Risk Compensation in Construction Workers' Activities

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Abstract

Construction has been plagued with serious injuries and deaths for years. Although the technological advances have made the world safer and healthier, researchers have noted that some safety interventions, which had clear objective safety benefits, had failed to achieve the forecast savings in lives and injuries. Purpose: The purpose of this study was to explore whether the construction workers show risk compensation and engage in greater risk taking when certain types of safety measures are implemented in the construction site. Method: A case study approach was used to achieve the aim of this study. A typical construction site in Sydney was selected as the subject of the case study. Data were collected through direct observations, questionnaires and interviews. Findings: The findings confirm that workers show risk compensation behaviours in the construction environment. The risk compensation behaviours of workers varied with the level of experience and whether they have suffered from a past workplace injury. Significance: The findings of this study may offer a better understanding of workers' behavioural patterns in construction environment and the effectiveness of safety interventions. The result of this study may provide supports for designing, implementing and evaluating safety interventions in construction site.

Keywords: Construction, accidents, safety, behaviour, risk compensation, risk perception.

1. Introduction

Construction has been plagued with serious injuries and deaths for years. Unfortunate incidents have contributed to excessive loss of lives and damage to property, casting a pall over the construction industry. Construction companies, both large and small, should be viewed and operated as businesses. One key to success in business is minimising cost (Appleby, 1994). Providing a safe workplace is one of the most effective strategies for holding down the cost of doing business (Goetsch, 2003). The main driving force behind the industrial safety movement is the fact that accidents are expensive, and substantial savings

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can be made by preventing them (U.S. Department of Labor, 1955). The situations of workplace safety in construction industry and the potential benefits of good WSH performance, both humane and economic (Bird and Germain, 1996), had prompted the government, industries and researchers to examine various strategies for enhancing construction site safety performance.

Although technological advances have made the world safer and healthier, researchers have noted that some safety interventions, which had clear objective safety benefits, had failed to achieve the forecast savings in lives and injuries (e.g., Adams, 1982; Evans, 1986; Sagberg et al., 1997). Adams (1982) examined the efficacy of seatbelt legislation through a comparative study of road accident fatality statistics from 18 countries and found that there was no correlation between the passing of seat belt legislation and the total reductions in injuries or fatalities. Sagberg et al. (1997) investigated drivers' responses to airbags and antilock brakes and found that drivers of cars with airbags and antilock brakes tend to compensate by closer following, more lane changes and a lower rate of seat-belt use, which accounted for the failure of airbags and antilock brakes to result in any measurable improvement in road safety. Shealy (2008) who studied skiing and snowboarding injuries for more than 30 years found that the usage of ski helmets did not reduce fatalities and helmeted skiers tend to go faster. These studies have suggested that individuals will react to environmental changes in a compensatory fashion so that riskier behaviours result from perceptions that the environment has become safer. Risk compensation theory states that individuals will behave less cautiously in situations where they feel "safer" or more protected (Peltzman, 1975). Peltzman (1975) proposed such compensation mechanism to explain why some safety interventions have produced negligible results. According to Peltzman (1975), drivers simultaneously experience the competing demands of lower risks (i.e., lower probability of death from an accident) and what Peltzman calls ''driving intensity'' (i.e., arriving at the destination more quickly, thrills, etc.). When safety devices are added, or the use of them is mandated, the risks associated with higher driving intensities are essentially lowered, e.g., drivers face a lower probability of death with the use of seat belt. Peltzman (1975) found that, under safer environment, drivers tend to increase speed rather than enjoy the increased safety associated with driving at the same speed. Peltzman's (1975) theory suggests that individuals tend to adjust their behaviours in response to perceived changes in risk (Stetzer and Hofmann, 1996).

This study aims to examine the risk compensation activities in the construction environment. This study may offer a better understanding of the theory behind: (1) the behaviours of the construction workers; (2) the relationship between safety interventions and safety behaviours; and (3) the relationship between safety interventions and safety performance. The result of this research may provide the basis for designing, implementing and evaluating safety interventions in construction site. Such knowledge should be of interest to construction contractors as they have to consider the risk compensation implications when they implement certain safety interventions. The identification of those construction workers most at risk for showing risk compensation will allow the contractors to focus prevention resources and target this high-risk group. Without knowing the possible risk compensation behaviours may result in the malfunction of certain safety measures and thus the waste of resources.

2. Method

The aim of this study is to explore whether the construction workers show risk compensation and engage in greater risk taking when certain types of safety measures are implemented in the construction site. This study seeks to gain an in-depth understanding of the safety behaviours of construction workers. It also seeks to propose research hypotheses for the next stage of the research project based on this initial inquiry into the problem. Based on the aim of this study and the circumstances for the use of case study design summarized by Yin (2009), a case study design is considered to be appropriate for this study. As suggested by Yin (2009), case study method is relevant the more that the research questions require an extensive and in-depth description of some social phenomenon. The case study was conducted in an ongoing building construction site (referred to as “Site A” in the subsequent sections) in Sydney, Australia. There are various methods/techniques to collect data in a case study, such as documentation, archival records, interviews, direct observations, participant observations, and physical artifacts. Yin (2009) noted that no single source has a complete advantage over all the others. “In fact, the various sources are highly complementary, and a good case study will therefore want to use as many sources as possible” (Yin, 2009, p.101). The use of multiple sources of data in case studies allows the investigator to address a broader range of historical and behavioural issues. It is also a type of triangulation (Fellows and Liu, 2008). Therefore, in this study, non-participant observations, questionnaire and interviews were used to collect the qualitative and quantitative data.

The data collection involved three stages. In the first stage, non-participant observations and informal interviews were conducted to identify a list of potential risk compensation scenarios. Fifteen potential risk compensation scenarios were identified through onsite observations of unsafe behaviours as well as informal interviews. In the second stage, a questionnaire was designed with the objective of testing whether the workers show risk compensation behaviours under these scenarios. The questionnaire is composed of two sections. Section A was designed to collection the background information of the participants, such as trade, age, experience, etc. Sample questions in this section are:

- *What is your position within your company?*
- *What trade do you work in? and*
- *Have you been injured in the past while working in your occupation*?

Section B lists fifteen potential risk compensation scenarios which were identified in the first stage. The respondents were requested to indicate their responses to the questions found in this section based on their experiences or perceptions on a 5-point Likert-type scale: 1=”Much less likely”; 2=”Somewhat less likely”; 3=”Neither more nor less”; 4=”Somewhat more likely”; and 5=”Much more likely”. Sample questions in this section are:

- *Are you more or less likely to over-extend your reach whilst working form a ladder and wearing proper PPE?*
- *Are you more or less likely to move up higher whilst walking along a steep pitched roof than what you normally would without a fall protection harness*?

The questionnaires were then distributed to all the construction workers who were working on Site A. A total of 95 questionnaires were distributed on site and 63 effective questionnaires were returned to the researcher, representing a response rate of 66%. The final stage of data collection involved three in-depth interviews. The open-ended interview questions aim to provide an insight into what makes a worker think, or act in a particular manner. Sample questions are:

- Do you feel that you make riskier actions in performing a work task from a height (whilst wearing PPE or with safety measures in place)? If so, in what way?
- What reason do you think is responsible for the increase in riskier actions or behaviour?

3. Result and discussion

Data were analysed using SPSS. *T*-test was performed to test whether or not there is risk compensation in construction workers' activities. The null hypothesis is that there is no risk compensation in construction workers' activities. The results of *t*-tests are presented in Table1. The test value was set as 3, which represent a neutral response. It shows that the mean values of all 15 scenarios are significantly higher than the test value "3". This indicates

Table 1. Result of t-test

	N	*Mean*	*Std. Deviation*	*Std. Error Mean*	*t*	*Sig.*
Scenario 1	63	3.87	.660	.083	10.504	.000
Scenario 2	63	3.75	.842	.106	7.034	.000
Scenario 3	63	3.67	.861	.109	6.143	.000
Scenario 4	63	3.75	.822	.104	7.200	.000
Scenario 5	63	3.71	.869	.110	6.522	.000
Scenario 6	63	3.83	.794	.100	8.252	.000
Scenario 7	63	3.79	.786	.099	8.013	.000
Scenario 8	63	3.76	.756	.095	8.000	.000
Scenario 9	63	3.60	1.056	.133	4.536	.000
Scenario 10	63	3.73	.865	.109	6.698	.000
Scenario 11	63	3.84	.766	.097	8.713	.000
Scenario 12	63	3.81	.820	.103	7.833	.000
Scenario 13	63	3.79	.826	.104	7.625	.000
Scenario 14	63	3.76	.797	.100	7.583	.000
Scenario 15	63	3.72	.791	.106	7.003	.000

Test value = 3

that workers tend to engage in risk compensation activities in construction environment. For example, workers are more likely to move up higher whilst walking along a steep pitched roof than what they normally would without a fall protection harness.

Having assessed the risk compensation behaviours among construction workers, we need to know what factors or conditions would contribute to such risk compensation behaviours. The sample was divided into subsamples by respondents' working experiences (e.g., experienced workers and less experienced workers) in the construction industry and whether they suffered from work injuries in the past. The independent t-test was used to assess whether there is a statistically significant difference between the means of the two conditions. Table 2 reports the result of independent t-test for equality of means for respondents in the less experienced (<10 years of experience) group and experienced (≥10 years of experience) group. It shows that the means of all scenarios for the more experienced respondents are significantly higher than those for the less experienced respondents. This result indicates that the participants with more experiences are more likely to show risk compensation in their activities than the participants with less experiences. Risk compensation theory (Peltzman, 1975) states that individuals tend to behave less cautiously when they perceive that the environment becomes safer. A possible reason for the greater tendency of more experienced workers to show risk compensation is that they tend to be more confident with their skills to perform the tasks and then more likely to speed up their operations or over-estimate their capacity to perform the operations safely. In comparison, the less experienced workers tend to be more cautious when performing a task.

Table 2. Independent t-test for equality of means for different experience conditions

Scenarios	*Experience*	*N*	*Mean*	*Std. Deviation*	*t*	*Sig.*
Scenario 1	≥ 10 years	26	4.23	.587	4.027	.000
	< 10 years	37	3.62	.594		
Scenario 2	≥ 10 years	26	4.04	.824	2.398	.020
	< 10 years	37	3.54	.803		
Scenario 3	≥ 10 years	26	3.96	.871	2.360	.021
	< 10 years	37	3.46	.803		
Scenario 4	≥ 10 years	26	4.04	.824	2.460	.017
	< 10 years	37	3.54	.767		
Scenario 5	≥ 10 years	26	4.00	.894	2.258	.028
	< 10 years	37	3.51	.804		
Scenario 6	≥ 10 years	26	4.15	.732	2.914	.005
	< 10 years	37	3.59	.762		
Scenario 7	≥ 10 years	26	4.15	.675	3.280	.002
	< 10 years	37	3.54	.767		
Scenario 8	≥ 10 years	26	4.19	.634	4.286	.000
	< 10 years	37	3.46	.691		
Scenario 9	≥ 10 years	26	4.12	.711	3.784	.000
	< 10 years	37	3.24	1.116		
Scenario 10	≥ 10 years	26	4.04	.824	2.466	.016
	< 10 years	37	3.51	.837		
Scenario 11	≥ 10 years	26	4.12	.766	2.476	.016
	< 10 years	37	3.65	.716		
Scenario 12	≥ 10 years	26	4.12	.864	2.593	.012
	< 10 years	37	3.59	.725		
Scenario 13	≥ 10 years	26	4.15	.784	3.095	.003
	< 10 years	37	3.54	.767		
Scenario 14	≥ 10 years	26	4.12	.711	3.155	.002
	< 10 years	37	3.51	.768		
Scenario 15	≥ 10 years	26	4.15	.732	3.566	.001
	< 10 years	37	3.49	.731		

Table 3 reports the result of independent t-test for equality of means for respondents who were injured in the past and those who have never been injured in the past. It shows that the means of all scenarios for the respondents who have suffered from work injuries in the past are significantly lower than the means for those who have never suffered from work injuries in the past. This result implies that the participants who have never been injured before are more likely to engage in risk compensation activities. It is possibly because the workers who have been injured before fear to be injured again, so they tend to behave in a more cautious way than those who have never been injured.

Table 3. Independent t-test for equality of means for different injury conditions

Scenarios	Injured in the past	N	Mean	Std. Deviation	t	Sig.
Scenario 1	Yes	31	3.55	.624	-4.358	.000
	No	32	4.19	.535		
Scenario 2	Yes	31	3.32	.748	-4.498	.000
	No	32	4.16	.723		
Scenario 3	Yes	31	3.26	.815	-4.166	.000
	No	32	4.06	.716		
Scenario 4	Yes	31	3.35	.798	-4.181	.000
	No	32	4.13	.660		
Scenario 5	Yes	31	3.26	.815	-4.763	.000
	No	32	4.16	.677		
Scenario 6	Yes	31	3.45	.768	-4.115	.000
	No	32	4.19	.644		
Scenario 7	Yes	31	3.42	.720	-4.186	.000
	No	32	4.16	.677		
Scenario 8	Yes	31	3.45	.723	-3.483	.001
	No	32	4.06	.669		
Scenario 9	Yes	31	3.19	1.078	-3.258	.002
	No	32	4.00	.880		
Scenario 10	Yes	31	3.32	.832	-4.129	.000
	No	32	4.13	.707		
Scenario 11	Yes	31	3.45	.723	-4.563	.000
	No	32	4.22	.608		
Scenario 12	Yes	31	3.45	.810	-3.751	.000
	No	32	4.16	.677		
Scenario 13	Yes	31	3.42	.807	-3.930	.000
	No	32	4.16	.677		
Scenario 14	Yes	31	3.39	.803	-4.099	.000
	No	32	4.13	.609		
Scenario 15	Yes	31	3.42	.848	-3.659	.001
	No	32	4.09	.588		

The subsequent interviews investigated the reasons for workers' risk compensation behaviours. The interviewees proposed a number of reasons that described why a worker engages in a risky action, or an action that they know breaks a standard of safe work. These reasons include:

- Rushing a task to avoid an extra activity, e.g., trying to finish painting works from a scaffold so that it can be packed up at the end of the day without having to be set up the next day to finish the painting works.
- Financial reasons, e.g., completing a job with a minimum financial expense.
- Time reasons, e.g., completing a job so the workers can move on elsewhere.
- General pressure from a manager, e.g., maintaining or speeding up programmed works.

All of the interviewees acknowledged that PPE measures increase the confidence of construction workers. This increased level of confidence is often responsible for a worker making an action that they usually would not make. Stromme (2004) found that improper use of PPE or using the PPE in any way that it is not designed for, is worse than using no protection. A worker without protection knows that he or she is vulnerable and exposed to risks, whereas with the PPE, the worker may rashly blunder into sever difficulty, thinking that they are safe when they are still exposed to danger (Stromme, 2004). The interviewees in this research also confirmed that the improper use of PPE is a risk to construction workers performing dangerous tasks. The interviewees raised a number of reasons for what they thought was responsible for their risk compensation behaviours. The main issues that were raised include: workers forgetting about risks, lazy workers, uncomfortable PPE, lack of experience, and worker complacency. Andrews and Kirby (2012) conducted a study which looks into why workers risk not wearing PPE in a dangerous environment. They found that comfort is a major factor when an employee completes a task with PPE in place. Their finding is further confirmed by the interviews in this study, where the interviewees stated that a number of workers constantly make complains about PPE such as; 'they are too tight', they run my head', and 'they fall off'.

4. Conclusion

This study examined the risk compensation activities on construction sites through a case study. The findings confirm that workers show risk compensation behaviours in the construction environment. The effect of protective measures may be counteracted by the workers' riskier behaviours when they perceive that they are more protected. It was also found that the risk compensation behaviours of workers varied with the level of experience and whether they have suffered from a past workplace injury. The more experienced workers and the workers who have never been involved in a past work injury are more likely to behave in a less cautious way when they perceive that the environment becomes safer. Several reasons may explain why individuals tend to show risk compensation in construction activities. They include: financial reasons; time reasons; pressure from management; improper use of PPE; workers' complacency; etc.

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