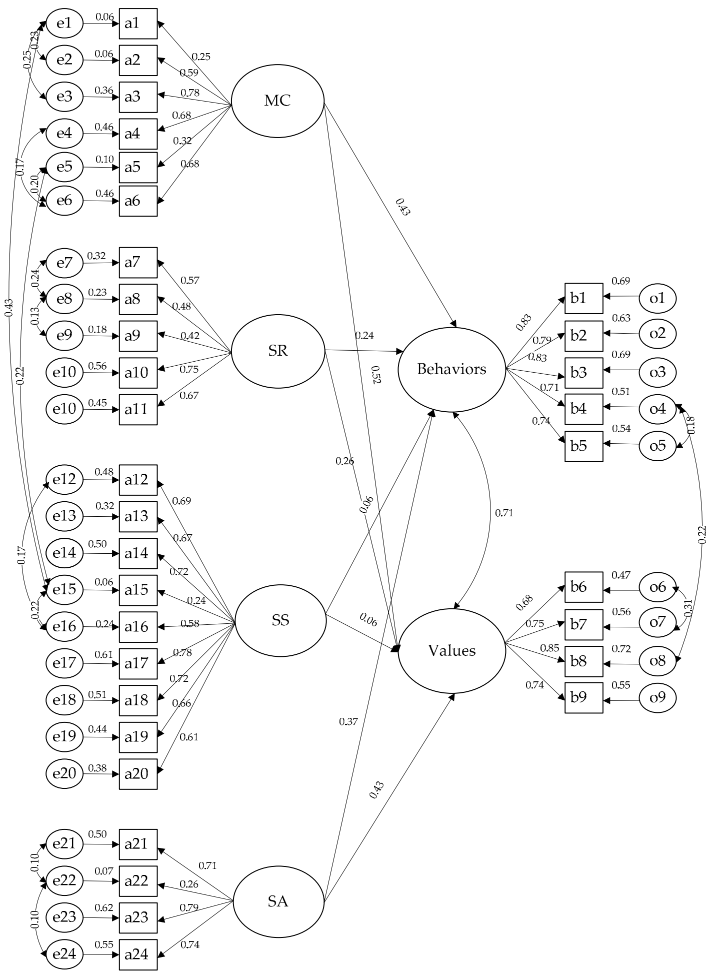

Figure 1. Modified structural model.

4.2.4. Analysis of the Relationship between Safety Climate and Spillover Effects

According to the results of the analysis, management commitment and safety attitude were positively related to the values and the degree of influence was large. Safety regulations had a certain influence on the values and were negatively correlated. Management commitment and safety attitude were positively related to behaviors, and have a larger degree impact. Safety regulations have a certain impact on behaviors, and therefore a negative correlation. This is a departure from H1a and H1c. In addition, it could be seen from the analysis results in the correlation between the values and behaviors shown in Table 13 that H2 was verified.

Table 13. The correlation between dimensions.

Dimensions			Unstandardized Path Coefficients	Standardized Path Coefficients	Mean Standard Deviation	CR	P
MC	↔	SR	0.094	0.637	0.027	3.451	***
MC	↔	SS	0.143	0.881	0.038	3.760	***
MC	↔	SA	0.039	0.235	0.018	2.225	0.026
SR	↔	SS	0.301	0.718	0.048	6.316	***
SS	↔	SA	0.163	0.344	0.042	3.933	***
SR	↔	SA	0.167	0.386	0.045	3.711	***
B	↔	V	0.203	0.887	0.026	7.177	***

*** Indicates $p < 0.001$.

5. Discussion

5.1. The Establishment of Construction Enterprises' Safety Climate Spillover Effects Questionnaire

5.1.1. Questionnaire Development

Based on Hanson [5] and Gao [1], this study first obtained three dimensions of the spillover effects: behaviors, values, and skills. Each dimension had five items, with a total 15 items. For the first time, exploratory factor analysis was used to analyze the sample data, and four items with low factor loading and severe cross loading were deleted. The remaining items were analyzed again by factor analysis, and, finally, three common factors were obtained. In the skills dimension, two items were deleted because of the cross loading with the behaviors dimension, and one item in the factor analysis was also divided into the behaviors dimension, finally leaving two items. This shows that the independence of the two dimensions of behaviors and skills was insufficient, and whether it can be the same as the structural dimension of the spillover remains to be further studied. After the reliability analysis, the skills dimension's Cronbach's α was 0.590 lower (<0.7), and the item of this dimension was less than three, so this dimension was deleted.

After removing the skills dimension, the Cronbach's α of the entire questionnaire reached 0.85, indicating that the questionnaire was suitable for measuring the spillover of safety climate. The Cronbach's α of the dimensions were 0.769 and 0.822, respectively, which are higher than the acceptable values. According to the exploratory factor analysis and reliability analysis results, the structural validity of the questionnaire could be accepted. At the same time, we also listened to the construction employees' suggestions, so the description of some questions was modified to improve the validity of the questionnaire.

5.1.2. Questionnaire Confirmation

In confirmatory factor analysis, the sample size should be at least between 150 and 200 [29]. The sample size of this study was 308, which met the requirements. The critical ratio of the path coefficient also showed that the questionnaire had good structural validity. The fitness index also met the requirements of the ideal model, indicating that the questionnaire had good validity.

The final questionnaire was different from the questionnaire designed by Gao [1] and only included two dimensions: behaviors and values. The results may be related to the different safety culture of the industry and safety management; furthermore, construction employees have different characteristics than college staff. Additionally, the behaviors and skills dimension to a certain extent may have cross-definition, so there may be duplicates in the items set. Overall, other dimensions of the questionnaire were validated to demonstrate that the questionnaire could serve as a powerful tool for measuring the safety climate spillover effects of construction enterprises.

5.2. The Confirmation of Construction Enterprises' Safety Climate Questionnaire

As the construction enterprises' safety climate measurement used an existing mature questionnaire, it only needed confirmatory factor analysis. The internal consistency of each dimension and questionnaire was analyzed by using reliability analysis. The results showed that the Cronbach's α of the whole questionnaire was 0.894, and the Cronbach's α of each dimension was 0.748, 0.731, 0.844, and 0.666, respectively. The items of safety attitude dimension were four, so it only needed to reach 0.6, therefore, the reliability of each dimension and the total questionnaire were ideal. The critical factors of the path coefficient were between 3.739 and 15.786. The significant p values of all items were less than 0.001, and the project's 24 path coefficients all reached a significant level of 0.05. The coefficient parameters were significant as $\chi^2/\text{d.f.} = 2.818$, RMSEA = 0.077 < 0.08 all reached acceptable standards, while GFI, AGFI, and TLI were less than 0.9, but greater than 0.8, and had little difference with the acceptable value, indicating that the safety climate structure model could match the data.

5.3. Analysis of the Impact of Safety Climate on Life Spillover

The results of this study showed that safety climate affects behaviors spillover and values spillover. The higher the level of safety climate in the construction enterprises, the higher the positive spillover of construction employees, so strengthening the safety climate of construction enterprises is an important way to promote the active spillover of construction employees.

However, in studying the impact of the dimensions of the safety climate on the life spillover of construction employees, not every dimension was related to the two types of spillover. The results showed that management commitment and safety attitude had significant influence on the spillover of the values and the behaviors spillover, among which management commitment had the greatest influence on values and behaviors. According to the results of this study, it indicates that illustrating the safety commitment of managers, and improving their own attitudes to safety are more favorable in enhancing the positive spillover of construction employees in their lives. The managers of construction enterprises should take the initiative to care about the safety of construction employees, provide them with safety facilities, communicate with employees and encourage them to make recommendations, which will not only enhance the safety of the enterprise, but also significantly influence their daily lives. In this study, the dimension of safety supervision had no significant effect on values and behaviors spillover. The dimension of safety regulations had a certain effect on values and behaviors spillover, and was negatively correlated. This was different from previous studies, and may be due to different research objects, the different safety management methods for construction enterprises, and the samples' subjective impact is also important. Thus, creating a different phenomenon from the previous study in the future can expand the investigation of the sample, with strict screening of the effective samples.

5.4. Limitations and Future Research Direction

Although with significant implications, this study still has some limitations. Most of the samples in this study were concentrated in Beijing, Hunan and Jiangsu. Future studies need to expand the number of samples and the areas of sample distribution, and strictly pick out effective samples. Furthermore, as the samples used in this study were collected from a number of construction enterprises, the safety education situation between different enterprises may be different, which may influence the results. In future study, the data from different enterprises can be separated for further analysis. In addition, in this study, we did not include the "affect" dimension within the factor structure of spillover. In the future, we can further consider this dimension, and compare research results with previous research works to explore the differences between domestic and foreign safety climate spillover structures.

6. Conclusions

Work and family lives are interdependent, and study on how the safety climate in the workplace influences daily life has shown large improvements in accidents in life. This study, which focused on the construction enterprises for the impact of the safety climate on the impact of life spillover, arrived at the following conclusions:

(1) This study obtained a form of spillover effects in the construction enterprises' safety climate, including the spillover of behaviors and values. In addition, a questionnaire was prepared to effectively measure the safety climate spillover effects of the construction enterprises.
(2) Under the influence of work–family integration, the safety climate that construction employees feel in the workplace not only affects their ability and safety level, but also has a significant spillover effects on their daily lives, and has a significant impact on their behavior and values. Therefore, construction enterprises should pay attention to the influence of safety climate on the employees' life and work, and strive to build a strong safety climate to reduce accidents in daily life.

(3) Management commitment of the construction's safety climate has the strongest effect on the whole spillover, the path coefficient is the largest, and other variables are also affected. Therefore, the managers of construction enterprises should pay more attention to safety through communication with workers, provide safety facilities, encourage employees to make safety recommendations, and other approaches to increase the importance of safety to improve the safety level of construction employees.
(4) The influence of the safety climate on value spillover is significant, and the interaction between the values and the behaviors spillover is larger. Therefore, construction enterprises should strengthen the training of employees' values, and strive to nurture the safety awareness of employees so that they can spontaneously make safety behaviors in their work and lives.

These theoretical conclusions and practical applications will make scholars and practitioners pay more attention to the spillover effects of the safety climate, and thus enhance the positive spillover to improve the safety level in daily life.

Acknowledgments: This work was supported financially by the National Natural Science Foundation of China (71572088), Fundamental Research Funds for the Central Universities of China (2-9-2017-077), and Key Laboratory of Toxic and Dust Hazards Prevention and Control Technology Fund Project (2018KFKT01). The authors would like to thank all of the construction workers who completed the questionnaires.

Author Contributions: Xiang Wu and Wenwen Yin conceived the key ideas and the system architecture; Chunlin Wu conducted the research; Xiaowei Luo and Wenwen Yin analyzed the data; Xiang Wu and Chunlin Wu wrote the paper; and Xiaowei Luo reviewed the process.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Safety climate spillover questionnaire.

Dimensions	Items
Behaviors	1. The safety practices that have been developed at work have prompted me to comply more with the safety rules in everyday life (such as more compliance with traffic safety rules) 2. Fulfilling the safety responsibilities in the work will help me to carry out the safety-related tasks better in daily life 3. The safety behavior required at work has prompted me to make safe and beneficial behavior in my daily life. 4. I often talk to my family and friends about the safety knowledge I have received in workplace and the safety issues that should be noticed 5. With the relevant safety behavior learned at work, I am more focused on making the family and friends living environment safer
Values	6. By the influence of the safety concept in the enterprise, I have become a safe person in my daily life 7. The safety management and safety concept of the enterprise make me pay more attention to the safety problems in daily life 8. I often apply safety knowledge and concepts that learned in enterprise to the daily life 9. I am better able to protect the safety of everyday life by using the skills I have gained in safety training at work

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