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A cognitive analysis of why Chinese scaffolders do not use safety harnesses in construction

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Chinese scaffolders not using safety harnesses is commonplace, despite scaffolders being constantly exposed to fall hazards on construction sites and the use of safety harnesses being required by law. The causes of Chinese scaffolders not using safety harnesses are explored through theoretical analyses and empirical tests. In theoretical analyses, based on Surry's model, the major cause of scaffolders not using safety harnesses was identified as their personal decisions not to do so. The theory of planned behaviour (TPB) was used to analyse why scaffolders decided not to use safety harnesses. In empirical tests, scaffolders on seven sites completed questionnaires developed based on TPB, and nine safety officers participated in a focus group meeting to collect their views on scaffolders' use of safety harnesses. In addition, two scaffolders, one gangmaster, one safety officer, and one foreman were interviewed to verify the results of the questionnaire survey. Empirical tests results show that the inconvenience and discomfort of using safety harnesses, underestimating the risk of not using safety harnesses, negative pressures from gangmasters, foremen, and safety officers, and lack of safety lines are causes of scaffolders deciding not to use safety harnesses. Measures enhancing the use of safety harnesses are proposed based on the results of empirical tests.

Keywords: China, cognitive model, safety harness, scaffolder, theory of planned behaviour.

Introduction

Falls from height are a common and serious accident type on construction sites. Among all fall protection measures, the use of safety harnesses is the last defence to avoid injuries due to falls from height and is commonly relied on by construction workers. The use of safety harnesses is stipulated by law for construction employees who work above a height of two metres in China. The *Safety Technical Code for Work at Height in Construction* stipulates that contractors should provide personal protective equipment to employees working at height (Ministry of Construction, 1992). Additionally, many large Chinese contractors' safety handbooks state that employees working at height are required to use safety harnesses, such as the safety handbook of China State Construction (China State Construction, 2008).

Given that construction workers are constantly exposed to the hazards of falls from height and that the use of safety harnesses is strictly required by law, it is reasonable to assume that construction workers should be willing to use safety harnesses in order to avoid falls from height. However, construction workers do not always use safety harnesses (Lipscomb *et al.*, 2008; Sa *et al.*, 2009). Since scaffolders spend most of their time working on buildings and removing scaffolding and are often seen on construction sites not using safety harnesses, this study focuses on the causes of scaffolders not using safety harnesses.

Since unsafe behaviour is recognized as a major cause of accidents, a number of studies have tried to explain unsafe behaviours of construction workers from various perspectives (Duff *et al.*, 1994; Chyene *et al.*, 1998; Abdelhamid and Everett, 2000; Glendon and Litherland, 2001; Suraji *et al.*, 2001; Kines, 2003; Dejoy, 2005; Mitropoulos *et al.*, 2005; Larsson *et al.*, 2008; Cavazza and Serpe, 2009; Edelson *et al.*, 2009; Lombardi *et al.*, 2009; Clarke, 2010; Kines *et al.*, 2010). Among these studies, those based on cognitive perspectives have grasped the essence of unsafe behaviour because unsafe behaviour is a kind of product of human cognition. Therefore, this study

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explores why Chinese scaffolders do not use safety harnesses from a cognitive perspective.

Theoretical analyses

Cognitive failures causing scaffolders not to use safety harnesses

Behaviour is a kind of product of human cognition. When an unexpected behaviour, such as an unsafe behaviour, is produced, there must be failures in the cognition process producing this unexpected behaviour. The human cognition process is simulated by various models, among which the information processing model is widely used in the studies of human error and unsafe behaviours (Kontogiannis, 1997; Lingard and Rowlinson, 1997; Shorrock and Kirwan, 2002; Kines, 2003; Chang and Mosleh, 2007). An information processing model, such as Wickens' model (1992), generally simulates human cognition as a sequential chain with several cognitive stages. Human cognition with five cognitive stages is generally used to analyse causes of unsafe behaviours, such as Surry's (1969) model. The five cognitive stages are:

(1) detecting hazards;
(2) recognizing hazards;
(3) perceiving responses;
(4) deciding a response; and
(5) executing the decided response.

Based on these stages, before correctly using a safety harness, a scaffolder may have the following sequential experiences:

(1) discovering a nearby fall hazard, such as an uncovered opening (Stage 1, detecting hazards);
(2) realization of the danger of falling from this opening and getting injured (Stage 2, recognizing hazards);
(3) retrieving long-term memory or looking at others to perceive potential responses including using a safety harness and not using a safety harness (Stage 3, perceiving responses);
(4) deciding from all the potential responses to use a safety harness (Stage 4, deciding a response);
(5) finally, correctly using a safety harness (Stage 5, executing the decided response).

Thus, there are five stages that may lead to scaffolders not using safety harnesses, as shown in Figure 1.

In order to have a deeper understanding of which stages may lead to scaffolders not using safety harnesses, a pilot study was conducted on a construction site at the authors' university. The building in construction is a research building with more than 10 floors. One of the authors spent two weeks on this site and every day he inspected the construction site with the safety officers. Five scaffolders and two safety officers at the site were interviewed at the end of the two weeks. Based on the interviews, failure of Stage 4 (deciding a response) was found to be an important cause of scaffolders not using safety harnesses. Thus, this paper focuses on Stage 4, exploring which factors lead to scaffolders deciding not to use safety harnesses.

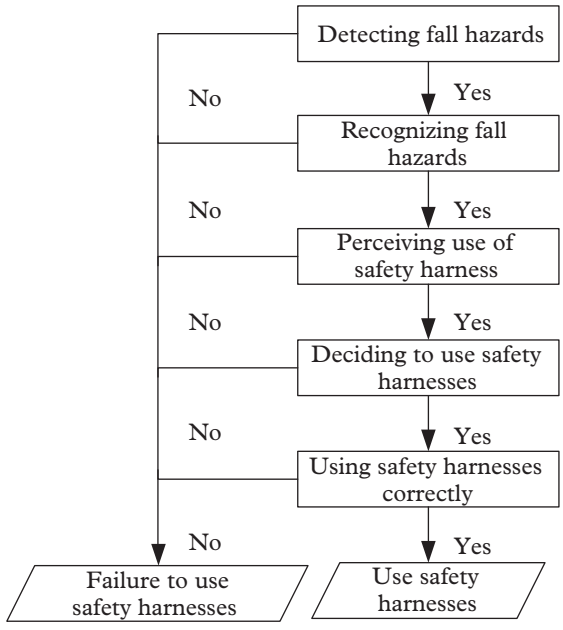

Figure 1 Cognitive failure types causing scaffolders not using safety harnesses

Causes of scaffolders deciding not to use safety harnesses

Scaffolders see fall hazards and they know that the use of a safety harness is a safe response to avoid falls from height but they still decide not to use safety harnesses. This kind of unsafe behaviour is classified as 'violation' according to Reason's classification of human error (Reason, 1990). Reason proposed using the theory of planned behaviour (TPB) to explore the causes of violation (Reason, 1990; Reason and Maddox, 1995). TPB has five main constructs, comprising attitude, subjective norm, perceived behavioural control, behavioural intention and behaviour. As shown in Figure 2, the theory states that behaviour is determined by behavioural intention and perceived behavioural control; behavioural intention, in turn, is determined by attitude, subjective norm, and perceived behavioural control (Ajzen, 1991).

Attitude is assumed to be determined by behavioural beliefs about the consequence of a behaviour

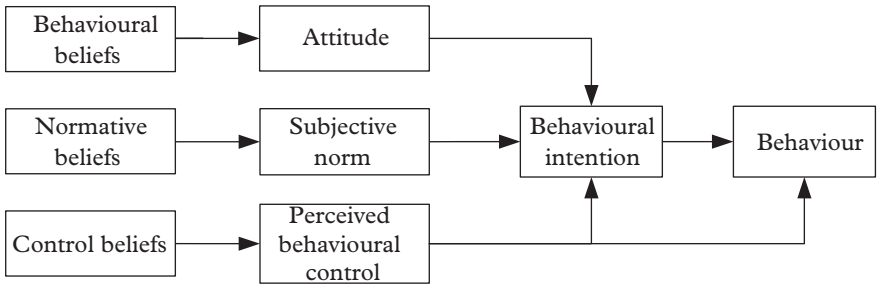

Figure 2 Theory of planned behaviour

multiplied by an evaluation of the desirability of the outcome for each belief. When scaffolders believe that using safety harnesses produces mainly positive outcomes and scaffolders highly desire these positive outcomes, their attitudes to this behaviour will be favourable. Subjective norm refers to a person's perceptions of significant others' expectations of his behaviour. Similar to attitude, subjective norm is determined by multiplying perceived expectations of important others and motivations to comply with these expectations. A scaffolder who does not believe that important others expect the use of a safety harness is less likely to use a safety harness. Perceived behavioural control refers to a person's perceptions of the ease or difficulty of performing a behaviour. This construct also depends on two components: control belief and perceived power. Control belief refers to perceived availability of resources, facilities, and other factors related to a behaviour. Perceived power reflects the extent to which these factors may facilitate or inhibit performance of this behaviour. The specific beliefs related to the use of safety harnesses are summarized as follows.

Behavioural beliefs determining attitude to the use of safety harnesses

Attitude to a behaviour is mostly based on the degree to which this behaviour meets a person's motivations. Three motivations may determine scaffolders' attitudes to the use of safety harnesses: the motivation for safety (Choudhry and Fang, 2008; Edelson *et al.*, 2009; Lombardi *et al.*, 2009; Bohm and Harris, 2010), the motivation for convenience (Atkinson, 1998; Haslam et al., 2005; Lipscomb *et al.*, 2008; Bohm and Harris, 2010), and the motivation for comfort (Bohm and Harris, 2010). Thus there are three kinds of behavioural beliefs determining scaffolders' attitude to the use of safety harnesses.

Because of the motivation for safety, a scaffolder facing a fall hazard will evaluate the risks of all potential behaviours including safe behaviours and unsafe behaviours, and form a risk perception of each potential type of behaviour. If a potential behaviour is perceived to be of lower risk than others, this behaviour can better satisfy the worker's motivation for safety and the worker will have a more positive attitude to this behaviour.

On construction sites, we often see a strange phenomenon that, although workers perceive a high risk of an unsafe behaviour, they still carry out this unsafe behaviour (Bohm and Harris, 2010). This phenomenon can be explained by the motivation for convenience. Workers want to complete their work in the least time and with the least effort (Atkinson, 1998; Haslam *et al.*, 2005; Mitropoulos *et al.*, 2005), especially when they engage in work with high physical demands and tight deadlines (Atkinson, 1998; Haslam *et al.*, 2005). If an unsafe behaviour is perceived as requiring less effort, workers may be willing to select this unsafe behaviour for convenience, even when the risk of this unsafe behaviour is not the lowest.

In considering the use of personal protective equipment (PPE), the discomfort of using PPE is a barrier to its uptake (Bohm and Harris, 2010). Since contractors generally purchase equipment only by price and durability with little consideration of usability (Haslam *et al.*, 2005), much PPE is difficult to use (Lipscomb *et al.*, 2008; Bohm and Harris, 2010), which is an important barrier to its uptake by workers. A scaffolder who does not feel comfortable using a safety harness may decide not to use it.

Normative beliefs determining subjective norms in the use of safety harnesses

For a scaffolder, significant others include management and co-workers. The significant influence of management on workers' behaviours has been demonstrated in behaviour-based safety researches (Lingard and Rowlinson, 1997; Marsh *et al.*, 1998; Cameron and Duff, 2007). Managers' evaluation of workers' performance determines workers' conditions and benefits such as salary, promotion and work stability so that workers have to consider managers' attitudes

to safety when deciding their own behaviours (Lingard and Rowlinson, 1997; Marsh *et al.*, 1998; Choudhry and Fang, 2008; Lipscomb *et al.*, 2008).

Workers judge managers' attitudes to safety through managers' behaviours, including attitudes and approaches to safety and training, the nature and extent of interaction with employees, willingness to learn from accident investigations, the frequency and strictness of safety inspections and feedback on workers' safety performance (Hinze, 2002; Haslam *et al.*, 2005; Choudhry and Fang, 2008; Edelson *et al.*, 2009; Lombardi *et al.*, 2009; Kines *et al.*, 2010). Among these managers' behaviours, feedback on workers' safety or unsafe behaviours is a main and direct channel through which workers may judge managers' attitudes to safety. If a worker's safe behaviour results in positive feedback, such as material reward or recognition, the worker will think it is more worthwhile working safely and belief in this safe behaviour is reinforced (Hinze, 2002; Lombardi *et al.*, 2009; Kines *et al.*, 2010). In contrast, a worker who is accused of low efficiency as a result of observing safe behaviours will tend to adopt unsafe behaviours. Regarding the use of safety harnesses, managers' feedback includes whether management criticizes scaffolders working without safety harnesses and whether management complains about low efficiency as a result of using safety harnesses.

As humans are social animals, acceptance is a basic human need. A construction worker may not be accepted unless behaviours are appreciated by co-workers. Thus, workers will tend to care about co-workers' attitudes. Three kinds of co-workers' attitudes may be considered by a scaffolder deciding on behaviours. The first is co-workers' attitudes to low work efficiency caused by safe behaviours. On construction sites, much work needs to be completed collaboratively by several workers. If the work efficiency of one worker is low, others' work will be affected. Thus workers may not like to cooperate with co-workers with low work efficiency.

The second is co-workers' attitudes to safety. Because many workers complete projects collaboratively and the workspace on a construction site is limited, workers performing unsafe behaviours not only may hurt themselves but also may hurt others. Therefore, workers are willing to work with co-workers following safety rules. Workers can judge their co-workers' attitudes to safety through their co-workers' behaviours (safe or not). Whether co-workers always talk about safety or warn others of dangers is also a channel through which they can understand co-workers' attitudes to safety.

The third is co-workers' views on the image of a person with unsafe behaviours, brave or not. Most people want to have a good image, and a 'brave person' is generally recognized by construction workers as a good image (Mullen, 2004; Choudhry and Fang, 2008). Choudhry and Fang (2008) found that some construction workers worked unsafely just to show that they were 'tough guys'. Edelson *et al.* (2009) considered this issue when they designed a questionnaire to collect information on barriers to earplug use.

Control beliefs determining perceived behavioural control in the use of safety harnesses

Each worker makes a judgement about how behavioural control will be perceived, based on internal and external factors. Internal factors include knowledge and physical conditions to implement a behaviour; external factors refer to environmental conditions, such as whether necessary equipment is provided. Using safety harnesses does not need too much physical exertion, so a scaffolder's perceived behavioural control on using a safety harness is mainly determined by knowledge of using a safety harness and provision of the necessary environmental conditions.

For the use of safety harnesses there are two necessary environmental conditions: the safety harness and the safety line. Safety harnesses must be provided to scaffolders, and there must be safety lines to secure the safety harness. Research on the use of safety glasses has identified that, although a contractor provided glasses to workers, the workers still did not wear safety glasses because of poor accessibility (Edelson *et al.*, 2009). Therefore, safety harnesses should be easily accessible to scaffolders.

Empirical tests

Procedure

Based on the foregoing literature review and the suggestions about which elements should be included in a standardized questionnaire based on TPB (Fishbein and Ajzen, 2010), a questionnaire was designed. This questionnaire was then refined in a focus group meeting held by the safety department of Beijing Construction Engineering Group (BCEG). The director and a member of staff of this department and seven safety officers from seven construction sites attended this meeting to confirm whether all the potential causes of not using safety harnesses were included in this questionnaire and to modify the questionnaire to make it more understandable to scaffolders. Led by the authors, the nine safety officers also discussed three topics, namely (1) the causes of scaffolders not using safety harnesses; (2) control measures to avoid scaffolders not using safety

harnesses; and (3) barriers to seriously implementing these control measures. Based on the number of scaffolders on seven sites, the corresponding numbers of questionnaires were provided to safety officers, who were asked to distribute the questionnaires to the scaffolders on their respective sites. Safety officers were asked to inform scaffolders that this survey was used for academic study and it was completely anonymous. Because of the wide variability in reading abilities among the workers, safety officers were required to read the items to scaffolders while scaffolders followed along with their questionnaires and completed their answers. Finally, the authors selected one of the seven sites and interviewed two scaffolders, one gangmaster, one foreman, and one safety officer to verify and further explore the results of the questionnaire survey.

Participants

This study was conducted by BCEG, which operates as a main contractor on residential projects. Scaffolders on seven sites in Beijing participated in the questionnaire survey; 218 questionnaires were given to safety officers on the seven sites who independently distributed the questionnaires to scaffolders, and a total of 178 scaffolders returned their responses. Among the 178 responses, 57 responses with uncompleted items and the same values for all items were removed, and 121 responses remained. In addition, two scaffolders, one gangmaster, one foreman, and one safety officer on a high-rise residential building project participated in the final interviews..

Questionnaire

In accordance with TPB and the foregoing literature review in theoretical analyses, the questionnaire included direct measures of attitude, subjective norm, perceived behavioural control, intention, and behaviour as well as measures of behavioural beliefs (belief strength), normative beliefs (motivation to comply) and control beliefs (control power).

Direct measures

In terms of direct measures, two items were designed to measure each of the three aspects: attitude, subjective norm, and perceived behavioural control. One item was designed to measure each of intention and behaviour. Responses were provided on a five-point scale with low scores indicating favourable dispositions to the use of safety harnesses. Attitude was assessed by an average of the following two items: 'I am pleased to use a safety harness when I am working on scaffolding', and 'I should follow safety rules to use a safety harness when I am working on scaffolding'.

In order to assess subjective norms, scaffolders were asked to indicate the extent to which they agree that most people who are important to them think they should use safety harnesses when they are working on scaffolding, and the extent to which they agree that most people who are important to them use safety harnesses when these people are working on scaffolding. The average of these two items was used as a direct measure of subjective norm.

The following two items assessed perceived behavioural control over using safety harnesses: 'I have the freedom to decide whether to use a safety harness when I am working on scaffolding', and 'It is not difficult for me to use a safety harness when I am working on scaffolding'. Responses to the two items were averaged to yield a measure of perceived behavioural control.

Intentions were assessed by asking scaffolders to indicate the extent to which they intend to use safety harnesses when they work on scaffolding. Information on actual use of safety harnesses was obtained by asking scaffolders how frequently they used safety harnesses when they were working on scaffolding. It is worth noting that the actual use of safety harnesses measured is of past behaviour that precedes the 'intentions' measured (see the section below on limitations for a discussion of the implications of this).

Behavioural beliefs, normative beliefs, and control beliefs

The above direct measures were merely used to demonstrate which constructs in TPB could successfully predict scaffolders' use of safety harnesses. From a practical perspective, it is crucial to know the specific underlying beliefs because these beliefs can reveal specific causes of scaffolders not using safety harnesses and form a basis for developing control measures.

- *Behavioural beliefs and belief strength*: There were three potential outcomes of using safety harnesses: (a) using safety harnesses can avoid fall injuries; (b) using safety harnesses is inconvenient; (c) using safety harnesses is uncomfortable. Scaffolders were asked to evaluate each outcome on a five-point agree–disagree scale with low scores indicating favourable dispositions to the use of safety harnesses. Responses to the three items were averaged to yield a total measure of behavioural beliefs. After that, they were asked to rate the extent to which they care about the safety, convenience, and comfort of using safety harness on five-point scales with low scores indicating they care more about them.

- *Normative beliefs and motivation to comply*: Gangmasters, foremen and safety officers, and co-workers were the important reference groups for scaffolders. Gangmasters can exert normative pressures from three approaches, including whether to criticize scaffolders who do not use safety harnesses, whether to blame scaffolders who waste time because of the use of safety harnesses and whether to use safety harnesses in the presence of scaffolders. Scaffolders were asked to indicate the extent to which they agree with each of the above three items on a five-point scale with low scores indicating favourable dispositions to the use of safety harnesses. The mean of these three items was used to assess normative pressures from gangmasters. Scaffolders were also asked to rate the strength of their motivation to comply with gangmasters' normative pressures with low scores indicating high strength.

  Since foremen and safety supervisors do not need to work like gangmasters, scaffolders only can feel pressures from whether foremen and safety supervisors criticize them if they do not use safety harnesses and whether foremen and safety supervisors blame them if they waste time in using safety harnesses. Scaffolders were asked to indicate the extent to which they agree with each of the above two items on a five-point scale with low scores indicating favourable dispositions to the use of safety harnesses. The mean of these two items was used to assess normative pressures from foremen and safety officers. Scaffolders were also asked to rate the strength of their motivation to comply with foremen and safety officers' normative pressures on a five-point scale with low scores indicating high strength.

  Scaffolders can perceive normative pressures from co-workers through four approaches. First, whether co-workers warn scaffolders if they do not use safety harnesses; second, whether co-workers laugh at scaffolders' timidity if they use safety harnesses; third, whether co-workers blame scaffolders if they waste time in using safety harnesses; finally, whether co-workers use safety harnesses. Scaffolders were asked to indicate the extent to which they agree with each of the above four items on a five-point scale with low scores indicating favourable dispositions to the use of safety harnesses. The mean of these four items was used to assess normative pressures from co-workers. Scaffolders were also asked to rate the strength of their motivation to comply with co-workers' normative pressures on a five-point scale with low scores indicating high strength.

- *Control beliefs and control power*: There were five factors that might interfere with the use of safety harnesses. The first two factors were related to safety knowledge on the use of safety harnesses. The other three factors were related to environmental conditions. Scaffolders were asked to indicate the extent to which they agree with each of the above five factors on a five-point scale with low scores indicating favourable dispositions to the use of safety harnesses, and then rate the extent to which the lack of that factor would hinder use of safety harnesses with lower scores indicating more influence.

Analyses

First, for descriptive purposes, means, standard deviations, and frequency distributions of the constructs (direct measures) in TPB were calculated. Second, in order to explore which constructs determine scaffolders' decisions to use safety harnesses, path analysis was used to test the validity of TPB based on the direct measures of the constructs in TPB. Path analysis can be used to analyse the linear relationships between multiple independent variables and dependent variables and to test the fit of the correlation matrix against the proposed causal models. Thus, path analysis can be used to test the validity of TPB by testing the fit of the correlation matrix against the proposed causal model based on TPB. In addition, for structural equation modelling (path analysis modelling is a kind of simplified structural equation modelling), a sample size with 10 to 20 times the observed variables is enough, as a rule of thumb (Wu, 2010). Because there are only five observed variables in the theoretical model, the sample size is big enough to do path analysis.

Third, means, standard deviations, and frequency distributions of belief strength, motivation to comply, and control power were calculated, which could reflect the beliefs that have important influence in shaping the constructs (possible constructs include attitude, subjective norm, and perceived behavioural control) determining scaffolders' decisions to use safety harnesses. Additionally, means, standard deviations, and frequency distributions of three kinds of beliefs were calculated. Based on the descriptive statistics, the possible underlying causes of scaffolders deciding not to use safety harnesses could be identified. Finally, safety officers' views on the causes of scaffolders deciding not to use safety harnesses and the measures to enhance the use of safety harnesses were analysed.

Results of empirical tests

Descriptive statistics of constructs in TPB

Attitude, subjective norm, perceived behavioural control, intention, and behaviour are major variables in TPB, and the descriptive statistics of these variables are reported in Table 1. The possible range of these variables is from 1 to 5, with low scores indicating favourable dispositions to the use of safety harnesses. It can be seen that scaffolders had, on average, highly positive attitudes to the use of safety harnesses; they perceived strong normative pressures from important others; they had moderately high perceptions of control regarding the use of safety harnesses; and they had strong intentions to use safety harnesses. In relation to their past behaviours, 68% of the 121 scaffolders always used safety harnesses (< 3), and 22% of 121 scaffolders did not always use safety harnesses (> 3).

Validity of TPB to explain why scaffolders decide not to use safety harnesses

Path analysis was used to test whether attitude, subjective norm, and perceived behavioural control predicted the intention to use safety harnesses and the actual use of safety harnesses, using AMOS 6. In addition to computing the chi-square for the differences between the model and the data, three indices of model fit were used: goodness-of-fit (GFI), adjusted goodness-of-fit (AGFI) and root mean square error of approximation (RMSEA) (Davis *et al.*, 2002; Fogarty and Shaw, 2010). GFI and AGFI can vary from 0 to 1, and a value above 0.95 is considered to indicate satisfactory fit. In terms of RMSEA, a value of 0.05 or lower indicates a good fit and values up to 0.08 indicate an acceptable fit.

Initial fit statistics were unsatisfactory: χ^2 (2, N = 121) = 41.29, GFI = 0.896, AGFI = 0.218 and RMSEA = 0.405. Significant co-variances remained between intention's residual and behaviour's residual and between behaviour's residual and subjective norm. From a theoretical perspective, subjective norm could have a direct effect on both intention and behaviour such as perceived behavioural control. Thus an additional pathway from subjective norm to behaviour was added on the basis of the above modification indices and theoretical consideration. This modification improved the model fit significantly: χ^2 (1, N = 121) = 0.451, GFI = 0.999, AGFI = 0.978 and RMSEA = 0.000.

As shown in Figure 3, attitude, subjective norm, and perceived behavioural control account for 39% of the variance in the intention to use safety harnesses. Subjective norm has a coefficient of 0.443, significant at $p < 0.001$; and attitude and perceived behavioural control have coefficients of 0.275 and 0.218 respectively, significant at $p < 0.005$. Figure 3 also shows considerable predictive validity with regard to the actual use of safety harnesses. Intention, perceived behavioural control, and subjective norm account for 49% of the variance in the actual use of safety har-

Table 1 Attitude, subjective norm, perceived behavioural control, intention and behaviour: means, standard deviations, and frequency distributions

Variables	M	SD	< 3 (%)	= 3 (%)	> 3 (%)
Attitude	1.73	0.54	99	1	0
I am pleased to use a safety harness when I am working on scaffolding	1.78	0.79	81	17	2
I should follow safety rules to use a safety harness when I am working on scaffolding	1.69	0.52	98	2	0
Subjective norm	2.38	0.93	71	8	21
Most people who are important to me think I should use safety harnesses when I am working on scaffolding	2.31	1.06	69	9	22
Most people who are important to me use safety harnesses when they are working on scaffolding	2.45	1.05	68	6	26
Perceived behavioural control	2.75	0.77	55	30	15
I have the freedom to decide whether to use a safety harness when I am working on scaffolding	2.22	1.01	82	5	13
It is not difficult for me to use a safety harness when I am working on scaffolding	3.28	1.03	22	28	50
Intention	2.14	0.72	77	19	4
I intend to use safety harnesses when I am working on scaffolding	2.14	0.72	77	19	4
Behaviour	2.23	1.25	68	10	22
I always used safety harnesses when I was working on scaffolding	2.23	1.25	68	10	22

Note: Percentages have been rounded to integers.

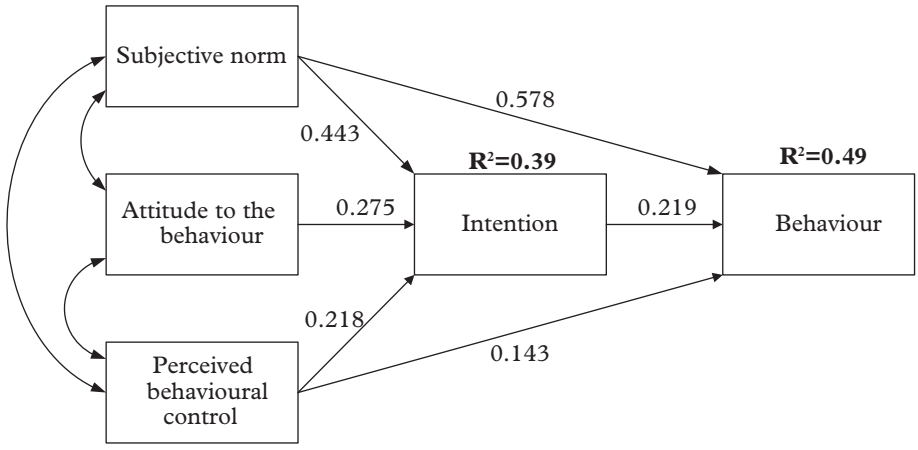

Figure 3 Empirical testing results showing significant paths to use of safety harness
Note: The numbers on the arrow are standardized path coefficients and the two R^2 are the explained variances.

Table 2 Standardized total effects

	Attitude	Subjective norm	Perceived behavioural control	Intention
Intention	0.275	0.443	0.218	–
Behaviour	0.060	0.675	0.191	0.219

nesses. Subjective norm has a coefficient of 0.578, significant at $p < 0.001$; intention has a coefficient of 0.219, significant at $p < 0.01$; and perceived behavioural control has a coefficient of 0.143, significant at $p < 0.05$. The total effects are shown in Table 2, in which subjective norm has the greatest effect on behaviour among all variables.

Descriptive statistics of behavioural beliefs, normative beliefs, and control beliefs

Table 3 presents the descriptive statistics of three kinds of beliefs. For behavioural beliefs, most scaffolders on average held positive behavioural beliefs on the use of safety harnesses (M = 2.56, 65% for values < 3). Almost all of the scaffolders thought that using safety harnesses can help to avoid fall injuries (92% for values < 3). However, more than one-third of the scaffolders thought the use of safety harnesses was inconvenient and uncomfortable (43% and 38% for values > 3 respectively).

All three kinds of normative beliefs, including beliefs about pressures from gangmasters, beliefs about pressures from foremen and safety supervisors, and beliefs about pressures from co-workers, on average, are positive (M = 2.80, 2.85, and 2.41 respectively); and the proportion of scaffolders holding positive beliefs about normative pressure from foremen and safety supervisors (34% for values < 3) is smaller than the other proportions of gangmasters and co-workers (55% and 73% for values < 3 respectively). In terms of specific normative beliefs, except the beliefs related to pressures from gangmasters, foremen and safety supervisors on wasting time in using safety harnesses (M = 3.34 and 3.59 respectively), all the others are positive.

The mean of control beliefs is lower than the means of behavioural beliefs and normative beliefs (M = 2.18, 2.56, 2.69 respectively), which implies that scaffolders felt that they grasped well the knowledge of using safety harnesses and that the provision of environmental conditions was well ensured. In terms of safety knowledge, 91% of the scaffolders thought they knew how to use safety harnesses and in which situations they needed to use safety harnesses. In addition, 87% of the scaffolders perceived that the environmental conditions for the use of safety harnesses could be ensured; however, only 49% of the scaffolders thought safety lines could be supplied, which is lower than the proportions of the other two specific beliefs, availability and accessibility of safety harnesses.

Descriptive statistics of belief strength, motivation to comply, and control power

Belief strength, motivation to comply and control power respectively reflect the influencing weights of behavioural beliefs about attitude, normative beliefs about subjective norm, and control beliefs about perceived behavioural control. Table 4 shows the descriptive statistics of belief strength, motivation to comply and control power.

Table 3 Minimums, maximums, means, standard deviations, and frequency distributions of behavioural belief, normative belief, and control belief

Belief	Min	Max	M	SD	< 3 (%)	= 3 (%)	> 3 (%)
Behavioural belief	1	3.83	2.56	0.69	65	3	33
Using safety harnesses can avoid fall injuries	1	5	1.98	0.84	92	3	6
I feel it convenient to use a safety harness	1	5	2.93	1.11	47	10	43
I feel comfortable to use a safety harness	1	5	2.78	1.06	56	6	38
Normative belief	1.39	3.78	2.69	0.41	76	1	23
Workers feel normative pressure from gangmasters	1.67	4.33	2.80	0.56	55	19	26
Gangmasters will criticize me if I do not use a safety harness	1	5	2.38	0.94	67	18	15
Gangmasters will not blame me if I waste time in using a safety harness	1	5	3.34	0.96	26	17	58
Gangmasters use safety harnesses	1	5	2.69	0.96	52	22	26
Workers feel normative pressure from foremen and safety officers	1	4.5	2.85	0.65	34	45	26
Foremen and safety officers will criticize me if I do not use a safety harness	1	5	2.12	0.71	90	2	9
Foremen and safety officers will not blame me if I waste time in using a safety harness	1	5	3.59	1.02	22	9	69
Workers feel normative pressure from co-workers	1	3.5	2.41	0.63	73	14	13
Co-workers will remind me to use a safety harness if I do not use it	1	5	2.36	1.04	69	11	21
Co-workers will not laugh at my timidity if I use a safety harness	1	4	2.41	0.77	60	31	9
Co-workers will not blame me if I waste time in using a safety harness	1	5	2.46	0.88	64	20	17
Co-workers use safety harnesses	1	4	2.41	0.99	70	6	24
Control belief	1	4	2.18	0.42	96	1	3
Workers have the knowledge to use safety harnesses	1	4.5	2.01	0.55	91	6	3
I know how to use a safety harness	1	5	1.91	0.55	97	1	3
I know in which situations I need to use a safety harness	1	5	2.12	0.80	84	8	7
Environmental conditions support workers to use safety harnesses	1	4.33	2.34	0.55	87	7	7
Safety harnesses are provided to us	1	5	2.10	0.70	85	10	5
It is convenient to get safety harnesses	1	5	2.23	0.70	75	19	6
There are safety lines to hang safety harnesses	1	5	2.70	0.99	49	26	25

Note: Percentages have been rounded to integers.

Table 4 Minimums, maximums, means, standard deviations, and frequency distributions of belief strength, motivation to comply, and control power

	Min	Max	M	SD	< 3 (%)	= 3 (%)	> 3 (%)
Belief strength	1	3.67	2.33	0.69	65	20	15
Safety is the first priority	1	3	1.29	0.49	98	2	0
Convenience of using safety harnesses is important	1	5	2.79	1.03	57	5	38
Comfort of using safety harnesses is important	1	5	2.90	1.11	54	5	41
Motivation to comply	1	4	2.39	0.73	76	7	17
I care about gangmasters' views on my behaviour	1	4	2.42	0.81	67	18	15
I care about foremen and safety officers' views on my behaviour	1	5	2.34	0.84	74	13	13
I care about co-workers' views on my behaviour	1	5	2.41	0.83	67	19	14
Control power	1	4.25	2.85	0.71	53	7	40
I cannot use a safety harness unless I have the knowledge	1	5	1.88	0.76	93	1	7
I will not use a safety harness unless it is provided	1	5	3.14	1.16	43	3	54
I will not use a safety harness unless it is easy to get	1	5	3.47	0.93	20	19	61
I will not use a safety harness unless there is a safety line	1	5	2.92	1.03	50	8	41

Note: Percentages have been rounded to integers.

The results for convenience and comfort of using safety harnesses imply that scaffolders, on average, had a moderate preference for less effort (M = 2.79 and 2.90 respectively). More than half of the scaffolders preferred convenience and comfort (57% and 54% for values < 3 respectively). In addition, almost all of the scaffolders were highly concerned about safety when they decided whether to use safety harnesses (M = 1.29, and 98% for values < 3).

On average, 76% of the scaffolders have a moderate motivation to comply with normative pressures from gangmasters, foremen and safety supervisors, and co-workers (M = 2.39). Each proportion of the scaffolders with the motivation to comply with normative pressures from gangmasters, with the motivation to comply with normative pressures from foremen and safety supervisors, and with the motivation to comply with normative pressures from co-workers was over 60% (67%, 74%, and 67% for values < 3).

Almost all the scaffolders thought that knowledge is very important for them to use safety harnesses (M = 1.88, 93% for values < 3). For lack of safety harnesses and the inconvenience of getting hold of safety harnesses, more than half of the scaffolders thought they could deal with these two barriers (54% and 61% for values > 3). However, only 41% of the scaffolders thought they could overcome the lack of safety lines.

Safety officers' views on scaffolders not using safety harnesses

Safety officers pointed out seven potential causes of not using safety harnesses (see Table 5). Three causes regarding scaffolders' attitudes to the use of safety harnesses were most frequently mentioned, which were 'Workers underestimate the risk of not using safety harnesses' (n = 6), 'Using safety harnesses is inconvenient' (n = 9), and 'Using safety harnesses is uncomfortable' (n = 5). Each of the other four causes related to subjective norm and perceived behavioural control was mentioned no more than three times. These results imply that, in the safety officers' view, scaffolders' decisions not to use safety harnesses were mainly caused by their own negative attitudes to the use of safety harnesses. However, these results are not consistent with the results of the questionnaire survey, which imply that, as well as negative attitudes to the use of safety harnesses, negative pressures exerted by gangmasters, foremen, and safety supervisors are also important barriers to scaffolders' use of safety harnesses.

Table 5 Safety officers' views on the causes of not using safety harnesses

Causes	Frequencies
Workers underestimate the risk of not using safety harnesses	6
Using safety harnesses is inconvenient	9
Using safety harnesses is uncomfortable	5
Lack of safety supervision	1
Negative influences among workers	3
Lack of knowledge	2
Lack of environmental conditions	3

Safety officers' views on the control measures to avoid not using safety harnesses are shown in Table 6. Because safety officers thought that scaffolders' negative attitude is the main cause of not using safety harnesses, all the safety officers considered modifying scaffolders' negative attitudes by safety training as an effective measure. In addition, eight safety officers pointed out that it is necessary to strengthen supervision on scaffolders' unsafe behaviours. There were also three safety officers who proposed reducing the inconvenience and discomfort of using safety harnesses by improving the design of safety harnesses. It is worth noting that one safety officer argued that gangmasters should take the responsibility for scaffolders' unsafe behaviours and it is necessary to raise gangmasters' concerns on the use of safety harnesses.

However, there were barriers to the implementation of the above control measures (see Table 7). Safety officers argued that scaffolders cannot be persuaded through safety training because of their low educational level, so that all of the safety officers regarded low educational level as an important barrier which

Table 6 Safety officers' views on the control measures to avoid not using safety harnesses

Measures	Frequencies
Safety training	9
Safety supervision	8
Improving the design of safety harnesses	3
Ensuring equipment supplies	1
Raising gangmasters' concerns on the use of safety harnesses	1

Table 7 Safety officers' views on the barriers to implement control measures

Barriers	Frequencies
Low educational level	9
Tight timeframe	2

influences the effectiveness of safety training. In addition, two safety officers pointed out that control measures could not be implemented seriously when the project was to be completed within a tight timeframe, which is consistent with the results of the questionnaire survey that gangmasters, and foremen and safety officers will blame scaffolders if scaffolders waste time in using safety harnesses (see Table 3).

Discussion

Validity of the cognitive approach for analysing the causes of scaffolders not using safety harnesses

Based on the pilot study, the cognitive perspective may be a suitable approach to analyse the causes of other unsafe behaviours. However, this study only focused on the fourth cognitive stage and explored this stage by using TPB. In studies on other unsafe behaviours, other cognitive stages may need to be explored by using other appropriate theories.

Validity of TPB for analysing why Chinese scaffolders decide not to use safety harnesses

In addition to the causal relationships proposed in TPB, the direct relationship between subjective norm and behaviour was demonstrated. This result indicates that scaffolders may give up their intentions under the pressures exerted by important others, such as co-workers, safety officers and gangmasters. This kind of phenomenon is often seen in construction. In Kines' study (2003), in two falling accidents involving tall, folded (closed) trestle ladders, the workers had thought of asking one of their colleagues for help with holding the ladders but decided not to ask as their colleagues were busy with their own tasks. The workers would ask for help even if their colleagues were busy, if they believed that their colleagues thought it was necessary to ask for help with holding the ladders.

It is worth noting that, among all variables with influences on intention and behaviour in TPB, subjective norm has the greatest effect on intention and behaviour. In this study, subjective norm was assumed to be shaped by the performance of co-workers and front line management (safety officers, foremen, and gangmasters). This result supported the importance of front line management highlighted in previous studies in accident prevention, having daily contact with staff and the opportunity to control the unsafe conditions and acts leading to accidents (Heinrich *et al.*, 1980; Chew, 1988; Simard and Marchand, 1994; Haslam *et al.*, 2005).

Possible causes of Chinese scaffolders deciding not to use safety harnesses

Attitude, subjective norm, and perceived behavioural control were demonstrated to have significant effects on scaffolders' behaviours, which implied that the beliefs shaping these three constructs may be possible causes of scaffolders deciding not to use safety harnesses.

Behavioural beliefs

Since scaffolders' attitude to the use of safety harnesses is a determinant of scaffolders' intention to use safety harnesses, scaffolders' negative behavioural beliefs shaping their negative attitude to the use of safety harnesses may be possible causes of not using safety harnesses (see Table 8).

Since more than one-third of the scaffolders thought that the use of safety harnesses was inconvenient (Table 3, 43% for values > 3) and more than half of the scaffolders were highly concerned about whether it was convenient to use them (Table 4, 57% for values < 3), inconvenience of use is a possible cause of not using safety harnesses. There are two practical approaches for dealing with this cause. The first approach is to improve the convenience of using safety harnesses by improving their design; the second approach is to reduce scaffolders' concerns about whether it was convenient to use them. Based on previous studies, scaffolders' concerns about whether their use was convenient could be explained from two aspects. First, construction work is a kind of moderate to heavy work, so that scaffolders want to complete their work with least effort (Abdelhamid and Everett, 2002; Gillen *et al.*, 2002). Second, construction work is sometimes implemented within a tight timeframe, so that scaffolders have to work quickly in order to meet deadlines (Haslam *et al.*, 2005; Mitropoulos *et al.*, 2005). In the interviews with scaffolders, they confirmed both these aspects, and thought that a tight timeframe was the most important factor in their concerns about convenience of use. Therefore, scaffolders' concerns could be reduced by lowering the workload or providing more time. However, safety officers argued that given the situation of the Chinese construction industry and the characteristics of construction work, reducing the workload and providing extra time are not realistic in the short run. Therefore, we would suggest that, for the time being, improving the convenience of use of safety harnesses by improving the design of the harnesses is the appropriate approach to avoid scaffolders' non-use.

The discomfort of using safety harnesses is also a possible cause of non-use. Among the scaffolders,

Table 8 Causes of scaffolders deciding not to use safety harnesses and control measures

Causes	Control measures
(1) Inconvenience of using safety harnesses	Improving design of safety harnesses
(2) Discomfort of using safety harnesses	Improving design of safety harnesses
(3) Underestimating the risk of not using safety harnesses	(a) Training scaffolders by using actual accident cases
	(b) Repeatedly warning scaffolders that they already have stood very high and may get injured
(4) Negative normative pressure coming from safety officers, foremen, and gangmasters	(a) Making managers understand their significant influences on scaffolders
	(b) Making gangmasters and safety officers understand the importance of using safety harnesses
(5) Lack of safety lines	Taking technical measures to avoid the lack of safety lines

54% did not like to use uncomfortable harnesses (see Table 4), and 38% thought that the use of safety harnesses was uncomfortable (see Table 3). In the interviews, the scaffolders complained that it was too hot to use safety harnesses in summer. Discomfort has been proved to be an important barrier in construction workers' use of PPE in previous studies. For example, dumper drivers did not use safety belts because of discomfort (Bohm and Harris, 2010); workers did not use protective eyewear because of distorted view and fogging (Lombardi *et al.*, 2009). Therefore, the comfort of using safety harnesses should also be considered when improving their design.

Underestimating the risk of not using safety harnesses is another possible cause of non-use. In this study, most scaffolders were highly concerned about safety in the decision about whether to use harnesses (Table 4, M = 1.29, 98% for values < 3), and almost all the scaffolders thought that their use can avoid fall injuries (Table 3, 92% for values < 3). These results imply that scaffolders do not use their harnesses only when they are confident of their ability to control the fall hazards without the use of harnesses. This inference was confirmed by two scaffolders and a safety officer. In the interview with the scaffolders, both of the scaffolders confirmed that the idea that 'I will not get injured if I do not use safety harnesses' was a potential factor in non-use. At the same time, the safety officer who had been a scaffolder in the past pointed out that scaffolders would use safety harnesses without concern for the convenience and comfort of using safety harnesses when they were working in high-risk situations. Considering that scaffolders may underestimate the risk of not using safety harnesses (Zhang *et al.*, 2011), they may be overconfident that they can control fall hazards without the use of harnesses, when such hazards are in fact beyond their abilities to control, and then improperly decide not to use safety harnesses. Previous studies showed that underestimating risk and overestimating ability were mainly the result of repeated experience of unsafe behaviour without injury or illness (Weinstein, 1980; DeJoy, 1989; Job, 1990; Lingard, 2002). Therefore, in order to reduce scaffolders' sense of unrealistic optimism that 'I can well control fall hazards', management needs to regularly provide scaffolders with information on accident cases caused by not using safety harnesses to give scaffolders a perception that accidents caused by not using safety harnesses do indeed happen. Moreover, when we interviewed the scaffolders, they told us that they were not afraid if they start building scaffolding from the ground and continue floor by floor. To increase scaffolders' perception of the danger of working at height, management should repeatedly warn scaffolders that they already have reached a sufficient height to justify the use of harnesses and may get injured if they fall from scaffolding.

Normative beliefs

In terms of normative beliefs and motivations to comply, most of the scaffolders had the motivation to comply with normative pressures (Table 4, 76% for values < 3), while there was a moderate proportion of scaffolders perceiving neutral and negative normative pressures (Table 3, 24% for value $\geq$ 3). It can be concluded that in the scaffolders' view, negative normative pressure is a possible cause of non-use. However, in the safety officers' view, scaffolders' non-use decisions were mainly caused by their own negative attitude to the use of safety harnesses (see Table 5). In the interviews with the foreman and gangmaster, although they thought they had some effects on scaffolders, they thought that scaffolders' decisions were mainly determined by convenience and comfort. This contradiction reveals that the managers, including safety officers, foremen, and gangmasters, underestimate their influence on scaffolders. It is important to let managers know the significant influence that they

have on scaffolders; only then will managers consciously pay attention to their words and deeds, which is the basis for shaping scaffolders' normative beliefs in relation to the management.

Regarding the three reference groups, scaffolders, on average, have the motivation to comply with pressures from all three reference groups with the strongest motivation to comply with foremen and safety officers' pressure (Table 4, M = 2.34). In the interviews, scaffolders claimed that they were brothers with the gangmaster and co-workers because they worked together every day and knew each other well. On the other hand, the scaffolders thought that foremen and safety officers were supervisors who might punish them if they broke safety rules. Therefore, they were more concerned about foremen and safety officers' attitudes to their behaviours. However, compared to the normative pressures from co-workers and gangmasters, the fewest scaffolders felt positive pressures from foremen and safety officers (Table 3, 34% for values < 3). These results suggest that, in the scaffolders' view, foremen and safety officers are the primary reference group to exert negative normative pressures on them. However, safety officers and foremen did not agree with this inference. In the interview, the safety officer argued that scaffolders' tasks were assigned by gangmasters and their salaries were also paid by gangmasters, so that gangmasters could exert the most significant normative pressures on scaffolders and should take the responsibility for scaffolders not using safety harnesses. Moreover, the safety officer stressed that although he had the right to punish scaffolders for not using safety harnesses, he rarely used this right because he knew scaffolders did not make money easily. In the interview with the foreman, he said that foremen typically contacted the gangmasters to assign tasks with even less contact with scaffolders, which was also confirmed by scaffolders and gangmasters. The underlying meaning of this foreman's view was that he agreed with the safety officer's view that gangmasters could exert the most significant normative pressures on scaffolders. Based on these results, it can be concluded that safety officers and foremen do not realize their significant influence on scaffolders; and gangmasters play a very important role in influencing scaffolders' behaviour.

In the interview with the scaffolders, gangmaster, foreman, and safety officer, we undertook an in-depth exploration of gangmasters' influence. Regarding the experience of gangmasters, most of them had worked as scaffolders in the past, and when they had some experience and resources, they started to recruit workers from their hometowns and became gangmasters. Both scaffolders and gangmasters said that new scaffolders acquired their knowledge from gangmasters, while bad habits, such as not using safety harnesses, were also passed on to new scaffolders. Safety officers pointed out that because these scaffolders' bad habits (including non-use of safety harnesses) were not considered as bad habits by gangmasters, they did not criticize scaffolders with these bad habits. This phenomenon is also apparent with old safety officers who had been scaffolders in the past, because they had also had these bad habits. These results suggest that, in order to make gangmasters and safety officers seriously strengthen the use of safety harnesses, it is necessary to let gangmasters and safety officers know the importance of using safety harnesses.

In terms of specific normative beliefs, only two beliefs related to the pressures from gangmasters, foremen and safety supervisors on scaffolders wasting time in using safety harnesses, on average, are negative (Table 3, M = 3.34 and 3.59 respectively). This finding is supported by two safety officers, who highlighted that tight timeframes are a barrier to their serious implementation of control measures to reduce non-use of safety harnesses (see Table 5). In the interview, the safety officer said that although the safety issue was always the first topic in weekly meetings, the construction schedule was what the project manager prized above all else. This surprised us since the Chinese government has taken a strong stance on safety in production and introduced policies to severely punish those responsible for accidents. The reasons why project managers do not make safety a priority are beyond the scope of this study, and need to be explored in future research.

Control beliefs

Almost all the scaffolders thought that knowledge was very important for them in their use of safety harnesses (Table 4, M = 1.88, 93% for values < 3), which implies that whether the scaffolders have knowledge about safety harnesses is an important factor influencing their perception of their behavioural control. Since 91% of the scaffolders thought they knew how to use safety harnesses and in which situations they needed to use safety harnesses (see Table 3), lack of knowledge is not a universal cause of scaffolders deciding not to use safety harnesses.

In relation to the lack of safety harnesses, 43% of the scaffolders thought it was a barrier to use (see Table 4). This result indicates that whether the scaffolders are provided with safety harnesses is a factor influencing their perception of their behavioural control. However, 85% of the scaffolders thought that they were provided with safety harnesses (see

Table 3). Interviews with the safety officer and scaffolders confirmed that almost all the scaffolders were provided with safety harnesses. Thus, the lack of safety harnesses is not a widespread cause of scaffolders deciding not to use safety harnesses. In addition, only 20% of the scaffolders thought the inconvenience of getting safety harnesses was a barrier to use (see Table 4) and 75% of the scaffolders thought it was convenient to get safety harnesses (see Table 3). Thus, the inconvenience of getting safety harnesses is also not a widespread cause of scaffolders deciding not to use safety harnesses.

Since only 49% of the scaffolders thought that safety lines could be supplied (see Table 3) and a relatively high rate up to 50% of the scaffolders thought lack of safety lines was a barrier to their use of safety harnesses (see Table 4), lack of safety lines is a possible cause of scaffolders deciding not to use safety harnesses. This inference was confirmed in the interviews with the safety officer and scaffolders. They said that there were insufficient necessary mount points to set up safety lines in some special situations. To remove this cause, some technical measures are required to deal with these special situations.

Limitations

First, this study focused on a subset of projects (seven sites in Beijing) belonging to one large contractor (BCEG). In fact, small to medium-sized contractors make up a large proportion of Chinese contractors and, generally, the management skills of these contractors are not as well developed as those of larger contractors. Even within the same contractor, the management skills in projects in different cities may differ. For example, the management skills in projects in large cities may be more developed than those in projects in small–medium cities and rural areas. In sum, the results of this study only represent the situation of large contractors' projects in large cities. It would be worthwhile to replicate this study in different settings to examine the generalizability of the results.

Second, the interview with the scaffolders, gangmaster, safety officer and foreman revealed that the normative pressures from foremen and safety officers may be different, but the normative pressures from foremen and safety officers were not distinguished in the questionnaire survey. It is also important to distinguish the normative pressures from foremen and safety officers to find out the exact reference group having negative influences on scaffolders.

Third, there may be a deviation between the measure of use of safety harnesses by using self-reporting and the actual use of safety harnesses. Site observation is suggested as a means of measuring the actual use of safety harnesses in future research. In addition, this paper has measured past actual use by using self-reporting. Strictly speaking, as a cause–effect relation, the measuring time of the dependent variable should lag behind the measuring time of the independent variable. However, there is a mismatch in time between current attitude, current subjective norm, current perceived behavioural control, current intention, and past behaviour in this paper. The availability of this practice is based on two assumptions: first, an individual's attitude, subjective norm, perceived behavioural control, intention and behaviour could remain constant for some time without external intervention; second, there are no external interventions during the period from when past behaviour existed to the point at which attitude, subjective norm, perceived behavioural control and intention were measured. Our suggestion is to design a research plan that incorporates the measuring time of the dependent variable lagging behind the measuring time of the independent variable.

Fourth, despite the care taken in constructing the questionnaire, there is no psychometric demonstration of the reliability of the measures. It is suggested that this questionnaire is developed in future research.

Conclusions

The stage of 'deciding a response' was focused on to explore why Chinese scaffolders decided not to use safety harnesses. TPB was used to theoretically construct the model of the stage of 'deciding a response'. The validity of TPB to model the stage of 'deciding a response' was demonstrated by empirical tests.

There are many possible causes for Chinese scaffolders not using safety harnesses, and relevant preventive measures should be taken to prevent Chinese scaffolders' non-use of safety harnesses according to these specific causes. To minimize scaffolders' perceptions of the inconvenience and discomfort of using safety harnesses, the design of safety harnesses needs to be improved. Because underestimating the risk of not using safety harnesses is mainly a result of repeated experience of unsafe behaviour without injury or illness, management needs to regularly provide scaffolders with reports of accident cases caused by not using safety harnesses to make scaffolders aware of accidents caused by non-use. Since scaffolders perceived that managers including gangmasters, foremen, and safety officers exerted negative pressures on the use of safety harnesses, it is important to let managers know the significance of their influence on

scaffolders. Only then will managers consciously pay attention to their words and deeds. In addition, technical measures should be taken to ensure that the safety lines could be set up when the use of safety harnesses is needed.

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