



Modelling the predictors of intention in workplace safety compliance of a multi-ethnic workforce



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ABSTRACT

This paper investigates the main drivers of intention, as enunciated by the Theory of Planned Behavior (TPB), to comply with safety practices among a multi-ethnic workforce of a steel fabrication yard in Singapore. A total of 341 male workers were surveyed on their safety attitude and habits. The participants' ages ranged from 19 to 60 years. Work experience ranged from 0 to 21 years. The survey questionnaire was translated from English into Tamil, Indian, Chinese, and Burmese, and back translated prior to administration in the 5 languages. The constructs measured were *attitude*, *subjective norms*, *perceived behavioral control* (PBC), and *habit* (which the authors introduced as an adjunct to the classical TPB). A TPB-based model was developed by path analyses using SPSS AMOS, revealing relationships among these predictors of intention to comply with safety procedures and protocol. Fit statistics of the model were good, accounting for 75% of the data's variance. *PBC* and *subjective norms* were found to be statistically significant direct predictors of intention. The relationship between intention and its predictors can be described by the structural equation: $Intention = 0.10 (Attitudes) + 0.56 (PBC) - 0.05 (Habits) + 0.31 (Subjective Norms)$. The model also affirmed the indirect influence of *habit* on *intention*, through the constructs of *perceived behavioral control* and *attitudes*, implying that workers perceive safety compliance as largely attributable to factors within their control. This cross-sectional study warrants rigorous follow-up longitudinal research before the conclusions can be generalized.

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1. Introduction

Typical workplace safety interventions have focused on regulating the physical work environment and task procedures in an effort to avert errors and accidents (Fogarty and Shaw, 2010). A contemporary approach puts an equal emphasis on human factors in workplace accidents, taking into account psychological pressures, cultural differences and factors that influence safety behavior (Fogarty, 2004). This paper investigates the human factors that drive workers' safety compliance in a steel fabrication yard. Earlier research in this area was based on worker focus group interviews, the analysis of risk acceptance and the perceived trade-off between productivity and safety (Nordlöf et al., 2014). In this research effort, we examine the predictors of intention driving behavior as postulated by Ajzen's (2001) in the Theory of Planned Behavior.

1.1. The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) (Ajzen, 2001) postulates that intention is predicate on three main predictors, i.e. attitudes, subjective norms and perceived behavioral control, intention itself triggering behavior. See Fig. 1. TPB can explain at-risk behaviors, which are defined as intentional non-conformance to a prescribed safe method of performing a task (Johnson and Hall, 2005; Fogarty and Shaw, 2010; Montano and Kasprzyk, 2008).

An individual's *attitude* towards behavior is a product of strong personal beliefs about the outcome and the outcome's consequences.

In the context of a workplace, *subjective norms* refer to the collective beliefs and behaviors of managers, supervisors and immediate co-workers. For example, if a workgroup operates in a weak safety-conscious culture, an individual worker within the work group is less likely to contradict the collective norms (Ajzen, 2001). Social conformity can produce positive outcomes when a work group has a strong safety culture (Mullen, 2004).

The final predictor of behavior is *perceived behavioral control* (PBC) which reflects the perception of the ease or hindrance of

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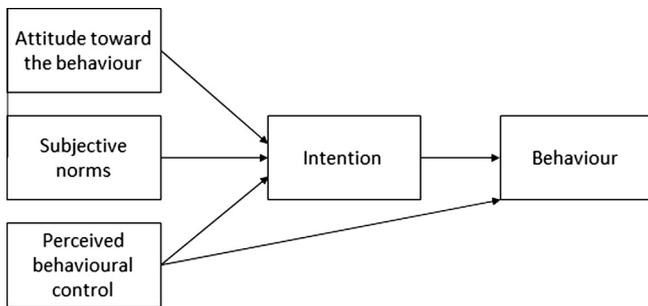


Fig. 1. The Theory of Planned Behavior (Ajzen, 2001).

performing a specific behavior. *PBC* is based on an individual's perceived control over internal and external factors that hinder goal accomplishment. *PBC* in turn is predicate on an individual's self-assessment of his/her ability to perform the behavior (Ajzen, 2001). *Actual behavioral control* reveals the real extent to which an individual has the requisite skills, and resources to execute the behavior. When *PBC* closely aligns to actual behavior control, it becomes a proxy predictor for behavior (Ajzen, 2001). There are instances when workers feel powerless to comply with safely rules due to external factors like insufficient time, resources, equipment and production pressure (Fogarty, 2004). Recent safety studies have found several determinants of safety behavior. A contemporary TPB model by Montano and Kasprzyk (2008) proposes that habits have a direct influence on safety behavior, bypassing conscious cognition and workgroup norms. Work group norms were found to have a significant influence of individuals' safety behavior (Hofmann and Stetzer, 1996; Zohar, 2000). In a study on safe-lifting behavior, individual attitudes were found to defer from the collective norms and perceived behavioral control (Johnson and Hall, 2005).

1.2. Workplace safety landscape

In Singapore an estimated 364,700 foreign workers are employed in the construction industry in Singapore (Ministry of Manpower, Singapore, 2014a, 2014b). By nationality, foreign workers in Singapore hail primarily from Malaysia, the People's Republic of China, Bangladesh, India, Thailand, Philippines, and Myanmar. Migrant workers, excluding live-in foreign domestic workers, are typically deployed in the construction, low-skilled manufacturing, and maritime industries (Phua et al., 2012; Baruah, 2013).

The major injury rate (severe non-fatal injuries such as amputations, crushing injuries, fractures/dislocations, electric shock, and drowning) increased slightly from 19.8 to 20.0 per 100,000 workers from 2013 to 2014. The minor injury rate (>3 days of sick leave, or admission to hospital for at least 24 h of treatment or observation that are not classified as major injuries) saw an increase from 362 to 383 per 100,000 workers from 2013 to 2014. For 2014, the overall number of reported injuries increased by 9.2% compared to 2014 (Workplace Safety and Health Institute, 2014a, 2014b).

The 3 traditionally high-risk sectors in Singapore are construction, manufacturing and marine. For 2014, the manufacturing sector had the highest overall injury rate (714 per 100,000 workers) since 2011, followed by the construction sector (594 per 100,000 workers). In 2014, the Construction sector was the highest top contributor to fatal and major injuries while Manufacturing remained the highest contributor to the number of workplace minor injuries.

By incident type, Falls-from-Height was the leading cause of fatal injuries in 2014. The chief major injuries type was Crushing, Fractures and Dislocations. Slips Trips and Falls (STF) was the top

incident type for workplace minor injuries (Workplace Safety and Health Institute, 2014a, 2014b). One study attributed the causes of workplace accidents to poor attitudes of workers, weak management commitment, insufficient safety knowledge and training of workers (Teo et al., 2005). The two main reasons identified for at-risk behaviors among contractors in Singapore were "don't know how" and "don't care". The former implies a lack of knowledge and poor safety training competency, which can be overcome with training and certification. The latter reflects an issue of worker attitudes and personal beliefs towards safety. The study proposed effecting organizational behavior modification through operant conditioning (Teo et al., 2005). Other studies have attributed workers' lower perception of work place risks to optimism bias in the absence of penalties or negative consequences (Cooper, 2003), and social conformity to group norms that do not subscribe to a safety culture (Choudhry and Fang, 2008).

Successfully ingrained safety norms underpin an organization's safety culture. It is imperative that a safety culture be nurtured in any organization. This culture fosters a safety ethic and actively strives to prevent accidents (U.S. Department of Energy, 2009). In their attempts to foster a safety culture, new hires of the two collaborative organizations involved in this study are assigned a buddy, typically an experienced senior co-worker, who instils safe behavior in them. Furthermore, employees are updated monthly on safe practices and recent safety breaches by the organization's Health and Safety Committee which also conducts safety talks for all employees. In this way, the institutional memory of best practices is preserved and reinforced in all employees, but especially transmitted to new employees (Mosey, 2014). A hazard analysis and risk assessment of each and every job is also conducted by the supervisor and worker, who then 'owns' the outcomes. In this way, the safety loop is closed in the system (Leveson, 2011).

2. Materials and methods

The Company's steel fabrication yard has pre-designated zones for large steel beams. Workers are exposed to risks of Slips/Trips/Falls risk if tools are not properly kept and obstructions are not detected, and to being cut or stabbed by objects from high-energy, high-speed grinding, cutting and welding machinery.

A total of 341 out of 413 male workers (i.e. 82.57% of the population) from the fabrication yard, ranging in age from 19 to 60 years ($M = 31.71$, $SD = 7.56$) were surveyed on their safety attitude and habits. Their work experience at the Company ranged from 0 to 21 years ($M = 4.54$, $SD = 3.86$). Demographic variables are summarized in Table 1. The respondents of the survey were assured of anonymity and confidentiality, and native speakers of Bangladeshi, Tamil, and Myanmar were on hand to interpret the survey document.

The survey questionnaire (see Appendix A) was constructed based on existing TPB constructs, namely *own attitude*, *subjective norms*, *intention*, and *violations*, to predict safe behavior and safety climate (Johnson and Hall, 2005; Fogarty and Shaw, 2010). The conventional TPB variables were augmented with additional questions on *Habit* to investigate the effects of habituation on intention to comply with safety protocol. The instrument design focused on four key areas: lifting operations, hot work, operation of machinery/equipment/tools, and housekeeping & access.

All items employed a seven-point Likert-style scale, from 1 (*Strongly disagree*) to 7 (*Strongly agree*), with the exception of the *past behavior* item that used 1 (*Never happen*) to 7 (*Always happen*). The score for each scale was computed based on the average of responses.

Prior to data collection, the questionnaire was examined by safety managers for issues such as appropriate questionnaire

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