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Industrial safety perception among post-graduate engineering students

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ABSTRACT

This paper describes industrial safe perception among University of Aberdeen post-graduate engineering student. The immediate objective of this research is to identify safety perceptions of different high risk occupational industries. Results obtained were analyzed and compared with Health and Safety Executives (HSE) reports as well as the Oil and Gas Producer Safety Performance Report. The result showed that the participants perceive the Oil and Gas Industry is safe, second only to the Aviation Industry and that the Oil and Gas Industry is safest in the European Region. The research also concluded that participants' perceptions were more influenced towards the concept of accident severity/dread rather than the concept of accident probability.

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1. Introduction

The general definition of risk is the possibility of suffering harm or loss. The definition of risk used by many researchers is the probability of loss, given the amount of exposure to risk situations or hazards [1,2]. Two main components of risk are the probability and the severity of a consequence. It is important to understand the differences of the two elements. Individuals usually only consider the severity aspect in risk, thus ignoring the likelihood of event occurring, as individuals tend to not understand probability [3]. For example, more individuals are afraid of flying on an airplane rather than driving a car, even though statistics suggest that car drivers are more likely to be involved in a fatal accident as compared to airline passengers. People are more focused on severity of airline accident, ignoring the higher rate of car accident probability [4].

A high risk industry can be interpreted as a working environment that may contain a high probability or severity of an accident occurrence or both. Referring to the Health and Safety Executives (HSE) statistical report, the Construction Industry as well as the Oil and Gas Industry are considered high risk [5]. This is because of the number of fatal and non-fatal accidents associated with these industries are high. The mining industry, the aviation, the space industry, the chemical industry as well as the military industry are example of high risk industry due to statistically high accident probability and severity [6].

Occupational risk and safety are terms that are correlated. It is important to manage occupational risk as this reflects the safety levels for employers and employees. In a survey conducted by the National Council of Examiners in Engineering and Surveying (formerly known as National Council of Engineering Examiners), it was concluded that nearly all disciplines of engineering as well as all kinds of engineering job industry had significant amount of health and safety responsibilities [7]. Therefore, it is in the engineer's responsibility to protect both the occupational and the public health and safety. Engineers must bear the important role of managing risk ensuring risks are kept to a minimum or acceptable level [8].

Engineers must also recognize other professions role in managing risk, and work with them on safety issues. Identifying hazards and managing risk often requires inter-disciplinary efforts to develop effective solutions to safety problems. No one person can be an expert in every aspect of managing risk. To be an expert in 'every' aspect of managing risk, one would require to be an expert in engineering, law, psychology, management, industrial process and many more. Thus, it is impossible for one person or one profession to be an expert in managing risk on its own [9,10].

There is a support for a stronger community participation in dealing with health and safety issue. Such support must come from participations of students and professional in health and safety research areas. It is important to understand the perceptions that are associated with industries. Understanding safety perceptions of various industries could pave for better ways to manage the exploitation of industrial perceptions, such as the Nuclear Industry and the Oil and Gas Industry, in a community. Managing industrial

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perceptions in a community could be beneficial in creating future occupational opportunities. This research approaches such issue by gathering safety perceptions among engineering students, through the use of questionnaire.

2. Methodology

A questionnaire was developed in reference to HSE reports and international safety performance report. The questionnaire was adapted from various sources, and was designed to accommodate assessment on safety perception with respect to elements such as geographical regions, types and probability of accidents [11,12]. The aim of the questionnaire was to analyze safety perceptions of industries among post-graduate engineering students.

The questionnaire was subjected to formal testing in validity as well as limited piloting. Ten research pilot tests were conducted on the questionnaire. The validity of the questionnaire was deemed appropriate on the grounds of adaptation of previous recognized researches and reports, formal testing and piloting.

A multiple choice (closed ended) format was used. The focus of this section was general safety perception of industries, geographical region and probability of accidents in the Construction and the Oil and Gas Industry. Each question has five choices of answers and students were required to mark the answer that best fit their views.

Two taught post-graduate groups were asked to voluntarily participate in this research. They were from the MSc in Safety, Reliability and Risk Management, academic year 2008/09. There were 73 post-graduate students participated in the research. The questionnaires were distributed at the beginning and the end of the academic year 2008/09. Comparisons of the data were made and recorded in this paper. A consensus method was used to resolve any disagreements on the conclusions made. A one sample *t*-test was used for all the analysis of the questionnaire data [13,14].

3. Results

A total of 73 students participated in this research, with average age of 28.6 years old. Over 88% of the participants were male. The overall response rate was 89.7%. A one sample *t*-test was used to analyze the data gathered. At 95% confidence interval, the participants rated the Aviation Industry ($m = 1.00$, SD = 2.78, $p < 0.01$) and the Oil and Gas Industry ($m = 1.31$, SD = 2.43, $p < 0.01$) as safe industries to work while the Mining Industry ($m = 0.85$, SD = 2.24, $p < 0.01$) and the Nuclear Industry ($m = 1.00$, SD = 1.79, $p < 0.01$) were rated as unsafe industries.

Participants conclusively rated the European region as the safest place for Oil and Gas Industry ($m = 0.87$, SD = 2.51, $p < 0.01$), followed by North America ($m = 0.65$, SD = 2.61, $p < 0.05$) and the Middle East region ($m = 0.97$, SD = 2.43, $p < 0.01$). More than 70% of the participants rated European region as safe, while America and Middle East region were rated by more than 65% and 45% of participants, respectively at 95% confidence interval as shown in Fig. 2.

The participants were also required to give their perceptions on probability of accident occurrence. The results indicate that participants perceive Explosions ($m = 0.89$, SD = 2.27, $p < 0.01$), Toxic Gas Leak ($m = 1.07$, SD = 2.08, $p < 0.01$) and Fall from Height ($m = 0.73$, SD = 1.99, $p < 0.01$) as highly probable accidents in the Oil and Gas Industry. 46.6% of the participants rated Falling Object accident as highly probable, while 42.1% rated it as low probability ($m = 0.84$, SD = 2.20, $p < 0.01$). The rest were rated either not applicable or were not answered.

The Cronbach's Alpha reliability test was conducted on the questionnaire. The results in Table 1 showed the reliability tests having values of above 0.7 which is a benchmark for validating a research tool.

Table 1
Cronbach's alpha test.

	Begin	End
General safety perception of industries	0.799	0.913
Safety of oil and gas industry in geographical regions	0.885	0.948
Probability of an accident in the oil and gas industry	0.956	0.980
Probability of an accident in the construction industry	0.934	0.982

In addition, the total-item correlation were determined to be above the 0.19 value. This suggest the items in the questionnaire were finely tuned.

4. Discussion

The objective of this research is to identify safety perception of various industries. The significance of this research was the participant's perception towards the Oil and Gas Industry. It was rated highly safe, second only to the Aviation Industry.

The participant's perceptions about unsafe industries must also be highlighted. The Nuclear Industry and the Mining Industry were rated as having one of the worst safety perceptions. This research postulates a theory that participants relate severity of nuclear incidence to safety perceptions rather than probability. In addition, there is an increase of 'unsafe' mean response (Fig. 1 – Nuclear Industry) which may suggest that more educational efforts are needed to manage such perceptions.

Fig. 2 showed that participants perceived the European region are safest for the Oil and Gas. The questionnaire was administered in the University of Aberdeen, United Kingdom. Although doubts of serious biasness may follow on the issue of safety regions, it must be noted that the population sample in this research was random. The 73 students that participated in this research were from various countries, thus elements of biasness to the European region are considered unwarranted.

Analysis on probability of various accidents in the Oil and Gas Industry reveals important information. While the Health and Safety Executive (HSE) reports accident type Falling from Height and Fallen Object as one of a high portion factor in reported injuries, the data gathered from this research suggest differently in participants' perceptions. The participants perceive the Oil and Gas Industry is likely to experience explosions and fire accidents

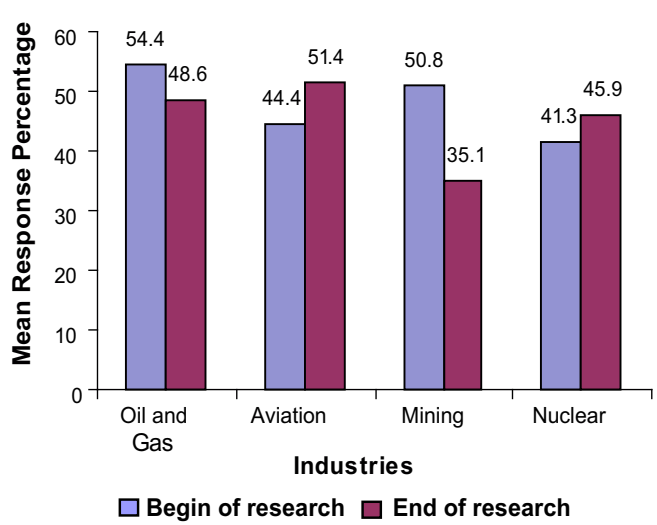

Fig. 1. Comparison of mean percentage by industries.

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