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Systematic impact of institutional pressures on safety climate in the construction industry

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ABSTRACT

This paper explores how three types of institutional pressure (i.e., coercive, mimetic and normative pressures) systematically impact on the safety climate of construction projects. These impacts are empirically tested by survey data collected from 186 questionnaires of construction companies operating in Shanghai, China. The results, obtained by partial least squares analysis, show that organizational management commitment to safety and employee involvement is positively related to all three institutional pressures, while the perception of responsibility for safety and health is significantly influenced by coercive and mimetic pressure. However, coercive and normative pressures have no significant effect on the applicability of safety rules and work practices, revealing the importance of external organizational pressures in improving project safety climate from a systematic view. The findings also provide insights into the use of institutional forces to facilitate the improvement of safety climate in the construction industry.

1. Introduction

The construction industry has been accident-prone and long criticized for its relatively poor safety performance (Jannadi and Bu-Khamsin, 2002). Despite the focus on individual behaviors that directly contribute to accidents (Fleming and Lardner, 2002), many scholars, such as Griffin and Neal (2000), advocate attaching an equal value to inherent, safety-related organizational factors. As a leading indicator of organizational safety (Hon et al., 2013), safety climate continues to be the focus of many studies because of its positive and significant influence on occupational safety behavior (Fang et al., 2006; Probst et al., 2008) and accident prevention (Siu et al., 2004).

Safety climate, defined as the employees shared perceptions of their work environment (Zohar, 1980), can reflect the current state of the underlying safety culture and highlight areas for overall safety improvement (Mearns et al., 2001, 2003). Due to the significant potential benefits of an improved safety climate, several studies have been conducted to identify the factors that influence its quality. Although the direct contributors to safety climate have not been addressed (Guldenmund, 2000), much research in this area has been devoted to examining how demographic characteristics influence workers' safety perception, which is recognized as a central component of safety climate. For example, employees who are older, married, or who have more family members to support, have a greater positive awareness of safety issues (Fang et al., 2006). Education level and safety-related knowledge are also positively correlated with the workers' safety awareness and attitudes (Siu et al., 2000).

Prior research indicates that safety climate in the construction industry is not only affected by individual elements, but can also be dependent on internal organizational attributes (Mohamed and Chinda, 2011), such as leadership style (Chinda and Mohamed, 2008), group cohesion and orientation (Burt et al., 2008), and the safety response of supervisors (Lingard et al., 2010). Further studies also suggest that there is a reciprocal relationship between the safety climate of construction project participant organizations (Fang and Wu, 2013), and the strategies of external organizations. External organizations such as the government, for example, can stimulate positive improvements in safety climate (Zhou et al., 2011). The government and the market are two equally important forces driving a positive safety climate, especially in China.

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Under their 'harmonious society' philosophy, Chinese government departments and industry associations not only advocate the importance of safety, but also have established mandatory rules and codes regulating safety behaviors. Therefore, safety performance has greatly improved in recent years. Meanwhile, more and more organizations are cooperating in safety training, including the co-hosting of events such as safety seminars and safety competitions. These activities are believed to be having a positive impact on the Chinese construction industry. However, there is currently little empirical evidence to help understand how different types of external pressures systematically affect the safety climate in construction projects.

Drawing upon institutional theory (DiMaggio, 1983), which considers external pressures in its explanation of multiple organizational behaviors and conditions, this study develops and empirically tests a simple model to explain how three types of institutional pressures (i.e., coercive, mimetic, and normative pressures) systematically influence safety climate in Chinese construction projects.

2. Theoretical foundation and hypothesis development

2.1. Institutional perspectives on safety climate

Institutional theory views organizations as *open systems* that are subject to the influences of particular environments. It emphasizes the critical role of the institutional environment in driving organizational decisions, behaviors and changes with the aim of gaining social legitimacy (DiMaggio, 1983; Scott, 2008). This is in contrast to the efficiency-seeking logic of transaction cost economics (Williamson, 1985). Indeed, many previous studies have proved that institutional theory can provide powerful explanations of several organizational behaviors, such as innovation acceptance and strategic change (Bhakoo and Choi, 2013; Cao et al., 2014; Teo et al., 2003). Based on these successful applications of institutional theory, this study posits that the institutional approach offers systematic insights into the varying levels of safety climate between construction industry organizations.

As an important organizational concept, safety climate is regarded as the product of collective sense-making in which members assess their organizational safety environment (Lingard et al., 2010; Zohar and Luria, 2004). It reflects the extent to which an organization prioritizes and pays attention to safety (Hon et al., 2013). This sense-making process can be influenced by both individual personalities and organizational characteristics (Guldenmund, 2000; Sunindijo and Zou, 2012). Although safety climate is positively related to safety behavior and safety performance (Cigularov et al., 2010), its benefits cannot always counteract the difficulties faced in developing a safer climate, which demands the efforts of all organization members and must be accompanied by organizational structural changes (Fung et al., 2005; Kheni et al., 2010). For this reason, the cultivation of a safety climate has been somewhat ignored by organizations due to related practical concerns, such as the implications on cost and project schedule (Hinze et al., 1998; Tam et al., 2004).

In construction projects, the participation of multiple stakeholders increases the complexity of the sense-making process because the safety climates in these participant organizations are iterated (Fang and Wu, 2013). For example, project participants may conform to government requirements, refer to the practices of similar organizations and heed the guidance of consultancy groups or other professionals to acquire institutional legitimacy. Certainly, this situation applies in China where the government is powerful and safety performance is relatively weak.

2.2. Institutional pressures

According to institutional theory, organizations have the tendency to follow socially accepted norms and behaviors in order to be structurally congruent with their specific institutional environment (DiMaggio, 1983). It is argued that institutional pressures can originate from both formal rules (regulations and mandates) and informal constraints (norms, conventions and beliefs) and the way in which organizations respond to these pressures will determine their institutional legitimacy (Scott, 2008). According to DiMaggio's (1983) research, there are three basic types of pressures shaping organizational behaviors: namely coercive, mimetic, and normative pressures.

2.2.1. Coercive pressures

Coercive pressures are defined as "formal and informal pressures exerted on organizations by other organizations upon which they are dependent" (DiMaggio and Powell 1983, p. 150). In emerging economies such as China that are undergoing the transition from a centrally-planned to a market-based system, government agencies and industry associations still frequently interfere with daily design and construction activities (Xu et al., 2005). In the context of this study, coercive pressures primarily stem from regulatory agencies and industry associations.

Specifically, in China, many government departments, such as the Ministry of Housing and Urban-Rural Development and the State Administration of Work Safety, are responsible for formulating safety regulations and supervising safety performance; and organizations, such as the Construction Safety Branch of the China Construction Industry Association, often develop more detailed project safety requirements. For example, the coercive strategies developed by government departments and industry associations include the Green Card Program (Labor Legislation, 2013) and the Pay for Safety Scheme (Construction Industry Council, 2012). Safety associations have been founded in a number of Chinese cities in the past decade. They are primarily responsible for the safety inspection of construction projects. Only projects that have passed the safety inspection process can begin construction (Shanghai Construction Safety Association, 2015). These authoritative activities, whether in the form of public regulations or project-specific requirements, can significantly influence the safety climate level of project participant organizations. Therefore, the following hypothesis is proposed:

H1. The level of coercive pressures is positively associated with the level of safety climate.

2.2.2. Mimetic pressures

Mimetic pressures are those that drive organizations to imitate the successful conduct of other structurally equivalent organizations (DiMaggio, 1983). The root cause of the mimetic pressures is uncertainty. When the environment creates uncertainty, or the risky situation is poorly understood, organizations tend to benchmark their behaviors against those of peer organizations, and mimic those that appear legitimate and progressive (DiMaggio, 1983). Since every construction project is unique to some extent – due to differences in project scope, complexity, tasks and participants (Chan and Chan, 2004; Dubois and Gadde, 2002) – there is no universal safety strategy for all projects. Moreover, as incidents in construction projects are accidental and unexpected in nature, there is increased uncertainty over the effectiveness of safety management. This high level of uncertainty can cause project participant organizations to be more easily influenced by the conduct of peer organizations, or by peer projects with similar project characteristics and institutional environments. As the primary safety risk bearers of construction projects, clients/owners are generally incentivized to mimic successful practices in peer projects or the successful practices of other client/owners, in order to better hedge against the risks associated with early adopters, and to avoid lagging behind their peers and thus lose legitimacy. To other project participants, the legitimacy acquired through mimicry further assists them in sustaining their competitiveness in future projects. These mimicking behaviors will then lead to improved safety climate in their own projects. Therefore, the second hypothesis is proposed:

H2. The level of mimetic pressure is positively associated with the level of safety climate.

2.2.3. Normative pressures

Normative pressures are primarily derived from professionalization (DiMaggio, 1983). Professional bodies in the safety field gradually form shared norms and collective expectations of what constitutes desirable behaviors. These norms and expectations can be diffused and strengthened within professional fields through information exchange activities such as formal education, participation in associations, conference communication and professional consultation (DiMaggio, 1983; Teo et al., 2003). Embedded within these professional fields, organizations can gradually develop their understanding of the commonly recognized professional values and beliefs, and then adjust their behaviors according to their specific organizational characteristics.

Normative pressures generally influence organizational attitudes and behaviors in a much less compelling manner than do coercive pressures. With regard to the safety climate in the construction industry, normative pressures can originate from a variety of sources. As quasi-government organizations, industry associations in the Chinese construction industry not only have the potential to exert coercive pressures on organizational attitudes and behaviors, but can also act as important mediums for norm-diffusion by organizing seminars, providing safety training courses and publicly advocating the importance of safety. Similarly, industrial consultants and universities could also exert normative pressures on practitioners through conference communication, specialized training and professional certification. Through direct or indirect interactions with safety professionals, project participants can better understand the values and methods needed to build an improved safety climate. This leads to the final hypothesis:

H3. The level of normative pressure is positively associated with the level of safety climate.

3. Research methods

3.1. Questionnaire design

Although safety climate structure is not a new research problem, it is difficult to obtain a consistent factor structure in samples drawn from different industries or different countries, even when the same or modified safety climate questionnaire and methodology are used (Zhou et al., 2011). Therefore, to investigate the subtle impacts of institutional pressures on different aspects of safety climate, we obtained data to re-analyze safety climate structure rather than relying on previous findings.

A questionnaire survey was chosen as the main method of data collection as it is an effective instrument for gauging people's perceptions. Furthermore, the information acquired can be used for further inter-correlation mining (Spector, 1994). The questionnaire was designed and developed based on information from the literature review, project observation and short semi-structured interviews.

The safety climate section of the questionnaire was adopted from the Safety Climate Index survey of the Occupational Safety and Health Council of Hong Kong. Although there are many kinds of safety climate measurements available in the literature (Choudhry et al., 2009; Dedobbeleer and Béland, 1991; Fang et al., 2006; Mohamed, 2002; Zhou et al., 2010), the Safety Climate Index survey items were selected for two reasons: the contextual similarity between Hong Kong and the Chinese mainland, and the prior empirical validation of this tool in Hong Kong. The Safety Climate Index survey was developed by the Health and Safety Executive and then shortened and modified to suit the local Hong Kong context. Its validity and practicality have been proven by its successful application in prior research (Hon et al., 2013).

With respect to the institutional pressures surveyed, the items relating to coercive pressures are adopted from the research of Liang et al. (2007), and capture the two authoritative influence dimensions of regulatory agencies and industry associations in the context of Chinese construction safety climate. The mimetic pressure items are presented in three terms of perceived quality of safety climate from other project participants, peer organizations and similar projects. Similar items have previously been validated by Teo et al. (2003) in other research fields. Finally, normative pressures are operationalized to reflect how the professional bodies shape the norms of safety climate in the industry. The three items are used to measure the normative influences of consultants, universities and industry associations.

All safety climate items and institutional pressure items are rated on a five-point scale from 1 (strongly disagree) to 5 (strongly agree).

3.2. Participants and procedures

A pilot study involving 21 respondents was conducted to assess the appropriateness of the questionnaire's scope, identify ambiguous expressions and test the validity of related constructs. All the 21 respondents were experienced senior managers responsible for safety in quasi-government organizations and private companies. Based on the pilot feedback, the questionnaire was revised by removing four items in the standard safety climate questionnaire. It was subsequently distributed to the targeted project organizations.

The survey was undertaken from December 2014 to March 2015. Only construction industry companies operating in Shanghai were involved, because Shanghai is the economic center of China, and both the government and market play important roles in its development. Responses were collected by a variety of means including e-mail, personal visits and an online survey. To enhance the quality of the responses, two trained student assistants helped the respondents to complete the questionnaire by answering their enquiries. In total, 233 responses were returned. After the deletion of outliers and imputation of missing values, 186 responses from 43 companies were considered to be valid for further analysis.

The respondents are from a mix of construction project participants, with 36.4% from owner/clients, 43.3% from contractors, 8.7% from subcontractors and 11.6% from consultants. Most are senior and professional individuals working in the construction safety field and represent almost all the major construction industry companies – such as Shimao Property, China Construction and Poly Property – and include 23 construction projects. Their jobs are all related to construction safety; they are familiar with safety codes, safety laws and national policies; and have previous experience in safety activities (such as safety training, safety inspection). Their professional knowledge and experience ensures their accurate estimation of external pressures. Moreover, they are quite aware of the safety climate within their organizations.

All the measurements of pressures are based on subjective perceptions. Because these perceptions are those of participants with sufficient relevant knowledge, they can be considered to be reliable. External pressures are perceived by organization members and are reflected in their behaviors thus influencing the safety climate within their organization.

Of the 186 valid responses, 42.1% were collected via e-mail, while the remaining 27.9% and 30.0% were collected via the survey system and personal visits respectively. An analysis of variance (ANOVA) indicates there is no statistically significant difference in the answers from the three types of responses.

3.3. Tools for data analysis

The collected quantitative data was further analyzed by factor analysis (FA) and partial least squares (PLS). FA is widely adopted as an effective statistical technique to identify a small number of individual factors that represent sets of interrelated variables (Hon et al., 2013). Exploratory Factor Analysis (EFA) with the Principal Component Analysis (PCA) extraction method was conducted to identify the underlying grouped factors, and condense and summarize the safety climate measurement items involved (Hair, 2010).

PLS is a technique using a combination of PCA, path analysis and regression for the simultaneous estimation of multiple dependent variables (Ringle et al., 2012). This method can estimate parameters for links between measurement items and their corresponding constructs and links among different constructs (Mohamed, 2002). This method fits the theoretical hypothesis of this study. Moreover, while the data obtained is somewhat limited, PLS does not demand a large sample size and can also handle non-normal data sets (Reinartz et al., 2009).

4. Data analysis and results

4.1. Factor analysis of safety climate

The 34 items of the SCI were subject to factor analysis. Prior to performing PCA, the suitability of data for factor analysis was assessed. The Kaiser–Meyer–Olkin (KMO) value is $0.821 > 0.6$, indicating meritorious sample adequacy (Field, 2009) while Bartlett's Test of Sphericity produces an approximation of $\chi^2 = 2743.756$ ($df = 703$, $p = 0.000 < 0.001$), indicating the correlations between variables to be sufficiently large for PCA (George, 2003). As a rule of thumb, factor loadings of 0.3–0.4 are minimally accepted (Hair, 2010). Since the correlation matrix reveals the presence of numerous coefficients of 0.3 and above, the factor loading cut-off was set to be 0.4 (Hon et al., 2013). In total, 16 items were removed.

The 18 remaining items were subject to PCA. As before, the suitability of the data for FA was firstly assessed. The KMO value is 0.837, exceeding the recommended value of 0.6 and the BTS reached statistical significance ($\chi^2 = 1042.900$, $df = 153$, $p = 0.000 < 0.001$). A total of 7 components having eigenvalues of 1 or more were extracted from the 34 items, accounting for 62.3% of the variance. The eigenvalues for each of the 7 factors were 7.421, 2.692, 1.992, 1.337, 1.136, 1.079 and 1.039, explaining 27.486, 9.972, 7.379, 4.988, 4.207, 3.998 and 3.847% of the variance, respectively. These factors were selected based on the criteria that the eigenvalue for each factor should be greater than 1 (George, 2003). However, Horn's parallel analysis is considered the most accurate method to determine the number of components to be extracted (Pallant, 2013). The scree plot and Horn's parallel analysis (Table 1) both support extraction of the three components. In the three-component solution, 44.8% of the variance is explained. This result is comparable to that of Choudhry et al. (2009), which produced a two-component structure explaining 43.9% of the total variance. The communalities of the variables are all above 0.3 (see Table 2).

The component correlations shown in Table 3 are all larger than 0.32. Direct oblimin rotation was conducted to enhance factor interpretability, as Tabachnick and Fidell (2001) suggest instead of orthogonal rotation (e.g., varimax) should be selected if the factor correlation exceeds 0.32. Cronbach's alpha values are all above the minimum threshold of 0.6 suggested by Hair (2010).

4.2. Factor analysis of institutional pressures

Similar factor analysis procedures were applied to extract the measurement items of institutional pressures. All 9 items of institutional pressures were analyzed. The KMO is $0.834 > 0.6$, indicating meritorious sample adequacy (Field, 2009) and Bartlett's Test for Sphericity produces an approximation of $\chi^2 = 1519.854$ ($df = 276$, $p = 0.000 < 0.001$), indicating the correlations between variables to be sufficiently large for PCA (George, 2003). The FA was then conducted with the factor loading cut-off set to 0.4 – the same as the SC analysis. In total, 2 items were removed.

The remaining 7 items of institutional pressures were subject to PCA. The KMO value is 0.849, exceeding the recommended value of 0.6, and the BTS reached statistical significance ($\chi^2 = 775.346$, $df = 28$, $p = 0.000 < 0.001$). In total, the eigenvalues of the 3 components are more than 1. Additionally, Horn's parallel analysis was conducted, which also supports 3 components being extracted, as shown in Table 4. In this three-component solution, 76.505% of the variance is explained. The component correlations in Table 5 are all larger than 0.32, so that the direct oblimin rotation was selected to enhance factor interpretability. All the Cronbach alpha values are above the 0.6 minimum threshold suggested by Hair (2010). Table 6 shows the final FA results with a direct oblimin rotation and the communalities of all variables all above 0.3.

4.3. Component interpretation

Since the suggested component label is entirely subjective, different researchers may use different labels (Choudhry et al., 2009). To improve the reliability of the component interpretation of safety climate, similar factor analysis results from the studies of Hon et al. (2013) and Choudhry et al. (2009) were referenced.

- **Component 1: Management commitment and employee involvement**
  This component consists of 12 variables that are related to management commitment, involvement and actions toward safety and employee involvement. Specifically, SC 8, 15, 16, 21, 24, 28, and 34 are more related to management commitment to safety, while SC 3, 9, 13, 25 and 38 are more related to employee involvement in safety practice.
- **Component 2: Applicability safety procedures and work practices**
  Four negative items are included in this component, concerning the safety system, procedures and work practices. The variables of SC 11 and 32 are related to inappropriate safety rules and procedures that could lead to unsafe behaviors, whereas SC 20 and 35 are related to unsafe work execution and practices.
- **Component 3: Perception of responsibility for safety and health**
  The two variables in component 3 describe both the organization and employee perception of safety responsibility. SC 10 is a reversed statement reflecting whether the employee perceived that working safety was a part of his/her responsibility, while SC 14 is whether the organization meets its responsibility in providing a safe working environment.

As to the institutional pressure components, the coefficients in Table 6 support the rationality of the three-type-pressure framework on which the questionnaire was based. Coercive pressures primarily arise from the compulsory safety requirements driven by government departments and construction industry associations.

Table 1
Comparison of the eigenvalues from PCA and the criterion values from Horn's parallel analysis (safety climate).

Component number	Actual eigenvalue from PCA	Mean eigenvalue from parallel analysis	Percntyl	Decision
1	7.421	1.98	2.11	Accept
2	2.692	1.86	1.95	Accept
3	1.992	1.77	1.84	Accept

Table 2
Component list.

Items		Pattern coefficients			Structure coefficients			Communalities
		C1	C2	C3	C1	C2	C3	
Component 1 (C1) – Safety commitment and employee involvement (Eigenvalue = *7.421, % of variance = 27.486, cumulative % = 27.486)*								
SC03	I fully understand the health and safety risks associated with my work	**.524**	−.115	.010	**.529**	−.149	−.139	.303
SC08	The company really cares about the health and safety of the people who work here	**.607**	.072	−.080	**.624**	.025	−.238	.400
SC09	Most of the job-specific safety trainings I received are effective	**.652**	.066	.012	**.644**	.023	−.158	.419
SC13	All the people who work in my team are fully committed to health and safety	**.519**	.159	−.352	**.603**	.098	−.480	.497
SC15	The company encourages suggestions on how to improve health and safety	**.546**	.227	−.365	**.629**	.163	−.495	.561
SC16	There is good preparedness for emergency here	**.649**	.031	−.198	**.700**	−.027	−.370	.526
SC21	There are good communications here between management and workers about health and safety issues	**.556**	.038	−.314	**.638**	−.023	−.461	.499
SC24	Sufficient resources are available for health and safety here	**.599**	−.122	−.258	**.676**	−.181	−.428	.537
SC25	It is important for me to work safely if I want to keep the respect of others in my team	**.453**	−.134	−.234	**.525**	−.182	−.366	.348
SC28	Safety inspection here is helpful to improve the health and safety of workers	**.691**	−.135	.315	**.616**	−.158	.120	.485
SC34	Staff are praised for working safely	**.694**	−.240	.092	**.685**	−.280	−.112	.532
SC38	I think management here does enough to follow up recommendations from safety inspection and accident investigation reports	**.637**	.085	.039	**.621**	.045	−.126	.394
Component 2 (C2) – Applicability of safety procedures and work practices (Eigenvalue = *2.692, % of variance = 9.972, cumulative % = 37.458)*								
SC11	Some health and safety rules or procedures are difficult to follow	−.030	**.459**	.277	−.172	**.488**	.313	.316
SC20	Some of the workforces pay little attention to health and safety	−.012	**.657**	.003	−.188	**.660**	.052	.436
SC32	Not all the health and safety rules or procedures are strictly followed here	−.339	**.396**	.314	−.466	**.511**	.366	.475
SC35	Supervisors sometimes turn a blind eye to people who are not observing the health and safety procedures	−.247	**.452**	.379	−.394	**.547**	.429	.508
Component 3 (C3) – Perception of responsibility for safety and health (Eigenvalue = *1.992, % of variance = 7.379, cumulative % = 44.837)*								
SC10	People are just unlucky when they suffer from an accident	.142	.148	**.656**	.059	.158	**.657**	.463
SC14	Little is done to prevent accidents until someone gets injured	.175	.014	**.720**	.123	.020	**.710**	.533

Major loadings for each item are shown in bold font.

Table 3
Safety climate component correlation matrix (Cronbach's alpha values in the diagonal).

	Item number	1	2	3
Component 1	12	(0.884)		
Component 2	4	0.330	(0.638)	
Component 3	2	0.435	0.463	(0.625)

Table 4
Comparison of the eigenvalues from PCA and the criterion values from Horn's parallel analysis (institutional pressures).

Component number	Actual eigenvalue from PCA	Mean eigenvalue from parallel analysis	Percntyl	Decision
1	6.359	1.88	2.09	Accept
2	2.676	1.75	1.83	Accept
3	1.656	1.63	1.71	Accept

Table 5
Institutional pressure component correlation matrix (Cronbach's alpha values in the diagonal).

	Item number	1	2	3
Component 1	2	(0.897)		
Component 2	2	0.476	(0.776)	
Component 3	3	0.388	0.353	(0.712)

Table 6
Component list of institutional pressures.

Items		Pattern coefficients			Structure coefficients			Communalities
		C1	C2	C3	C1	C2	C3	
Component 1 (C1) – Coercive pressures (*Eigenvalue = 4.713, % of variance = 48.907, cumulative % = 48.907*)								
CP 1	Government departments require our organization to attach great importance to safety	**.927**	.062	.018	**.961**	.441	.516	.927
CP 2	Industry associations require our organization to attach great importance to safety	**.778**	−.024	.194	**.863**	.455	.575	.771
Component 2 (C2) – Mimetic pressures (*Eigenvalue = 1.730, % of variance = 17.468, cumulative % = 66.375*)								
MP 1	Other project participant organizations attach great importance to safety	.237	**.716**	.127	.662	**.885**	.534	.868
MP 2	Peer organizations in other projects attach great importance to safety	−.086	**.898**	.138	.433	**.923**	.555	.810
Component 3 (C3) – Normative pressure (*Eigenvalue = 1.311, % of variance = 10.130, cumulative % = 76.505*)								
NP 1	Industry associations strongly advocate the our organization to attach great importance to safety	−.117	.189	**.844**	.382	.578	**.883**	.741
NP 2	Industry consultants strongly advocate the our organization to attach great importance to safety	.293	−.135	**.731**	.603	.304	**.828**	.732
NP 3	Universities strongly advocate the our organization to attach great importance to safety	−.050	.106	**.731**	.414	.434	**.851**	.733

Major loadings for each item are shown in bold font.

Mimetic pressures originate from the great importance of safety for participant organizations in the same project and peer organizations in other projects. Moreover, the advocacy of construction safety by universities, consultants and industry associations impose normative pressures on the invested organization.

4.4. Hypothesized PLS model

Based on the factor analysis of safety climate and institutional pressures, the hypothesized model was revised and is shown in Fig. 1. Three types of institutional pressures are supposed to have a significant impact on the three safety climate components.

4.5. Evaluation of measurement models

As shown in Table 7, all the measurement item loadings are larger than 0.4, with t-values larger than 2.58, which indicates acceptable indicator reliability (Hair et al., 2011; Ling et al., 2013). The composite reliability values are all larger than 0.7, suggesting a satisfactory level of reliability of internal indicators with each construct (Hair et al., 2011; Ning, 2014). The AVE values are more than 0.5, showing a satisfactory level of convergent validity of the constructs (Hair et al., 2011; Ning, 2014).

Table 8 shows that each construct's AVE is higher than its squared correlation with any other construct. Table 9 also shows that each item loading on the corresponding construct to be larger than all of its cross loadings. These both indicate the high discriminate validity of the constructs (Cenfetelli and Bassellier, 2009; Hair et al., 2011; Ning, 2014; Zhao et al., 2013). The results of the measurement model evaluation suggest that each construct has internal consistency reliability.

4.6. Evaluation of structural models

As Fig. 2 illustrates, with the exception of CP and C3, NP and C2, and NP and C3, all the path coefficients between institutional pressures and safety climate components have a t-value larger than 2.58 – indicating statistical significance at the 0.01 level (Henseler et al., 2009).

5. Discussion, implications and future research

5.1. Discussion of findings

Currently in China, new projects are booming and construction technologies are quickly evolving. This rapid growth poses a major challenge for construction safety procedures and methods, and their objective measurement is an essential part of safety climate. The primary objective of this study, therefore, was to examine the mechanism of the three types of institutional pressures that influence organization-level safety climate in the construction industry. The factor analysis demonstrates the structure of safety climate and the sources of external pressures to show that safety climate comprises three components: namely safety commitment and employee involvement; applicability of safety procedures and work practices; and the perception of responsibility for safety and health. Safety commitment and employee involvement indicate organizational and individual safety awareness. For instance, positive actions to improve construction safety indicate a positive attitude to safety. The perception of responsibility for safety and health measures how much organizations and individuals are clear about their responsibilities with respect to safety. It is also important to differentiate between safety attitude and safety perception: the latter being directly related to safety knowledge while

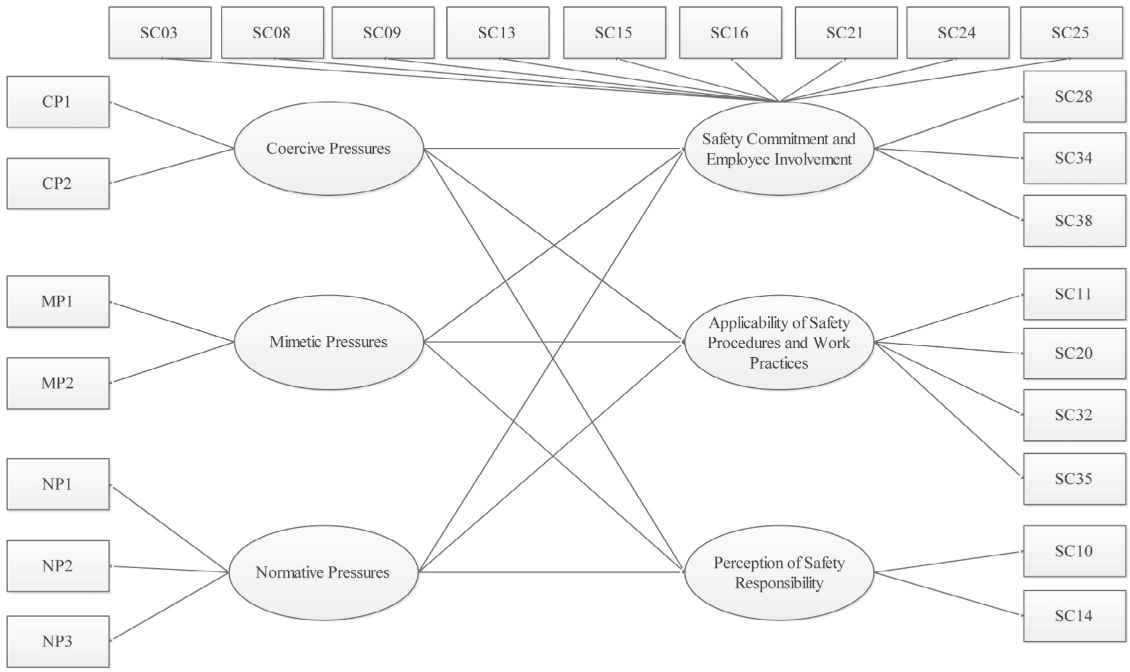

Fig. 1. Hypothesized detailed relationship model.

Table 7
Measurement model evaluation results.

Construct	Code	Loading	T-value	AVE	CR
CP	CP1	0.9356	18.7847	0.8952	0.9447
	CP2	0.9566	16.7899		
MP	MP1	0.8966	14.9509	0.8048	0.9252
	MP2	0.9187	14.6669		
NP	NP1	0.8504	7.2521	0.7172	0.8838
	NP2	0.8517	8.2037		
	NP3	0.8385	7.2225		
C1	SC03	0.4487	3.9965	0.6985	0.8868
	SC08	0.6636	5.7685		
	SC09	0.6646	4.1561		
	SC13	0.6698	3.3789		
	SC15	0.5940	7.8684		
	SC16	0.6954	5.4157		
	SC21	0.6153	7.1920		
	SC24	0.7195	4.3610		
	SC25	0.8569	6.5534		
	SC28	0.5020	6.4135		
	SC34	0.6737	5.5712		
	SC38	0.6056	7.9138		
C2	SC11	0.5757	3.1231	0.5920	0.7932
	SC20	0.7305	6.3671		
	SC32	0.7456	6.5909		
	SC35	0.7396	6.2813		
C3	SC10	0.6817	4.9265	0.5995	0.7472
	SC14	0.6667	4.0924		

Table 8
Construct correlations and square root of AVE.

Construct	CP	MP	NP	C1	C2	C3
CP	**0.9462**					
MP	0.6694	**0.8971**				
NP	0.5573	0.5434	**0.8469**			
C1	0.5669	0.5660	0.4726	**0.8358**		
C2	0.4443	0.4774	0.3342	0.5451	**0.7694**	
C3	0.3109	0.3737	0.2850	0.5182	0.3855	**0.7743**

The square root of the AVE value of each construct is shown in bold font.

Table 9
Cross loadings for individual measurement items.

	CP	MP	NP	C1	C2	C3
CP1	**0.9356**	0.4886	0.3661	0.2773	0.5767	0.4770
CP2	**0.9566**	0.5761	0.4645	0.3093	0.6807	0.5701
MP1	0.6197	**0.8966**	0.5156	0.5599	0.4551	0.3850
MP2	0.6369	**0.9187**	0.4980	0.4955	0.4415	0.3125
NP1	0.4783	0.5647	**0.8504**	0.4057	0.3208	0.2769
NP2	0.4686	0.4700	**0.8517**	0.4295	0.2815	0.1780
NP3	0.4701	0.4844	**0.8385**	0.3622	0.2386	0.2688
SC03	0.2351	0.2410	0.2585	**0.4487**	0.2529	0.2015
SC08	0.3544	0.4239	0.4072	**0.6636**	0.3727	0.3727
SC09	0.2695	0.3246	0.3620	**0.6646**	0.3065	0.3970
SC13	0.4938	0.5153	0.4260	**0.6698**	0.3725	0.3599
SC15	0.3694	0.2907	0.2086	**0.5940**	0.4263	0.2812
SC16	0.3959	0.4306	0.2902	**0.6954**	0.3914	0.3268
SC21	0.3592	0.3448	0.1988	**0.6153**	0.3844	0.3021
SC24	0.3717	0.3877	0.1883	**0.7195**	0.4231	0.4613
SC25	0.2738	0.3590	0.2441	**0.8569**	0.5615	0.3983
SC28	0.2458	0.2530	0.3513	**0.5020**	0.1611	0.2261
SC34	0.3629	0.3147	0.2825	**0.6737**	0.3709	0.5983
SC38	0.3104	0.3776	0.2358	**0.6056**	0.2770	0.2603
SC11	0.2179	0.2701	0.1566	03131	**0.5757**	0.1494
SC20	0.3144	0.4272	0.2140	0.2840	**0.7305**	0.2616
SC32	0.3996	0.3475	0.2546	0.5124	**0.7456**	0.3239
SC35	0.2876	0.4132	0.3122	0.3039	**0.7396**	0.3284
SC10	0.2022	0.1889	0.2529	0.1952	0.1675	**0.6817**
SC14	0.4177	0.3772	0.3232	0.1540	0.3219	**0.6667**

the former is a more subjective attribute. For instance, people with extensive safety training and sufficient knowledge that break safety protocols is a reflection of their poor safety attitude.

In the Chinese context, with its dual government and market influences, the three types of institutional pressures derive from a variety of sources. First, *coercive pressures* stem from the mandatory power of law and order. Since the Chinese government proposed the notion of a harmonious society in 2006, it has constantly stressed the importance of work safety. A number of safety regulations and laws have been passed to enforce construction safety and punish unsafe behaviors. For example, according to Chinese criminal law, the maximum sentence for compelling an employee to operate at risk (illegally) and thus causing a fatal accident, has increased from 7 to 15 years (National People's Congress Standing Committee, 2006). In recent years, the direct cost of a fatal accident has increased to more than CNY 400 000 (Zhou et al., 2011). Apart from punishing unsafe behaviors, the government has also implemented initiatives to avoid possible safety problems. For instance, the prevailing Green Card Program is organized by the Labor Department to mandate safety training courses. Construction workers are obligated to enroll in these training courses and to pass written exams before they are qualified to work on construction sites. With regard to corporate financial input, the Pay for Safety Scheme was launched in the public sector by removing contractor pricing for safety items from consideration in the competitive bidding process.

As the market rapidly grows in China, so do industry associations that form the bond between government and corporations. Recently, construction safety associations have been founded across all China. The members of these organizations consist of major industry stakeholders, including government departments, construction firms, consulting firms and research facilities. These

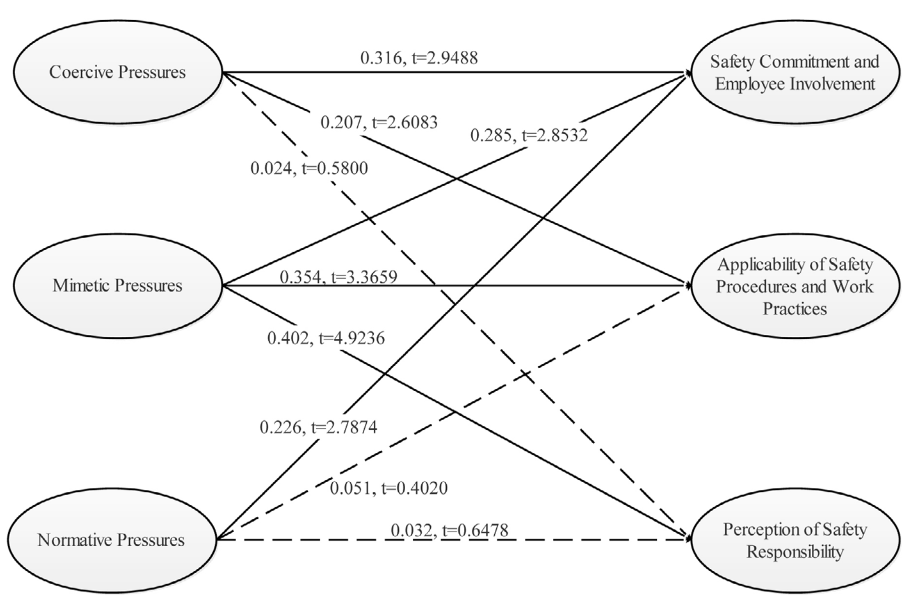

Fig. 2. Testing results of the theoretical model.

associations help to advocate government safety regulations and codes, monitor safety performance on construction sites and promote communication among corporations. These associations are also typically responsible for the inspection of construction plans, checking the feasibility of the plans before construction starts and monitoring site safety during construction. Only firms with approved construction plans can commence construction – an example of the coercive pressure from safety associations.

The second component of institutional pressure is *mimetic pressures*, which motivate individuals to avoid unnecessary dangers and have a sense of belonging. Organizations comprise individuals who interact with each other, mimic each other and learn from each other. As an important platform for corporate communication, safety associations regularly host safety seminars and safety competitions to foster communication between corporates and promote competitiveness. The high level of safety performance in some companies provides an incentive for other companies, thus creating mimetic pressure.

The third institutional pressure of *normative pressure* is the least intense pressure of the three. This type of pressure mostly stems from safety suggestions that stress the importance of safety. For instance, research facilities, or consulting firms who are at the forefront of safety research, might advocate cutting edge technologies and innovative safety methods. This advocacy, in turn, can put pressure on organizations to update their technology and keep up with cutting edge safety developments.

In general, each component of safety climate is associated with at least one component of institutional pressure. This shows that institutional pressures could be utilized to explain uneven levels of safety climate. Individually, different kinds of institutional pressure bear weight in distinctive ways.

Safety commitment and employee involvement are found to be significantly influenced by all three pressures. Therefore, mandatory regulations, peer pressure and instructive corporate guidelines can all influence safety awareness and safety attitude. The influence of coercive pressures on safety commitment and employee involvement is also much stronger than the influence of the two other types of institutional pressures. This is due to the particular conditions of the Chinese context, where government bodies have just as much power as the market to influence corporate actions. Government policies are crucial to the success of corporations and, because China is growing rapidly and the government realizes the importance of human rights, more and more importance is being attached to workplace safety. Thus, the national government's attitude toward safety has a great influence on an enterprise's safety attitude and its mandatory laws and regulations have a great effect on corporate safety performance.

The applicability of safety procedures and work practices is statistically proven to have a close correlation with both coercive and mimetic pressures. Moreover, mimetic pressures exert a much stronger impact than coercive pressures. These findings indicate that both compelling pressures and industry competition can push organizations to establish appropriate safety procedures and safety practices. Unreasonable safety procedures and work practices can result in injuries and accidents, and mandatory inspection and punishment should ensure organizations improve these procedures and avoid accidents.

At the same time, peer pressure pushes organizations to cooperate and share safety experiences, thus enhancing safety performance. However, compared to other pressures, peer pressure has a direct and profound influence on safety procedures. This is attributed to the fact that safety regulations do not cover detailed safety procedures and practices, which are complicated and relate to specific scenarios. In this instance, laws and regulations serve as guidelines rather than concrete protocols. In contrast, corporate seminars and safety competitions usually provide some insight into safety guides and manuals. Thus, benchmarking is an effective way to cultivate improved safety practices.

On the other hand, the study did not provide sufficient evidence to demonstrate a significant influence of normative pressures on the applicability of safety procedures and work practices. This might be explained by suggestions from research bodies and consulting firms being too forward-thinking for practical use. For instance, the application of specific IT technology in safety production might work well in trial studies, but has not been tested and applied as yet on a large scale. Thus, the exploratory nature of some of these technologies makes them unsuitable for incorporation into uniform regulations.

The perception of safety responsibility is significantly influenced by mimetic pressures only. As mentioned earlier, perception is the objective measurement of safety knowledge and training is seen as the best way to improve this perception. Therefore, training and safety seminars delivered by safety associations are crucial in raising safety perceptions among organization members, clarifying their safety responsibilities and regulating safety procedures. Mandatory government measures would also help to raise positive safety attitudes. Safety advice from experts and consultants who are more forward-thinking and less practical has less influence on safety perceptions or attitudes.

5.2. Implications

This study extends the domain of institutional theory and empirically validates its applicability to construction safety climate. More importantly, integrating both external institutional pressures and safety climate components into the research model reveals the influencing mechanism of institutional pressures on organizational safety climate behaviors.

The empirical results of this study have several practical implications. First, they reinforce the belief that the cultivation of safety climate should be treated as a socialized activity that is more influenced by external institutional pressures than by proactive efficiency needs. Therefore, related institutional forces can be utilized as strategies to facilitate an improved safety climate. Second, the results show that coercive and normative pressures have a stronger influence on safety commitment and employee involvement, while mimetic pressures are the dominate force in the applicability of safety procedures and work practices. Accordingly, government and industry professionals need to provide safety guidance and suggestions at the strategic level, and for participant and peer organizations to standardize best practices of detailed/practical organizational safety behaviors.

5.3. Limitations and future research directions

The first limitation of this study lies in the opinion-based nature of the questionnaire survey. However, the study minimized participant bias by the selective sampling of participants and the anonymous nature of the questionnaire. The second limitation is that the study was conducted in the specific institutional context of the Shanghai construction industry. This might limit the generalizability of the results to other institutional contexts. A natural extension of the research would be to compare the ways in which institutional pressures manifest themselves in different cultures.

6. Conclusions

While safety climate has been revealed as a positive influence on OHS performance in the construction industry, there is currently little research that provides insight into ways in which to foster its improvement. In this study, we developed and empirically tested a research model to explain, from an institutional theory perspective, how coercive, mimetic and normative institutional pressures influence organizational safety climate in the construction industry. The analysis indicates quite clearly their significance.

The findings suggest that building an organizational safety climate is a highly socialized activity that can not only be motivated by the rational needs to reduce accidents, but also by institutional pressures to comply with its specific institutional environments. The study also shed light on the way in which different types of institutional influence could be better exercised to facilitate safety climate improvement in the construction industry.

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