SAFETY BEHAVIOR IN THE MALAYSIAN PETROCHEMICAL INDUSTRY

By

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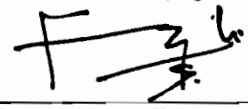

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ABSTRAK

Keselamatan pekerjaan mempunyai hubungan yang positif dengan produktiviti, reputasi organisasi dan keuntungan dalam perniagaan. Terdapat banyak faktor penyumbang yang menyebabkan kemalangan, namun tingkahlaku keselamatan pekerjaan kurang mendapat perhatian biarpun faktor ini merupakan penyumbang utama kepada kemalangan di tempat kerja. Berkemungkinan, ini adalah disebabkan oleh tingkahlaku manusia yang sukar difahami dan ditafsirkan, lebih-lebih lagi mengenalpasti sifat-sifat peribadi manusia yang memberi kesan kepada tingkahlaku keselamatan pekerjaan merupakan suatu cabaran yang getir. Pada masa yang sama, mendidik pekerja-pekerja untuk mengamalkan budaya kerja selamat merupakan suatu cabaran yang amat besar kepada industri. Oleh hal yang demikian, suatu rangka-kerja *(framework)* telah dicadangkan untuk kajian ini berdasarkan rujukan-rujukan daripada kajian-kajian yang telah lalu dan konsep bahawa niat mempengaruhi tindakan seseorang (Theory of Planned Behavior). Setiap pembolehubah telah diukur mengunakan kaedah yang telah digunapakai oleh penyelidik-penyelidik sebelum ini. Walaubagaimanapun, kaedah untuk mengukur komitmen pada keselamatan di tempat kerja telah digunakan untuk kali pertama dalam kajian ini selepas ianya diperkenalkan pada tahun 2008. Untuk tujuan mengumpul maklumat, sampel telah diperolehi daripada kakitangan-kakitangan yang bekerja dalam industri petrokimia di Malaysia termasuklah kontraktor-kontraktor dengan mengagihkan kajian soalselidik kepada mereka yang bersetuju untuk menyertai kajiselidik ini. Maklumat yang diperolehi telah dianalisa menggunakan *Statistical Package for Social Science* (SPSS) versi 11.0.1 untuk mengenal pasti taburan latarbelakang responden dan seterusnya untuk membantu kepada rumusan hasil kajian. Keputusan daripada analisa faktor *(factor analysis)* menunjukkan jumlah faktor yang diperolehi dalam kajian ini adalah sama dengan jumlah faktor yang diperolehi daripada kajian-kajian yang telah lalu, namun tidak semua faktor yang diperolehi dalam kajian ini terdiri dari pernyataan-pernyataan yang serupa sepertimana yang diperolehi dalam kajian-kajian yang telah lalu. Kajian ini mendapati motivasi keselamatan, kepekaan pekerja-pekerja, komitmen pada keselamatan dan kecekapan pekerja mempunyai kesan yang positif pada tingkahlaku keselamatan pekerjaan. Kajian ini juga mendapati komitmen pada keselamatan menjadi perantara dalam hubungan di antara motivasi keselamatan, kepekaan pekerja-pekerja dan kecekapan pekerja dengan tingkahlaku keselamatan pekerjaan. Selanjutnya, rumusan dari kajian ini menunjukkan niat dalam bentuk komitmen pada keselamatan daripada kakitangan-kakitangan dan juga sokongan dari majikan di tempat kerja mempunyai kesan yang mendalam dalam mempengaruhi tingkahlaku keselamatan pekerjaan. Perlu dinyatakan, sokongan dari majikan memainkan peranan penting untuk menambah keyakinan diri, motivasi dan kecekapan kepada setiap pekerja dalam membaiki tingkahlaku mereka untuk bekerja dengan selamatnya. Justeru itu, kajian ini mencadangkan bahawa perhatian yang serius dalam usaha untuk menambahbaik tingkahlaku keselamatan pekerjaan perlu difokuskan kepada pembangunan sumber manusia dalam bentuk pembangunan kecekapan, keyakinan diri, dan komitmen pada keselamatan di tempat kerja kerana semua ini mempengaruhi niat serta komitmen mereka terhadap budaya kerja selamat di tempat kerja masing-masing.

ABSTRACT

Occupational safety at the workplace has a positive relationship with productivity, reputation and profit. While many factors contributed to workplace accidents, safety behaviors have received little attention in occupational safety studies even though unsafe behaviors were blamed for almost all reported accident cases in the industries. This is probably because of the complexity to understand the variability and the dynamic nature of human behavior and with different personality characteristics, identifying which personality characteristic influencing safety behavior has been a challenging task. Similarly, guiding employees to work safely is a major challenge for the industries. Through literature reviews, the behavior safety conceptual framework, supported by the Theory of Planned Behavior, was developed. The measurement tools were adopted from the published work of previous researchers except for safety commitment measurement tool which was tested for the first time in this study after it was developed in 2008. The target respondents were the employees working in Malaysian petrochemical industry and quantitative method using availability sampling method was applied. The data gathered from the survey were analyzed using Statistical Package for Social Science (SPSS) version 11.0.1 for descriptive and inferential statistics analysis. The responses to the survey were rated according to the Likert scale type with "1" indicated strongly disagree and "5" indicated strongly agree. The factor analysis indicated the number of factors extracted from this study was the same as extracted from previous studies, however not all factors have the same statements as previously found. This study showed safety motivation, employees' conscientiousness, and employees' competency were positively and significantly related to safety behavior. In addition, safety commitment was partially mediated the relationship between safety motivation, employees' conscientiousness and employees' competency with safety behavior in petrochemical industry in Malaysia. Therefore, it requires a strong commitment from the employees as well as a strong support from the employers to help employees gain their confidence, motivation and at the same time to be competent in their jobs in order to improve safety behavior at the workplace. With this finding, it was recommended that the focus of safety improvement programs in this industry should be on developing human capabilities, enhancing their personality characteristics, motivating employees on the importance of safety and enhancing their commitment to safety at the workplace.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

1.1.1 Trends in Occupational Safety

The issue related to occupational safety had gained increase attention from the public, academicians and practitioners (Adams-Roy, Knap, & Barling, 1995; Zacharatos, 2001). This is most likely due to the aftermath of several major industrial accidents such as the nuclear disaster in Chernobyl (1986), the Three Mile Island (2009), and the release of Methyl Isocyanate in Bhopal (1984). These highly publicized events have increased the public's awareness of the potential threat of industrial accidents to the public and employees' safety. However, it was argued that the industrial main focus had been on the threat to the public rather than focusing on its own employees (Adams-Roy, Knap, & Barling, 1995). This may in part explain why, despite the alarming number of injuries which continue to occur in the workplace and increasing interest in the issue, occupational safety remains an underdeveloped area of research in the management science (McLain, 1995; Zacharatos, 2001; Cai, 2005).

Major industrial accident is catastrophic. It has a significant emotional and economic impact on businesses, families and society. The history has recorded some of the worst major industrial accidents in the world since the last 100 years. As shown in Table 1.1,

major accidents due to the explosion or the release of toxic gases resulted in the lost of hundred of lives. Many of these catastrophic accidents occurred in the chemical industries and among the first who experienced these tragedies were those nations who entered the industrialization during the beginning of its age. In the first quarter of the century, the Germans mourned the death of 561 people due to the explosion of Ammonium Nitrate in Oppau, Germany (Kliesh, 1987). About 25 years later, other catastrophic accidents occurred in America and Germany claiming the life of 576 and 245 people, respectively. The worst accident in the chemical industry was the accidental release of Methyl Isocyanate (MIC) from Bhopal manufacturing facility in 1984 killing 2000 people and injuring 200,000 more. Although all of these were the process safety related accidents, it could be implied that the occupational safety accidents would have resulted in similar losses only in the smaller scale.

As shown in Table 1.2, the number of reported industrial accident cases in Malaysia increased from 2,578 cases in 1999 to 4,731 cases in 2006, a dramatic increase by 54 percent in 10 years (Department of Safety and Health, 2007). By the same token, the reported industrial accidents cases with fatality also increased from 133 in 1999 to 209 in 2006 (Department of Safety and Health, 2007). This upward trend, as shown in Table 1.2, indicates that the industrial accidents in Malaysia might be worsening as the industries expand, especially in the manufacturing sector which reported the highest number of accidents with 21,609 cases (Table 1.3) in 2006 (Social Security Organization, 2006). In 2006, the reported industrial accidents involving manufacturing of chemicals were 440 cases with 4 deaths and 79 victims were permanently disabled.

Table 1.3 shows the number of reported accident by industry in 2006 (Social Security Organization, 2006). Falling from heights was stated as the main cause of fatality for occupational accidents with 16,974 reported cases involving 209 deaths and 2,838 permanently disabled. This was followed by 181 deaths caused by stepping on and striking against objects, 49 due to being caught in between objects, 25 caused by being stroked by falling objects, 9 because of contact with extremely high temperature, 6 due to either over exertion or exposure to harmful substance and 5 deaths because of contact with electric current (Social Security Organization, 2006). Head injuries were the main caused of fatalities (179) followed by injuries at the limb (147), trunks (108), multiple-locations (5) and neck (4). A total of 268,900 recipients received the benefits from Social Security Organization in 2006 due to these occupational accidents.

In comparison with this statistics, the United States recorded 5,804 work-related fatalities and 4.1 million nonfatal occupational injuries and illnesses in 2006 (Bureau of Labor Statistics, U.S. Department of Labor, 2007). In addition, the BLS also reported 41 cases of fatal injuries in manufacturing sector in 2005, an increase by 37 percent compared to previous year. These data illustrate the enormous cost of industrial accidents for organizations, not only in terms of production lost, but more importantly, in terms of lives altered and lost by these work-related events. There have been major advancements in technology, engineering solutions, processes and legislation, and there are safety and occupational health programs and accident prevention that focused primarily on identifying and eliminating workplace hazards; however, there have not been significant reductions in occupational accidents and costs. Thus, it has become apparent that efforts

taken to improve safety at the workplace have been unable to fully address the safety issue and positively affect the situations which can lead to reduction in accidents and injuries (Baas, 2002).

Table 1.1
Major industrial accident hazards in the world

Year	Description	Location	Injuries	Fatalities
1921	Explosion of Ammonium Nitrate storage	Oppau, Germany	1900	561
1947	Explosion of Ammonium Nitrate storage	Texas City, USA	> 3000	576
1948	Explosion of Di-Methyl Ether	Ludwigshafen, Germany	> 3800	245
1972	Release of toxic gases	Yokhaidi, Japan	978	76
1974	Explosion of Cyclo-Hexane	Flixborough, UK	78	28
1980	Explosion of propane gas	Ortuella, Spain	Not recorded	51
1984	Release of MIC	Bhopal, India	200,000	2000

Source: Kliesh, 1987

Table 1.2
Reported industrial accidents in Malaysia

Year	Number of accidents	Number of fatality cases
1999	2,578	133
2000	2,292	90
2001	3,172	146
2002	3,032	137
2003	3,304	190
2004	3,550	174
2005	3,837	196
2006	4,731	209

Source: DOSH, 2007

Table 1.3
The number of reported accidents by industry in Malaysia

Industry	Number of accidents
Agriculture, forestry and fishing	3,567
Mining and quarry	394
Manufacturing	21,609
Electricity, gas, waste and sanitary services	509
Construction	3,686
Trading	11,430
Transportation	3,610
Financial institution and insurance	5,370
Public service	8,146

Source: SOCSO, 2006

The occupational safety in high risk industry (e.g., petrochemical) is a major concern because of the high number of inherent hazards in its operation and the hazardous substances involved. Because of these risks, Malaysian government established regulation 15 under OSH Act 1994 which specify the rules that employers must abide to. The government expects better safety management from the industry focusing on identifying hazards, conducting risk analysis and controlling those risks. According to definition stated in the Control of Industrial Major Accident Hazards, petrochemical industry is high risk and therefore it must comply with this regulatory requirement.

In Malaysia, occupational safety in petrochemical industry is one of the most concerns due to the presence of hazardous chemicals which may cause adverse effect to human. Therefore, there is a strong need to examine the occupational safety closely as this leading industry employs thousands of workers who are at risks (MIDA report, 2004). This industry covers a wide range of products such as liquefied natural gas, monomers and alcohols which are all hazardous. Whilst striving to maintain its position, the petrochemical industry needs to pay particular attention to safety of its workforce because

of public perception that associates petrochemicals with horrifying accidents and devastating mishaps. In addition, this industry has had more than its fair share of bad press. The then Deputy Prime Minister, in his keynote address during chemical industry dinner in 2006 said "Whilst it can be said that so far the damage caused by this negative image has been manageable, it must be noted that in order for the industry to attract more investment and have wider public appeal, efforts must be taken to correct this image problem" (Chemical Industrial Dinner, 2006).

Many companies implemented comprehensive safety programs in view of significant social and economic impact associated with occupational accidents. Education and training were aggressively pursued to ensure employees are competent and capable to work safely. Standard operating procedure (SOP), job safety analysis (JSA), safety audit, plant general inspection (PGI), emergency response planning, and so on are properly documented and implemented to achieve superior performance in occupational safety. The government introduces several measures through Occupation Safety and Health Act 1994 to guide companies and to ensure there would be no compromise on safety. Section 15 of the Act, for example, clearly states that one of the general duties of employers is to ensure the safety, health, and welfare of their employees at work are well taken care of (Occupational Safety and Health Act 1994 and Regulations, 2007)

Not only employees and the public in Malaysia are concerned about workplace safety but the rest of the people working in industries across the globe share the same concern. This led to the establishment of Responsible Care which was initiated by the global chemical

industry to foster working relationship among companies to improve workplace safety. Responsible Care demands that companies, through their national chemical associations, work together to continuously improve the health, safety and environmental performance of their products and processes. In Malaysia, Chemical Industries Council of Malaysia (CICM) had been in the forefront linking local chemical companies to work together on improving safety, health and environmental performance of the chemical industry. The Council officially launched Responsible Care in Malaysia on April 24, 1994. In 2008, 118 chemical companies in Malaysia have signed up as Responsible Care signatories (Chemical Industries Council of Malaysia, 2008)

The above information signifies that understanding and improvement of occupational safety in petrochemical industry demands for immediate attention. The increasing trend of occupational accidents, the ineffective safety measures, and the concern of the employees suggest that workplace safety in this area remains an undeveloped area of research in management science (Zacharatos, 2005). In addition, the economic impact due to accidents and injuries is costly and no companies like to invest in the healing process.

1.1.2 The Legal Development of the Occupational Safety and Health in Malaysia

The Occupational Safety and Health (OSH) development in Malaysia took off during the early state of the country development when the economic structure during that time depended heavily on agricultural and mining (Malaysia Trade Union Congress, 2008).

The growth of these sectors produced various safety hazards to workers. In addressing these issues, several legislations were introduced. The Selangor Boiler Enactment was the first legislation introduced in 1892 to address industrial safety issues. In 1913, the Machinery Ordinance was enacted to ensure safety of machinery used in the boilers and internal combustion engines. In 1932, this Ordinance was updated to include additional provisions on registration and inspection of machinery installations. In 1953, the Machinery Ordinance was enforced in all 11 states of Malaya under the jurisdiction of Machinery Department, Ministry of Labor. This early OSH legislation addressed the potential impact of hazards from the machineries and its installations to workers. The conduct of safety behavior among workers at the workplace during that time was not given a priority. However, the legislation included the public health provisions which covered the provision of accommodation, sanitation, medical care services, decent working conditions and livable wages for mining and estate workers.

In 1967, as the country moved towards industrialization, the government of Malaysia enacted the Factory and Machinery Act (FMA) to address industrial safety and health issues in manufacturing sector. This Act and the regulations made under was the cornerstone for OSH improvement in manufacturing sector for the next 30 years since its inception in 1967. Table 1.4 shows the summary of regulations made under the FMA 1967. Altogether, 15 regulations were made under this Act covering the safety of the machineries and the competency of the person in charge of operating the machines. Additionally, the provisions targeted to address the occupational health hazards in the workplace were also included. However, a number of deficiencies were identified in this

Act. First, the Act encompassed only the factories and covered only 23 percent of the country workforce (Malaysia Trade Union Congress, 1988). Second, the Act was prescriptive in nature which based on a checklist where hazards were identified and corrective measures were identified. Third, it depended heavily on command and control approaches and improvement depended on the effectiveness of enforcement agencies. Compare to Machinery Ordinance 1953, there was some improvement made to these regulations. However, the conduct of safety behavior of the workers was not addressed in the regulations.

Table 1.4
List of Regulations made under the FMA, 1967

Regulations	**Year**
Certificate of Competency-Examination	1970
Electric Passenger and Good Lift	1970
Fencing of Machinery and Safety	1970
Notification of Fitness and Inspections	1970
Person-In-Charge	1970
Safety, Health & Welfare	1970
Steam Boiler & Unfired Pressure Vessel	1970
Administration	1970
Compounding of Offences	1978
Compoundable Offences	1978
Lead	1984
Asbestos Process	1986
Building Operations and Works of Engineering Construction (Safety)	1986
Noise Exposure	1989
Mineral Dust	1989

Source: Factory and Machinery Act 1967

In 1994, the government moved another step in addressing industrial safety issues when they introduced Occupational Safety and Health Act 1994 (OSHA). The OSHA 1994 covered a wider employee base except the armed forces and the workers aboard the ship,

as well as newer hazards found in the workplace. In contrary to command and control system of FMA 1967, this Act emphasized on self-regulation and the duties of the employers, employees and the manufacturers. The employers' duties include the provision of a safe system of work, training, maintenance of work environment and arrangement for minimizing risks as low as reasonably practicable (ALARP). The responsibility on OSH is made to rest on those who create the risks (employers) and those who work with the risks (employees). Table 1.5 and Table 1.6 show the summary of the regulations, guidelines and Code of Practices (CoP) made under this Act from 1994 until 2007.

The duties of the employees at the workplace are detailed out in Section 24 of Occupational Safety and Health Act and Regulations. Contravening the provision of this section is an offense and upon conviction an employee is liable to a fine not exceeding one thousand Ringgit or imprisonment not exceeding three months or both. The full explanation is described below:

> *Section 24 (1): It shall be the duty of every employee while at work –*
>
> *(a) to take reasonable care for the safety and health of himself and of other persons who may be affected by his acts or omissions at work;*
>
> *(b) to co-operate with his employer or any other person in the discharge of any duty or requirement imposed on the employer or that other person by this Act or any regulation made thereunder;*
>
> *(c) to wear or use at all times any protective equipment or clothing provided by the employer for the purpose of preventing risks to his safety and health; and*

(d) to comply with any instruction or measure on occupational safety and health instituted by his employer or any other person by or under this Act or any regulation made thereunder.

The provision in Section 24 mandated employees to comply or otherwise face the penalty. While it can be said that the effort by the government to enforce self-regulation was an excellent step to improve safety at work, more effort is needed to influence employees to comply and voluntarily participate in all safety programs established by the employers (Malaysia Trade Union Congress, 2008). Resting on the regulation alone and hoping for the employees to comply might not be the best options to influence safety behavior. The mechanism to influence the employees to appreciate safety at workplace has to be in place before they can comply and participate in safety programs. Unfortunately, the underlying process and mechanism to change the behavior were not stated in the Act and the regulations. This study was a complementary to OSH legislation by going deeper to understand and determine the influencing factors affecting the safety behavior at the workplace.

Table 1.5
The Regulations made under OSHA, 1994

Regulation	Year
Employer's Safety and Health General Policy Statement (Exception)	1995
Control of Industrial Major Accident Hazards	1996
Safety and Health Committee	1996
Classification, Packaging, and Labeling of Hazardous Chemicals	1997
Safety and Health Officer	1997
Safety and Health Officer Order	1997
Prohibition of Use of Substance	1999
Use and Standards of Exposure of Chemicals Hazardous to Health	2000

Source: OSHA, 1994

Table 1.6
Guidelines and Code of Practices made under OSHA, 1994

Guidelines and Code of Practice	Year
Guidelines for Public Safety and Health at Construction Site	1994
Guidelines on First Aid Facilities in the Workplace	1996
Guidelines on Occupational Safety and Health in the Office	1996
Guidelines for the Classification of Hazardous Chemicals	1997
Guidelines for labeling of Hazardous Chemicals	1997
Guidelines for the Formulation of a Chemical Safety Data Sheet	1997
Guidelines on Control of Exposure to Dust in the Wood Processing Industry	1998
Guidelines on Safety and Health in the Wood Processing Industry	1998
Guidelines on Reduction of Exposure to Noise in the Wood Processing Industry	1998
Guidelines on Occupational Safety and Health in Tunnel Construction	1998
Guidelines for the Preparation of Demonstration of Safe Operation Document (Storage of Liquefied Petroleum Gas in Cylinder)	2001
Guidelines on Medical Surveillance	2001
Approved Code of Practice for Safe Working in a Confined Space	2001
Approved Code of Practice on HIV / AIDS in Workplace	2001
Guidance for the Prevention of Stress and Violence at the Workplace	2001
Code of Practice on Prevention and Management of HIV / AIDS at the Workplace	2001
Guidelines on Occupational Safety and Health for Standing at Work	2002
Guidelines on Occupational Safety and Health in Agriculture	2002

Source: OSHA, 1994

1.2 PROBLEM STATEMENT

The existing bodies of literature in occupational safety found unsafe behavior and human error were the two major contributors for workplace accidents (Geller, 2001; Dekker, 2002; Cooper, 2009). However, despite serious implication of this finding to the occupational safety practitioners, safety behavior studies have received little attention from the scholars particularly the studies involving high risk and hazardous working

environment (Reason et al, 1998). Therefore, this study filled up this gap by focusing on safety behavior of the employees and contractors working in the Malaysian Petrochemical Industry.

Human errors and unsafe behavior are both the cause of failures which led to accidents. Reason, Parker and Lawton (1998) defined human error as "the failure of planned actions to achieve their desired ends". They argued that although human error was a major cause of unsafe behaviors and accidents, previous studies had not provide much insight into the behavioral mechanisms that leads to unsafe behaviors. Reason (1997) further claimed that effective safety measures should focus on much more than just the individual's behavior, which was typically at the receiving end of much of the trouble. Accordingly, Reason (1997) suggested that the mechanism influencing the intention to perform a behavior is to be well understood so that early assessment can be conducted and preventive actions can be planned to rectify unsafe behavior at the workplace. This understanding of the intention addressed in this study in influencing safety behavior would be a new contribution to the safety behavior studies.

The discussion on safety behavior issues is nothing new and had been around for almost 80 years. However, the solutions remain scattered and scarce. In analyzing the cause of industrial accidents reports in early 1930s, Heinrich discovered that 88 percent of workplace accidents were caused by unsafe behavior (Goetsch, 2008). Since then organizations established various measures to reduce injuries and to prevent accidents at the workplace. However, due to variability nature of human behavior, these goals had

been very challenging (Reason, Parker, & Lawton, 1998; Zohar, 2002). It is not abnormal to find employees take shortcuts and violate safety rules and procedures during routine activities. The promise to resolve safety behavioral issue in hazardous working environment is even more challenging than any other industries due to the nature of the industry which involves hazardous substances (e.g., flammable liquid). Any mishaps such as unintended exposure to chemicals without proper personal protective equipment may result in severe negative consequences. Dekker (2002) sees human error and unsafe behaviors as symptoms to accidents and not direct causes. He viewed human error as a symptom of something deeper involving individual's personality and safety system practiced in the organizations. He believes that employees have to create safety because work systems are not always in concert with the multiple goals they pursue simultaneously. Dekker (2002) also thinks that human error can be systematically connected to features of people, tools, tasks, and operating environment. Therefore, there is a need to understand more of this notion and its effect on the safety behavior.

Studies have also found that individual traits or characteristics help to promote compliance behavior and it is importance to measure employees' safety behavior in an attempt to improve the company's safety record (Reason et al, 1998). Positive and negative attitudes were believed to be relevant to safety. Negative attitudes were found to harm safety efforts, while positive attitudes played more of a facilitatory role. In addition, Geller (2001) stated that workplace safety behavior is the most crucial and effective measures to reduce occupational injuries and prevent accidents. Meanwhile, the personality trait which received more attention is employees' conscientiousness and had

been cited by several studies to have positive relationship with performance (Barrick & Mount, 1991; Schmidt & Hunter, 1992; Salgado, 1997; Stewart, 1999; Hurtz & Donovan, 2000; Moon, 2001), and with safety behavior (Wallace & Vodanovich, 2003). However, contradicting findings were also discovered partly because of different in sampling population. A study by Fallon et al. (2000) did not find a significant relationship between conscientiousness and occupational safety. On the other hand, Arthur and Graziano (1996) and Arthur and Doverspike (2001) found negative relationship between conscientiousness and driving accidents. Wallace and Vodanovich (2003) conducted two separate studies to examine more closely the relationship between conscientiousness and occupational safety and discovered that conscientiousness significantly and negatively related to unsafe work behaviors and workplace accidents. They argue that even though there has been an overwhelming support for the relationship between conscientiousness and performance, limited research has been conducted examining the relationship between conscientiousness and occupational safety. Therefore, there is a need to investigate this relationship further incorporating both safety motivation and employees' conscientiousness with safety behavior using new sample population of employees working in high risk industry (e.g., petrochemical).

Previous studies had shown that safety behavior depends substantially by motivation (Hofmann, Jacobs, & Landy, 1995; Neal, Griffin, & Hart, 2000; Probst & Brubaker, 2001; Hinsz, Nickell, & Park, 2007). It catalyzes self-awareness among employees which drives them to perform the job safely resulting in fewer accidents and less number of injuries. Furthermore, if motivation is lacking, there is a potential adverse effect of the

work outcomes (Hoffman & Stetzer, 1998). While previous studies had shown positive relationship between safety motivation and the outcome of safety behavior, no study was conducted in the petrochemical industry and therefore it imperative to test this relationship again in another working environment with different safety standards.

Another important human factor associated with individual's success and high performance is competency (Mirabile, 1997; Giesecke & McNeil). It is attributed to knowledge, skill, ability and attitude that contribute to positive behavior and paramount to organizational success in business endeavors (Stephens, Cole, Gibbs, Riehle, and Weare Jr, 2009). In keeping up with the changes in technology and work setting, manufacturers have been consistently validating the competency requirements for its employees. The search for competent people encompasses a wide spectrum of job level starting form entry levels to the board of directors (Orlikoff & Totten, 2009). Different competency models were proposed for different work setting (Orlikoff & Totten; Stephens et al., 2009). A competent person with right mindset has better perceived behavior control for the intended and very likely excel on the job (Spencer & Spencer, 1993; Bartram, Roberson, & Callinan, 2002). Previous study by Lind and Nenonen (2008) concluded that lack of competencies were responsible for 40 percent of fatal accidents in maintenance operation performed by subcontractors. Being mobile and sometimes in totally new locations were quite risky but ironically they did not have proper knowledge on how to conduct proper risk assessment and perform safe work practices. Malaysian legal requirements specify the need to have competent persons to handle safety matters (i.e., safety officers). For petrochemical industry, a Safety Officer

is required when more than a hundred people are employed by any petrochemical manufacturing facilities (Occupational Safety and Health Act and Regulations, 2007). In view of its importance to ensure success of safety performance and in response to regulatory requirement, there is a need to examine the competency relationship with safety behavior in new work setting of petrochemical industry.

Wallace and Vodanovich (2003) suggested that a mediating variable should be included in the personality and safety behavior relationship for future research on occupational safety. They believed the personality factors shall influence a mediator which affects the positive or negative outcome of a behavior. Furthermore, they suggested that future studies should be conducted using more diverse samples to represent the general population. Barron and Kenny (1986) stated that adding mediating variable in the construct is justified when there is strong relationship between predictors and criterion variables. This condition was fulfilled and therefore, there is a need to consider the suggestion by Wallace and Vodanovich (2003) by adding a mediator in the proposed model. It follows that the model should link attitude and personality factors to safety behavior while incorporating a mediator in the relationship.

As mentioned earlier, a number of studies have identified the relationship between personality and attitudes to safety behavior, but no study has yet to examine the relationship between safety commitment and safety behavior as well as its mediating effect. This is important because many studies concluded that safety commitment is crucial in safety management and accident prevention program (Clarke, 1998; Abd Aziz,

2008). It reflects the attitude and drives positive behavior of the employees towards reducing injuries and preventing accidents. Only ongoing commitment that requires active participation from all concerned parties in the organizations ensures superior safety performance at the workplace. Abd Aziz (2008) suggested that safety commitment is multi-dimensional which may arise from employees as well as employers but the established measurement tools are yet to be tested. Thus, there is a need to expand the bodies of literature by examining the mediating effect of safety commitment on safety behavior.

1.3 RESEARCH QUESTIONS

There is a need for additional study on occupational safety, especially on the behavioral aspects and how such behavior might be influenced by individual differences and contextual factors at work (Wallace, 2004). Furthermore, there are relatively few studies that have been directed to the safety behavior in the chemical industry, especially in the Malaysian context. The current body of knowledge is the work of a few people, the work still lacks empirical support, and as a result, there is a great need for further research to increase our understanding of safety behavior.

This study intends to address the following research questions:

1 What is the relationship between employees' conscientiousness and safety behavior?

2 What is the relationship between employees' conscientiousness and safety commitment?

3 What is the relationship between safety motivation and safety behavior?

4 What is the relationship between safety motivation and safety commitment?

5 What is the relationship between employees' competency and safety behavior?

6 What is the relationship between employees' competency and safety commitment?

7 To what extent does safety commitment mediates the relationship between employees' conscientiousness and safety behavior?

8 To what extent does safety commitment mediates the relationship between safety motivation and safety behavior?

9 To what extent does safety commitment mediates the relationship between employees' competency and safety behavior?

1.4 RESEARCH OBJECTIVES

Generally, the objective of this study is to examine the effect of employee conscientiousness, competency, safety motivation, and safety commitment on safety behavior.

Specifically, the objectives of the study are:

1 To determine the relationship between employees' conscientiousness and safety behavior.

2 To determine the relationship between employees' conscientiousness and safety commitment.

3 To determine the relationship between safety motivation and safety behavior.

4 To determine the relationship between safety motivation and safety commitment.

5 To determine the relationship between employees' competency and safety behavior.

6 To determine the relationship between employees' competency and safety commitment.

7 To determine the mediating effect of safety commitment on the relationships between employees' conscientiousness and safety behavior.

8 To determine the mediating effect of safety commitment on the relationships between safety motivation and safety behavior

9 To determine the mediating effect of safety commitment on the relationships between employees' competency and safety behavior

1.5 SIGNIFICANCE OF THE STUDY

Organizations are struggling to find ways to reduce occupational accidents for economic and human reasons. A few of them might have implemented good safety programs but failed to reduce the accidents while some might have implemented successful safety programs but they like to improve further. This study will help the organizations to learn more about human factors and how it can help to reduce the incidents at the workplace. This is important because improving safety behavior is the way forward to achieve the organizations' safety goals.

This study provides a conceptual model for safety behavior together with the assessment tools which should be useful for the organizations to access the status of the safety behavior among their employees. In addition, this study provides new approach to enhance safety behavior by focusing on employees' safety commitment to reduce the unsafe behavior at workplace. It is reflected in the belief that safety is important while at the same time this belief is translated into the actions by demonstrating safe behavior. By measuring the level of safety commitment, it provides a good indicator of safety practices in the organizations. Thus, the results will be used to develop efficient safety programs in order to prevent accidents and reduce injuries.

The safety commitment measurement tool was tested for the first time in this study after it was developed in 2008 by Abd Aziz (2008) using the sample from railway system. It would be interesting to compare the safety commitment among employees working in the railway system and petrochemical industry and its association with the level of risks. Petrochemical is high risk industry and it is expected the safety commitment is at the highest level. Thus, the present study provides detail explanation and discussion about the link between safety commitment and safety behavior. In addition, the influence of safety motivation, and employee conscientiousness and employees' competency on the employee safety commitment at the workplace will contribute to the knowledge.

1.6 DEFINITION OF THE TERMS

1.6.1 Safety Behavior

Safety behavior is defined in terms of safety compliance and safety participation (Neal & Griffin, 2006). Safety compliance refers to the core activities that individuals need to carry out to maintain workplace safety whereas safety participation describes behaviors that do not directly contribute to an individual's personal safety but that do help to develop an environment that supports safety.

1.6.2 Employees' Conscientiousness

Conscientiousness is one of the Big Five personality traits associated with a person's conscience and self-control (Stewart, 1999). Highly conscientious people actively plan, organize, and carry out tasks diligently (Costa & McCrae, 1992). It also relates to the level of self-motivation whereby more conscientious individuals have higher level of work motivation (Schmidt & Hunter, 1992). They set goals and exhibit high commitment to goal achievement (Barrick, Mount, & Strauss, 1993).

1.6.3 Employees' Competency

Competency is defined as sets of behaviors that are instrumental in the delivery of the desired results (Spencer & Spencer, 1993; Mirabile, 1997; Giesecke & McNeil, 1999;

Berge, Verneil, Davis, & Smith, 2001; Bartram, Robertson, & Callinan, 2002). It relates to the behaviors underpinning successful performance; what it is people do in order to meet their objectives; how they go about achieving the required outcomes; and what enables their competent performance (Stephens et al, 2009).

1.6.4 Safety Motivation

Safety motivation refers to an individual's willingness to exert effort to enact safety behaviors and the valence associated with those behaviors. Individuals are motivated to comply with safe working practices and to participate in safety activities if they perceive that there is positive safety climate in the workplace (Neal & Griffin, 2007).

1.6.5 Safety Commitment

Safety commitment is defined as an individual's identification with an involvement in safety activities, characterised by a strong acceptance of and belief in the organization's safety goals at workplace (Cooper, 1998). It reflects the attitudes and behavior toward preventing accidents at workplace.

1.6.6 Petrochemical Industry

Petrochemical industry is defined as an industry involves in the production of chemicals from natural gas, natural gas liquid, or refinery products derived from crude oil

distillation or cracking. These compounds are made up of hydrocarbons (Malaysia Petrochemicals Association, 2006).

1.7 ORGANIZATION OF THE DISSERTATION

This dissertation is divided into five chapters. Chapter One contains the statement of the problem to be studied, the research questions, the objectives of the study, significance of the study, and the definition of the terms. Chapter Two provides a review of the literature, which includes the historical view of the Occupational Safety and Health in Malaysia, and past studies and theories, which are of primary interest to this study. It also presents a theoretical model which depicts the relationships between independent and dependent variables, and the mediating effect of these relationships. Specific hypotheses about these relationships are proposed in this chapter, and operational definitions for the independent, mediation and dependent variables will be specified. Chapter Three presents the methodology utilized in the study, and includes the research type and design, a description of the population and sample, research instrumentation, the procedures for data collection and analysis. Chapter Four provides the data, results of the hypotheses testing, analysis and discussion. Finally, Chapter Five concludes the study with a summary of findings, conclusions and recommendations for future research.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this chapter is to review the literature, identify previous conceptual and empirical works that could provide a solid basis for the successful execution of the research effort. This chapter will also formulate hypotheses for this study and support a theoretical framework for the development of the research model. The literature review provides support for a methodology that would empirically investigate the relationships between various variables used in the study. A research model and a theory that underpinned the theoretical framework are also provided in this chapter.

2.2 SAFETY BEHAVIOR

The safety behavior and behavior-based safety (BBS) are sometimes used interchangeably to refer to the behavioral approach to improve safety performance at the workplace even though both have different concepts and approaches. The concept of BBS is to apply the science of behavior change to real world problems and it focuses on what people do, analyzes why they do it and then applies a research-supported intervention strategy to improve what people do. This approach is short term and addresses only the visible behavior of the employees (Goetsch, 2008). The missing piece of the BBS approach is to go deeper into the inner core of the individual and understand their personality characteristics, competency level and what motivate them to behave

safely. Safety behavior identifies this gap and therefore its concept is to improve the behavior by improving the inner-self of the individuals. It's a long term process and involves rigorous effort and commitment from the employers and the employees.

The evolution of safety behavior at workplace was first established in the early 1930 after the findings of the accident reports revealed that as many as 95 percent of workplace accidents were caused by employees' unsafe acts (Geller, 2001; Wikipedia, 2008; Cooper, 2009). Cooper (2009) described at length the reason why people behave unsafely was because they had never been hurt while doing their jobs in unsafe ways. Over the extended period of time, the lack of any injuries of those who have been consistently committing unsafe acts will reinforce the unsafe behaviors. These behaviors may eventually lead them to serious accidents. Cooper (2009) also stated that unsafe act is a reinforcer and its effects are stronger because the consequence is soon, certain and positive. As an example, the reason why the smokers find it hard to stop smoking (i.e., unsafe behavior) is that the consequences of smoking are soon (immediate), certain (every time) and positive (nicotine top up) whereas the negative consequences (e.g., lung cancer) are late (some years later) and uncertain because not every smoker dies from lung cancer.

In the same way, some employees take shortcut and find it hard to comply with safety rules and procedures because their behaviors are consistently (certain) rewarded by an immediate (soon) time saving that achieve additional production (positive). This unsafe behavior may be further reinforced by unsafe process workflow and by line managers

who turn a blind-eye and therefore indirectly encouraging employees to take shortcuts for the sake of production. It has become one of the primary determinants of occupational accidents (Sadullah & Kanten, 2009) with tremendous impact on cost to the industries while the pain, suffering and burdens placed on the families were immense (Cooper, 1999).

In this study, safety behavior is expressed in term of employees' compliance to the organization safety rules and regulations as well as voluntarily participation in safety programs and initiatives (Neal & Griffin, 2002). Safety compliance is directly contributed to personal safety and represents the core activities that need to be performed to maintain workplace safety. The basic compliance is the requirement for the use of personal protective equipment which is enforced by many organizations and also mandated by the authority under the Occupational Safety and Health Act, 1994. Similarly, safety participation describes the behaviors that do not directly contribute to employees' personal safety but help to create an environment that supports safety at the workplace. As an example of safety participation is attending safety meeting to discuss safety issues which is not compulsory but employees are encouraged to participate and contribute ideas in promoting safe working environment at the workplace. The safety compliance and voluntary participation behavior resemble the performance definition described by Borman and Motowidlo (1993) as task performance and contextual performance. The compliance behavior represents the task performance while participation in safety programs represents contextual performance.

Campbell et al. (1996) argued that there are differences in safety behavior performance among employees and largely the differences are determined by employees' knowledge, skill and motivation. Accordingly, inadequate knowledge on workplace safety and lack of skill to perform the job safely affect individual safety behavior performance. Likewise, differences in the level of safety motivation will also affect the individual safety performance. Employees who are self-motivated will normally demonstrate high safety standards.

In discussing the importance of guiding the employees to pathway that ensures safety compliance at the workplace, Reason et al. (1998) suggests 10 rule-related behaviors. The authors divide these rules into 4 categories: psychologically rewarding and unrewarding behavior, violations and compliant behavior, correct and incorrect actions and good and bad rules. Accordingly, the authors describe that a behavior is psychologically rewarding when it satisfies personal safety goals and it motivates employees to comply with safety rules and safe operating procedures. They shall properly access the risks at the workplace and take necessary actions to protect themselves against the danger and work according to appropriate safety rules. The 10 types of rule-related behaviors as proposed by Reason et al. (1998) are described below:

1. Correct compliance: A psychologically rewarding behavior performed after a person conducted a proper risk assessment at the workplace.
2. Correct violation: A psychologically rewarding behavior by deliberately deviating from the rules considered not appropriate for the jobs.

3. Correct improvisation: A psychologically rewarding behavior by improving the work procedure in the absence of appropriate operating rules.
4. Misvention: A deviation behavior from appropriate operating rules.
5. Mispliance: A mistaken compliance behavior with inappropriate operating rules.
6. Mistake: A behavior that resulted from an incorrect plan of action in absence of appropriate operating rules.
7. Incorrect but psychologically rewarding violation of appropriate rules. Individuals with this type of behavior achieve their safety goals despite failing to assess safety hazards and violating the appropriate operating rules.
8. Correct but psychologically unrewarding compliance with appropriate rules. This type of behavior signifies the correct assessment of the safety hazards but the actions do not satisfy the individual goals.
9. Correct but psychologically unrewarding violation of inappropriate rules. This type of behavior recognizes the rules are inappropriate and chooses to violate them but the person feels uncomfortable violating the rules.
10. Incorrect but psychologically rewarding compliance with inappropriate rules. This type of behavior chooses to comply with safety rules despite judging them inappropriate for the task.

Previous studies suggested that safety behaviors were influenced by organizational safety climate and safety culture (Hoffman & Stetzer, 1996; Neal & Griffin, 2000; Cooper & Phillip, 2004; Probst, 2004; Clark, 2006, O'Toole 2002, Perez-Floriano & Gonzalez, 2007), safety culture (Cooper, 2000; Harvey, Bolam, Gregory & Erdos, 2001),

organizational safety commitment (Komaki, Heinzmann & Lawson, 1980; Morgeson, 1999; Wyld, 2002; Zohar, 2002; Broadbent, 2004; Michael, Guo, Wiedenbeck & Ray, 2006) and personality factor (Wallace & Vodanovich, 2003; Wallace, 2004; Hinsz, Nickell & Park, 2007). The following paragraphs describe the influence of each factor to safety behavior followed by a summary at the end of the chapters.

Safety climate influences how employees perceive organizational safety commitment at the workplace (Neal & Griffin, 2000; Lu & Shang, 2005). This includes the perception of management values on safety, safety communications, safety training, and safety system (Probst, Brubaker, & Barsotti, 2008). Neal and Griffin (2002) added that safety climate reflects the perceptions of organizational safety related policies, procedures, practices but more importantly how these practices were valued in the organizations influenced the safety behavior of the employees. Active involvement in safety activities and compliance with organizational safety rules and procedures were indicative of employees' positive perception on organizational safety climate. As long as it is well established and managed across organizations, the employees' positive perception on organizational safety commitment help to influence their safety behaviors.

Harvey, Bolam, Gregory and Erdos (2001) argue that developing the perceptions was timely and significant behavioral changes could only be produced when safety is paramount importance in the organization. Across organizations and in industries practicing partnership agreement where people from different groups work closely such as in offshore platform, Fuller and Vassie (2001) found positive safety climate brought

harmony in their working relationship and consequently minimized unsafe behavior. Neal and Griffin (2000) conducted 2 studies to determine the relationship between safety climate and safety behaviors using archival survey data and administered questionnaires distributed to employees working in manufacturing and mining organizations. They found positive relationship between safety climate with employees' safety compliance and safety participation. It can be concluded that employees appreciate and value safety on the condition that prior organizational commitment must be established through positive safety climate. This was supported by a study by Zohar (2002) who collected data from 411 production workers in a metal processing plant found higher safety climates created by greater concern for employees' welfare and safety arising from closer individualized relationships promotes safe behaviors among the employees.

Hofmann and Morgeson (2003) tested safety climate as a moderator in a relationship between leader-member exchange and safety citizenship behavior. It was suggested that employees would reciprocate implied obligations of leader-member exchange by behaving in ways consistent with contextual behavioral expectations. The data were collected from 127 U.S. army personnel attached in the transport unit and in charge of transporting heavy equipment as part of the military deployment process. The safety citizenship behavior was measured by having the team leaders rate each team member's performance using 27 items of safety citizenship behaviors. The authors found high-quality leader-member exchange relationships resulted in expanded in safety citizenship behavior occurred when there was a positive safety climate and no such expansion occurred under less positive safety climate.

Zohar (2005) collected data from 3,952 production employees in 401 work groups nested in 36 small to medium size plants in metal, food, plastics and chemical industries to examine the mediating effect of group level safety climate in cross-level relationship between organizational safety climate and safety behavior. The finding indicates that safety behavior of the employees was mediated by the group level safety climate. It means the organizational level safety climate will be effective to influence safety behavior when it is aligned with group level safety climate. The middle ranks such as supervisors have significant role to play in influencing group members on safety behavior by enforcing and educating group members on organizational safety policies, rules and procedures.

In another study, Glendon and Litherland (2001) used safety climate questionnaire and safety behavioral observation checklist to access safety performance of the employees in the road construction organizations. They reported contradictory result compared to the findings by Neal and Griffin (2000) and Zohar (2002) that no relationship between safety climate and safety behavior measure was found. Cooper and Phillips (2004) also used safety behavioral observation checklist to assess safety behavior among 540 employees in a packaging production plant and conclude that the changes in safety climate perceptions did not necessarily reflect changes in the levels of behavioral safety performances. Likewise, changes in safety behavior do not necessarily reflect the changes in safety climate perceptions. Furthermore, the authors strongly suggest that the positive relationship between safety climate and safety behavior was not a clear cut as commonly assumed. The only difference which could explain these contradictory results was the

different measurement method used in the assessment of safety behaviors for these two studies. Safety climate questionnaire is a subjective self-report measure while behavior observation is more objective method and therefore the questionnaire provided different information compare to objective measure of behavioral observation.

Probst, Brubaker and Barsotti (2008) used safety climate measure to predict the extent of organizational injury rate underreporting in the construction companies. The safety climate was assessed using data gathered from 1,390 employees of 38 companies contracted to work in a large construction site while injury rate were obtained from recorded injury logs kept by the companies. The authors find organizations with positive safety climate experienced fewer workplace injuries and the underreporting of injury rates was about 50 percent lower compared to the underreporting of injury rates from the organizations with poor safety climate. DeJoy, Shaffer, Wilson, Vanderberg and Butts (2004) tested the relationship of safety climate measure with perceived safety at work using data from 2,208 employees in 21 retailers. The respondents were given a range of options from very safe to very unsafe for them to rate their personal exposure to safety and health hazards at the workplace. The authors found the influence of safety climate was a direct relationship rather than a mediated relationship to perceived safety at work. It can be implied that fewer workplace injuries and good perception of safety at work were attributable to positive perception of the organizational safety climate which led employees to demonstrate safe working behavior at the workplace.

Hoffman and Stetzer (1996) in a study among production workers in a metal processing plant found organizational safety climate has significant negative relationship with unsafe behavior and accidents. In another study using data collected from manufacturing and mining workers in Australia, Neal and Griffin (2000) found organizational safety climate has significant positive relationship with safety participation and compliance behavior. Clark (2006) identified 35 studies in a meta-analysis study linking organizational safety climate with occupational accidents, injuries, safety compliance and safety participation. Almost half of the studies identified (N=15) involved data collected from manufacturing sectors while construction industry, mining industry, offshore oil and gas, and other industries made up a smaller numbers. The finding indicated positive relationship between safety climate and safety compliance and participation, with the latter demonstrating stronger relationship. Probst (2004) collected data from 136 manufacturing employees to examine whether safety climate would moderate the negative effects of job insecurity on self-reported safety outcomes such as safety knowledge, safety compliance, accidents, and injuries. The finding indicated that a strong organizational safety climate would attenuate the negative effects of job insecurity on those mentioned variables and thus cushioned the impact of potential safety non-compliance, injuries and accidents.

Mark et al (2007) conducted a longitudinal study to examine the moderating effect of safety climate on the relationship between staffing adequacy and work condition on nurse injuries. Three different sets of questionnaires were distributed in 6 consecutive months involving 281 medical-surgical units in 143 general acute care hospitals. The authors

found work engagement and work conditions were positively related to safety climate. Furthermore, safety climate was found to moderate the effect of work conditions and work engagement on nurse injuries. Subsequently, the authors suggested that positive work engagement and work conditions enhance safety climate and influence safety behavior of the nurses which can reduce nurse injuries.

Another important safety behavior determinant which is closely related to safety climate is safety culture. It describes the shared values and beliefs that interact with organizational structures and control system to produce behavioral norms in relation to ongoing safety and health performance (Cooper, 2000). O'Toole (2002) finds the reduction in injuries at the workplace was strongly influenced by several measures of organizational safety culture such as management safety commitment. The beliefs in positive safety culture were predicted to influence safe behaviors which will lead to fewer accidents at the workplace. Perez-Floriano and Gonzalez (2007) find safety cultural values differ across geographical regions, however it influences the way in which people think and behave when faced with a safety-related issues.

In summary, all of the above studies concluded that organization safety climate and culture promote personal safety ownership which drives employees to develop stronger norms on safety behavior and would eventually engage in fewer unsafe behaviors. Furthermore, organizations who were successfully improving safety climate would achieve real benefits in term of reduction in occupational accidents and injuries (Clark, 2006).

Philson (1998) argued that the presence of safety and health professionals in the organizations did not guarantee high safety performance without active, genuine and continuous management support. The support has to start with the belief that safety of the employees is top priority and that organizational commitment can make a difference in enhancing safety behaviors. Broadbent (2004) discussed the intricate linkage between management safety commitment and safety outcomes. The author suggested all managers especially supervisors, line managers, and senior managers should display their commitment to safety because this will influence safety behaviors of the employees. It was found that supervisor has the greatest influence on safety behavior of their team members due to their direct control of team members' performance (Heinrich, 1959). The care and concern of safety well-being of their team members gave a positive signal that management is committed to safety of its employees. This influence was examined by O'Dea (2001) who collected data from 231 workers operating six North Sea oil and gas installations and found employees' safety initiative was related to their feeling of identification with the organizations and the compliance behavior was predicted by their perception of supervisor commitment to safety, transformational leadership and workgroup cohesion.

Nielsen, Carstensen and Rasmussen (2006) examined the relationship between incident rates, safety climate, the willingness to report incidents and perceived management commitment to safety using an intervention design before and after the implementation of safety reporting scheme. The findings indicated that top management safety commitment was the key factor in influencing the implementation of incident reporting scheme to

reduce the injuries. Zohar (2002) found improved frequency of safety related communication between supervisors and subordinates resulted in significant decreased in micro accidents and increased in safety compliance behavior (e.g., using personal protective equipment).

Komaki, Heinzmann and Lawson (1980) conducted 165 safety observations over 45 weeks to study the effect of safety training and feedback on safety behavioral performance of the maintenance workers. The findings indicated that safety training alone without supervisory support to provide feedback on employees' behavioral safety performance was not sufficient.

Hofman and Morgeson (1999) used data from 49 supervisor-group-leader dyads in a manufacturing facility to assess the influence of perceived organizational support and leader-member exchange relationship on safety related behavior. The results indicated that the support organizations show for their employees and the quality of exchange relationships with their respective supervisors were associated with safety-related communication and safety commitment which would ultimately improve their safety behavior at the workplace. On top of that, Miozza and Wyld (2002) stated that the success of safety programs such as behavior-based safety which was proven technique to reduce injuries and prevent accidents depended on the top management support, both through personal involvement, leading by example and allocating adequate organizational resources to promote workplace safety.

Hofmann and Morgeson (1999) in a study among manufacturing employees producing commercial heating and air conditioning systems found organization support on employee safety and the quality of exchange relationships among supervisors and subordinates improved safety behavior and reduced accidents. Michael, Guo, Wiedenbeck and Ray (2006) in a study among blue collar employees in wood product manufacturing facilities found that positive leader-member exchange relationship improved safety behaviors of the employees. Accordingly, only the strong support and commitment from the management on safety would drive employees to reciprocate the deeds by demonstrating safe behaviors at workplace. However, strong support and commitment from the management alone do not guarantee safety behavior of the employees unless there is a strong commitment from the employees to drive safety to a higher level of safety standards.

2.3 SAFETY MOTIVATION

The motivational aspects in many studies have been referred to as a source of energy, desire to achieve, desire to perform better than others, responsive to rewards, perceived behavioral control and intentions (Klehe & Anderson, 2007). These are the key drivers influencing the behaviors to achieve the intended goals. In many respects, high level of motivation leads to positive outcomes. Campbell (1990) argued that motivation consists of the combined effect of three choices: (a) the choice to expend effort, (b) the choice of which level of effort to expend, and (c) the choice to persist in the expenditure of that effort. In addition, motivation is required for any task to be performed. Furthermore,

Neal and Griffin (2006) defined safety motivation as an individual's willingness to exert effort to enact safety behaviors and the valence associated with those behaviors.

Neal and Griffin (2000) revealed that motivation factor is an important component to influence safety behavior among employees in Australian manufacturing organization. In a study among 53 participants, Vohs et al. (2007) find there were stable individual differences in the motivation. Their study suggested that when a person anticipated a decision would be taken advantage by others, then that person would be motivated to take an aversive emotional response to prevent that from happening. In a data collected from 81 MBA graduates, Cheng and Ho (2001) found career commitment was positively related to learning motivation and transfer. In addition, they concluded that motivation is the source of energy which is crucial for the training program to be effective. Individuals who have the ability to master the training program may fail to do so without motivation (Noe, 1986). The result of this study indicates that motivation is a significant predictor of transfer of knowledge during training ($r = .31$, $P < .01$).

Diefendorff and Mehta (2007) found workplace behaviors among 392 employed psychology and business undergraduate students were uniquely predicted by approach motivation traits. Accordingly, the study suggested the motivational traits were sensitive to rewards. The roles of motivation in relation to workplace behaviors was explored further with a study conducted by Klehe and Anderson (2007) among 138 students and suggest that motivation in the form of ability, direction, level, and persistence of effort exerted rise significantly under the maximum performance condition. This is the stage

where the maximum driving force is triggered by performers' explicit awareness of them being evaluated, complied with instructions to maximize effort and focused on the tasks (Sackett et al, 1988).

In workplace safety, previous studies have largely focused on ergonomic factors, personal selection, and training as primary antecedents, thus ignoring the potential role such as motivation (Probst & Brubaker, 2001). Hinsz, Nickell and Park (2007) found motivation for safety behaviors among 162 employees working in turkey processing plant was substantially influenced by attitudes and subjective norms. Built on the theory of intentional behavior, their study suggested "There is significant research on intentions and behavior that serves as fertile conceptual ground for considering factors that contribute to employees' behavior in work settings." Accordingly, the results indicate that there was a strong positive relationship between the intentions and self-reports of behaviors to keep the food safe and uncontaminated. Probst and Brubaker (2001) collected data from 237 food-processing employees and state that employees who reported high perception of job insecurity exhibit decreased in safety motivation and compliance, which in turn were related to higher levels of workplace accidents and injuries.

In a data collected from 700 employees working in an Australian hospital, Neal and Griffin (2006) find that individual safety motivation was associated with increased in self-reported safety behavior and reduction in accidents. Probst and Brubaker (2001) find that safety motivation had a lagged effect on safety compliance 6 months later. As long

as positive perception sustains, safety motivation can have a long lasting effects on safety performance. The employees are more willing to carry out activities that do not necessarily contribute to their own safety but that do help to make the working environment safer. In addition, the study had shown a reciprocal relationship between safety motivation and safety participation over time. It appears that the act of participating in safety activities can lead to further increase in safety motivation. The reverse effect is because individuals who carry out discretionary activities such as participating is safety walk receive positive reward and encouragement, which motivates them to carry out further activities. Merely complying with safety requirements is unlikely to generate reward or encouragement, which may explain why compliance did not have the same effect on motivation.

A study by Zacharatos (2001) in manufacturing industries suggests that motivation plays a crucial role to change employees' behavior towards working safely. Neal (2006) also found safety motivation has a strong link with employees' safety behavior during performing the job. Neal (2000) stated that safety motivation also influenced safety climate and safety performance at the workplace. According to Wallace and Vodanovich (2003) conscientious people perform better in safety because they have higher level of motivation.

2.4 EMPLOYEES' CONSCIENTIOUSNESS

The Five Factor Model (FMM) of personality consists of Conscientiousness, Agreeableness, Extroversion, Openness to Experience and Neuroticism (Costa & McRae, 1992; Goldberg, 1992) and it forms a comprehensive and parsimonious taxonomy of personality traits (Barrick, Mount, & Strauss, 1993). It describes the quality of a person which differentiates him or her from the other colleagues (Hampson & Goldberg, 2006). The growing interest in personality literature emerged after many studies and meta-analytical reviews revealed its predictive relationship with job performance (Barrick & Mount, 1991; Salgado, 1997; Judge, Martocchio, & Thoresen, 1997 and Hurt & Donovan, 2000). The general finding indicated that conscientiousness was the valid predictor for job performance in all occupational groups and job categories studied (Hough et al., 1990; Barrick & Mount, 1991). The validities for the other four Big Five factors were either smaller or were predictive for subset of occupational types (Barrick, Mount & Strauss, 1993).

Conscientious individuals possess qualities that reflects dependability (e.g., thorough, organized, responsible, careful) and need for achievement (Hough et al., 1990; Barrick, Mount, & Strauss, 1993). These are the individuals who are generally hardworking and reliable. They are self-motivated and highly committed to achieve the individual and organizational goals. For this reason, conscientious individuals are believed to perform better as they have high level of motivation and behave safely at work due to the characteristics they hold and exhibit.

Previous studies showed that the Big Five personality factors, in particular conscientiousness, have been linked to many work performance studies (Barrick & Mount, 1991; Salgado, 1997; Judge, Martocchio, & Thoresen, 1997; Stewart, 1999; Hurtz & Donovan, 2000). Barrick et al. (1993) conducted a study among 91 wholesales representatives from a large appliance manufacturing company. They examined personality traits as predictors, autonomous goal-setting and goal commitment as mediators, and sales volume and supervisor ratings as performance indicators. The results from the structural equation modeling revealed autonomous goal-setting and goal commitment were partially mediated the relationship between conscientiousness and both performance indicators. The direct relationship showed significant positive relationships between conscientiousness and sales volume and supervisor rating of job performance. Ashton (1998) examined the personality traits with respect to job performance criteria based on self-reported workplace delinquency in a sample of 127 entry-level employees. The delinquent workplace criteria assessed for his study was unnecessary absenteeism, lateness, alcohol use or influence, safety violations, avoiding work during paid time, theft, giving free goods to friends or relatives, and vandalism or sabotage. The results showed that conscientiousness was negatively and significantly correlated with the workplace delinquency composite.

Major, Turner and Fletcher (2006) collected data using a web based survey among 183 employees of a financial services firm. The author assessed the proactive personality and the Big Five personality as predictors, motivation to learn as mediator and development activity as a criterion variable. The results from the structural equation modeling

indicated that conscientiousness was positively related to motivation to learn, which was crucial for the development activities of the wholesale representatives. Hampson, Goldberg and Dubanoski (2007) conducted a longitudinal study to examine the influence of the Big Five personality traits of childhood on adult health status. The samples consisted of 1,054 members of the Hawaii personality and health cohort. The results from the structural equation modeling revealed that the childhood conscientiousness positively influenced adult health status indirectly through education attainment, healthy eating habits, and smoking. Lounsbury, Smith, Levy, Leong and Gibson (2009) examined the relationship between the Big Five personality factors and life satisfaction among 347 undergraduate students majoring in business study. The correlation results showed conscientiousness correlated positively and significantly with life satisfaction.

Jin, Watkins and Yuen (2009) examined the mediating effect of career self-efficacy in a relationship between the Big Five factor of personality and the career commitment process using a sample of 785 Chinese graduate students. There were two dimensions of career commitment process described in their study: vocational commitment and tendency to foreclose. Vocational commitment was explained as a progression phase of career commitment process from indecisive stage, followed by exploration stage and finally a committed phase. Tendency to foreclose, on the other hand, involved the open attitude to diverse experience in committing to a career goal. The multiple regression analysis showed that conscientiousness related positively and significantly to career commitment both directly and indirectly through career decision self-efficacy (i.e., partially mediated).

In driving safety, Arthur and Graziano (1996) conducted a study among undergraduates and employees from a temporary employment service and found a significant negative relationship between conscientiousness and being involved in driving accidents. A more recent study by Cellar, York and Bauer (2001) found a significant negative relationship between conscientiousness and accidents. This finding was confirmed by Arthur and Doverspike (2001) who also found negative relationship between conscientiousness and driving accidents. It was clear from these studies that conscientious drivers exhibit safe driving practices and involved in fewer vehicle accidents.

In occupational safety, several studies had been conducted linking the Big Five personality factor which included conscientiousness or its facet with safety performance. To begin with, Fallon et al. (2000) conducted a study examining the relationship between conscientiousness and counterproductive work behavior among 359 Sales Associates of a large home improvement retail organization. The productive and counterproductive work behavior was assessed using five dimensions: rehire rating, composite performance, safety or integrity and attendance. The results from the correlations analysis indicated that the relationship between conscientiousness and rehire rating, composite performance and attendance were significant but the relationship with safety or integrity was not significant.

Wallace and Vodanovich (2003) conducted two studies using two separate samples to closely examine the relationship between conscientiousness and unsafe behavior and

workplace accidents. In the first study, the authors used a sample of 219 employees responsible for the production of chemical products. The second study was designed to replicate the finding in the first study using the sample of 263 enlisted military personnel. Both studies confirmed that conscientiousness was significantly and negatively related to unsafe work behavior and workplace accidents.

In another study, Wallace (2004) examined the cross-level model relationship that linked the facets of conscientiousness (dependability, achievement) and climate (safety, productivity) to facets of performance (safety, speed) via regulatory focus (promotion, prevention) as a mediating variable. The focus of the safety performance was on the safety compliance in task execution while the speed performance reflected how fast a task could be completed. Data were collected from 251 participants from a large facility department in exchange for the research findings. The results indicated that conscientiousness facets were mediated by prevention focus in its relation to safety performance. Wallace (2004) concluded that individual personality characteristics (i.e., conscientiousness) played an important role in predicting his or her regulatory focus which influenced safety performance.

The above findings revealed that except for one study involving counterproductive behavior which showed that the relationship between conscientiousness and safety performance was not significant, all the other findings showed the overwhelming supports of conscientiousness in relationship to performance in many areas of studies (e.g., sales performance, life satisfaction, career commitment, health status, and driving

safety). This finding is encouraging that it should have been tested on safety behavior performance and thus extended its area of applicability. However, despite a strong relationship between conscientiousness and job performance, hardly any study was conducted in occupational safety to determine its influence on safety behavior.

2.5 EMPLOYEES' COMPETENCY

The definition of competency is progressively reevaluated following the development of industrial requirement and the changes in technology and business (Berge, Verneil, Berge, Davis, & Smith, 2001). As a result, there were several versions of competency definitions offered by the literature which were not universally agreed upon (Stephens, Cole, Gibbs, Riehle, & Weare Jr, 2009), only ambiguity and confusion (Dole, Hurych, & Liebst, 2005). A typical definition found in the literature explains competency in term of knowledge, skill and abilities (Berge et. al, 2001). Mirabile (1997) defines competency as "knowledge, skill, ability, or characteristics associated with high performance on the job such as problem solving, analytical thinking and leadership". Giesecke and McNeil (1999) added personal attributes in their competency definition which collectively defines as "the skill, knowledge, personal attributes that contribute to an individual's success in a particular position".

Bartram, Robertson, and Callinan (2002) defined competency as "sets of behaviors that are instrumental in the delivery of the desired results". McLagan (1996) identified six approaches to defining and developing models for competency which include job tasks,

results of work efforts, outputs, knowledge, skills and attitude, qualities of superior performance, and bundles of attitudes. Spencer and Spencer (1993) provided broader definition of competency by explaining the underlying characteristics of an individual and its relationship with the behavior and performance. In detailing the underlying characteristics, Spencer and Spencer (1993) identify five competency characteristics:

1. Motives

   A person with this competency characteristic directs, drives, and selects behavior toward certain actions and away from other actions. The achievement oriented individuals set challenging goals for themselves and take personal responsibility to achieve them. In injury prevention as the primary goal in occupational safety, motives shall drive the individuals to select safe behavior while performing the jobs.

2. Traits

   Trait competencies reflect the physical characteristic of a person and his or her consistent responses to situations. For a mechanical fitter, handy with tools is his physical trait competency. Consistent response is emotional self-control of a person in a given situation whereby some people maintain calmness and do not blow up at other colleagues and do extras above the call for duty to resolve issues at workplace.

3. Self-concept

Self-concept is the self-image of a person, his attitudes and values. For example, feeling confidence about being effective in any situation and job assignment is a self-concept. A person who values safety as a top priority is likely to exhibit safe behavior when he or she is assigned to do a job in a hazardous area.

4. Knowledge

Knowledge is the information a person has in specific content areas. For example, a mechanical fitter's knowledge is specific in mechanical fittings and fixing them in the piping system. The competency associated with knowledge is the ability not only to memorize specific facts but also the ability to find the information, identify which facts are available and relevant to a specific problem. Subsequently, a knowledge competency predicts what a person can do and selects which of several options is the right response to a specific problem.

5. Skill

Skill is the ability of a person to perform a physical and a mental job. For example, a mechanical fitter's physical skill is to install a valve in a pipe line without damaging the nuts and bolts. A mental skill includes the ability to process the knowledge and data, determine the cause and effect, organize plans (analytical thinking) and ability to recognize pattern in complex data (conceptual thinking).

In summary, knowledge, skill and ability (KSA) form the basis of competency definition described by many researchers. Personal attributes and behavior are additional elements included in the definition which linked to performance of the individual and organization.

Even though competence and competency are sometimes used interchangeably in the literature as if both carry the same meaning, in actual fact they're not. Kurtz and Bartram (2002) clearly differentiate between these two terms and explain that competence is about mastery in relation to specified goals. It is not related to the individual behavior but to his or her performance and measured by the assessment of performance in the workplace against pre-defined set of occupational standards. On the contrary, competencies relate to the behaviors of the people to achieve those goals and are best described as what people do to achieve the objectives, how they go about achieving the objectives and what enables their competence performance.

Employees' competencies are paramount to the success of any organizations in many industries (Stephens et al, 2009). Since their talent is the most important driver in business operation, manufacturers consistently validate the competencies of the new applicants as well as its existing employees (McNelly, 2009). In preparation for employment, the competency certification program was introduced by certain bodies (e.g., Malaysia Industrial Training Institute) to "allow workers to be productive on day one" (McNelly, 2009). In fact, the search to have competent people covers a wide spectrum of job levels, starting from entry levels up to the board of directors (Orlikoff & Totten, 2009). In this sense, a set of competencies applicable for every job level were

formulated to ensure the highest performance by the job holders. In health care, Orlikoff and Totten (2009) outline the competencies required for the board members which are the knowledge, skills, and personal capabilities. In library profession, Stephens et al (2009) explain about four central leadership competencies required to be an effective library leader. By getting feedback from the leaders already in the service, the four competencies are described below:

- Cognitive ability

  This competency reflects the ability of a person to actively and creatively solve problems, make sound and timely decision and accurately access shortcoming and implement continuous improvement.

- Vision

  Vision is about the ability of a person to think globally beyond geographical boundary, think creatively and innovatively and has foresight to anticipate problems and opportunities.

- Interpersonal effectiveness

  Interpersonal effectiveness is a competency that reflects the ability of a person to create conducive environment for communication and working as a team, where every member of the team feels appreciated and has something to contribute to the team. The central elements for this competency is for a person to respect the cultural diversity, lead by example, promote team building, develop the people,

motivate and inspire the people and encourage environment of active communication.

- Managerial effectiveness

  The managerial effectiveness is the competency of a leader to manage change, manage resources, plan for the future, collaborate with others and have the ability to be flexible.

In addition to the four central competencies required to be an effective library leader, personal attribute is the fifth competency that was believed to fit in the competency model. Studies have shown that personal attributes affect the behavior of the leaders during their tenure in the organization (Stephen et al, 2009). Attributes such as ethical, honest, humble, gracious, and teachable are definitely great for leaders to be effective.

Matthews, Jones and Chamberlain (1992) tested the individual differences in mail-coding skills and their variation with ability level. The data were collected from 58 Post Office trainees who were selected for their high coding ability and 158 members of general public who had mixed ability (e.g., high and low ability) for mail-coding. The ability measures consist of visual checking of postcodes, digit-letter substitution and rule-based coding of town names. The findings suggest that the ability varies with practice and that cognitive (e.g., tapping on computer keyboard) and personality (e.g., extraversion) measures predicted considerable variance in skilled performance for mail-coding. It can be concluded the individual's competency differs and therefore explains the variance in

their task performance. This has to be assessed and recognized by the employers in an effort to upgrade their employees' competencies and the outputs.

A similar study in predicting individual differences in ability and skill acquisition was conducted by Ackerman (1992) using data collected from 102 participants, mostly university students. They were tested in their abilities to operate the simulated terminal radar air traffic controller for 22 hours in 6 session experiments. Sets of ability measures including reasoning, spatial ability and perceptual speed were selected to represent the general and broad content of abilities. The results indicate ability is substantially predicted the individual difference in task performance at all stages of skill acquisition. These results also confirmed the findings from Matthews, Jones and Chamberlain (1992) on this issue.

Wilk, Desmarais and Sackett (1995) discussed the match between the individual ability and the job. According to these authors, the individuals, over the course of their working experience, will sort themselves into jobs that are compatible with their interests, values, and abilities. Furthermore, these individuals may be prompted to seek alternative employment in the hope of achieving better degree of fit. The data were collected from 3,887 participants sorted according to the criteria set in the National Longitudinal Survey-Youth Cohort database of over 11,000 individuals. The cognitive ability was measured using the Armed Services Vocational Aptitude Battery (ASVAB) while the job movement in a job-complexity hierarchy was measured by a job classification system called the Occupational Aptitude Patterns Map (Gottfredson, 1986). The findings

suggest that the individuals with higher cognitive ability move into jobs that require more cognitive ability. Similarly, the individuals with lower cognitive ability move into jobs that require less cognitive ability. To apply this notion into occupational safety, higher cognitive ability individuals in processing the information and applying it to the job are preferable over the lower ability individuals because of the occupational risks that only competent individuals able to handle this situation.

Lind and Nenonen (2008) analyzed occupational risks in industrial maintenance and concluded poor ergonomics is the typical risk in maintenance operation. They gathered 90 real accident cases categorized as severe accidents occurred for the last 10 years. In their analysis, they found about 40 percent of severe accident cases were fatal. It involves subcontractors who were sent to various customer locations sometimes long distance from their base to perform unscheduled repairs, inspection, planned preventive maintenance, calibration and testing. Being new to these locations and the time needed to adapt and asses the hazards, very unlikely they have a full knowledge of the hazards in addition to time pressure to complete the job, it is understandable that the likelihood of accidents is great. No doubt, the competency by means of risks assessment and practicing safe working can prevent accidents due to ergonomic factors (Lind & Nenonen, 2008).

Camuffo and Gerli (2007) find competent Production Supervisors were significant contributor to help their companies stay in business during economic downturn. The authors identified four threshold and nine distinctive competencies to form superior

manufacturing capabilities that can withstand tough business environment. The threshold competencies are essential to performing the jobs and include efficiency orientation and initiative (goal and action cluster); empathy and group management (people management cluster). The nine distinctive competencies are related to superior performance and include planning and attention (goal and action luster); persuasive, self-confidence, and development of others (people management cluster); use of concepts, networking, use of technologies and social objectivity (analytical reasoning cluster). These competencies fosters efficiency in manufacturing and drive performance improvement while at the same time make organizational communication more efficient, motivate workers, reduce conflicts and drive skills development. These efforts in driving competency for efficiency improvement and performance enhancement in the manufacturing process would be meaningless if the organizations lack of competent persons to run the operation safely. Therefore, the role of employees' competency in safety behavior model has to be determined to support and reinforce the beliefs that competency is required for occupational safety behavior.

2.6 SAFETY COMMITMENT

According to Cooper (1998), commitment to safety is defined as "an individual's identification with an involvement in safety activities, characterised by a strong acceptance of and belief in the organization's safety goals at workplace". Employee's safety commitment at workplace is a crucial element in organizational behavior. It reflects the employees' attitudes and behavior toward preventing accident at workplace.

Numerous dimensions had been identified to explain the meaning of commitment (Morrow, 1983). It refers to consistent behavior (Becker, 1960), employees' involvement (Brown, 1969), employee's identification (Hall et al., 1970), organizational citizen membership (Becker & Randall, 1995), employer and employee binding (Allen & Meyer, 1990).

Buchanan (1974), in a study on building organizational commitment among the business and government managers, had elaborated three dimensions of commitment, which are identification, involvement, and loyalty. This was then followed by Cook and Wall (1980), who adapted this concept of involvement and found that the outcomes were not consistent among three manufacturing organisations.

Weiner and Gechman (1977) introduced a commitment behavioral approach at the workplace. He defined commitment behavior as a socially accepted behavior that exceeds formal and/or normative expectations relevant to the object of commitment. Using the female elementary schools as the sample, he revealed that there was moderate correlation between work commitment and attitudinal variables (job involvement and job satisfaction). However, Salancik (1977) depicted the differences within commitment from the view of organizational behavior and commitment as seen from the psychological perspective.

Reichers (1985) argued that the individual's attitudinal commitment at the workplace environment cannot be totally based on the commitment to the organisation. Attitudinal

commitment is related to the process of identification with and involvement in achieving organisation goals and values. Therefore, the commitment underlying this concept should be linked with the coalitional aspects of organisation entities (Reichers, 1985) and organizational commitment measurement cannot demonstrate and predict behavior (Becker & Randall, 1995).

Allen and Meyer (1990) proposed three components of organizational commitment, which are affective, continuance, and normative components. Affective commitment refers to the employee's attachment, identification, and involvement with the organisation. Continuance commitment refers to an awareness of the costs associated with leaving the organisation. Finally, normative commitment reflects a feeling of obligation to continue employment.

Recently, research on employee commitment has discussed the concept of multiple commitments. This approach is more precise and comprehensive in measuring the foci of workers commitment than organizational commitment (Reichers, 1985; Becker, 1960) which reflects the differences in organizational behavior (Allen & Meyer, 1990). The concept of commitment to work at the workplace should reflect all possible elements within the organisation (Weiner & Gechman, 1977). Becker and Randall (1995), in his study on comparative multi-dimensional view of commitment and Theory of Reasoned Action among restaurant workers, found that a multi-dimension view of commitment approach is more adequate in predicting a specific human behavior. A study involving

hospital nurses by Lok and Crawford (1999) showed that employees' commitment has strong correlation with job satisfaction.

Safety practices and activities typically seek to gain safety commitment from both the employees and employers. A major main determinant of the commitment to safety is employee attitude and behavior, which is related to attitudinal commitment and behavioral commitment toward achieving safety goals. Zohar (1980), and Diaz and Cabrera (1997) concluded that management commitment is prerequisite for safety improvement. Dedobbeleer and Beland (1991), in a study of safety climate amongst construction workers, found that there are two important factors that should be included in safety surveys, namely management commitment to safety and employee involvement. Similarly, O'Toole (2002) in a study on mining and construction product companies found that management commitment to safety had an impact on employee's perception toward safety.

Cooper (1998) cited that management commitment plays an important role in the safety change process and safety auditing, and Cox and Flin (1998) found critical factors for safe operations. Likewise, organizational commitment is linked with employee motivation and accident rates. Diaz and Cabrera (1997) mentioned that some findings showed that low-accident companies were very precise in their management of commitment to safety, safety training, and selection procedures.

Clarke (1998, 1999) found that in the railway safety practice, the manager's commitment to safety influences the employee's perception upon safety practices. Manager commitment and action play as the main elements for improving the employee's attitude toward safety and safety activities (Cheyne et al., 1998). However, looking from the social engineered approach, commitment is a driving force upon the safety engine in organizational safety (Reason, 1990). Commitment to safety is a key element for safety culture performance in the organisation (Cox & Flin, 1998) and involves personal decision-making processes (Cooper, 1998).

All workers should give strong commitment to safety in order to improve safety performance at the workplace. Implementation of safety and health activities depends on employees' attitude and commitment (Cascio & Baughn, 2000). Safety managers should study the employee's attitude and behavior to gain commitment from them (Goetsch, 1999), and major accidents and disasters in many organizations are mainly signs of a lack of commitment to safety (Hopf, 1994). Barling and Hutchinson (2000) in a study of safety behavior revealed that commitment-based safety practices would significantly affect perceived safety climate, both directly and indirectly. Without full commitment to safety from workers, all safety programs would be unsuccessful (Cascio & Baughn, 2000). Employees with high commitment to safety would enhance safety performance and generate rewards in terms of quality and profitability (Cooper, 1998). Clarke (1998) found that there were different perceptions on safety practices among groups of employees, but they shared understanding of the importance of safety issues at the workplace. Safety committee members should comprise all levels of management in the

organization and feedback or opinions from subordinates are valuable information for the safety management system (O'Toole 1999). Therefore, a similar safety policy and regulations should be applied to all departments in the organization to achieve organizational safety.

Safety procedures and regulations are priority in high risk industrial working environments (Reason, 1997; Cox & Flin, 1998; Cheyne et al., 1998, 2000). Normally only well-trained, experienced, and competent employees are selected to perform the job in these industries (Reason, 1997; Cheyne et al., 1998, 2000) and these employees have high commitment to safety at the workplace (Cheyne et al., 1998 Cooper, 1998). Therefore, these employees have high knowledge and skill to perform the job within high risk working environments.

The concept of employee's commitment at the workplace is widely utilised and have been receiving increasing attention in occupational safety studies. Management and employee's commitment to safety are crucial elements in safety management and accident prevention programmes (Zohar, 1980; Dedobbeleer & Beland, 1991; Cooper, 1998).

A Study by Abd Aziz (2008) among Malaysia railway employees found that employees' safety commitment is multi-dimensional. This study also revealed that safety commitment consists of three dimensions which are priority on safety, safety

involvement and safety compliance. However, the findings from only one research study (i.e., Malaysian Railway) might not be conclusive to apply employees' safety commitment in other industries and population, therefore this study conducted among employees in Malaysia Petrochemical Industry would complement and extended the above findings in wider area of applications.

2.7 THEORETICAL DEVELOPMENT

The theoretical development to support the conceptual framework of this study was based on the concept of behaviorism and the behavior change theories. Behaviorism states that all things that organism do including acting, thinking and feeling should be regarded as behaviors (Wikipedia, 2010). It maintains that there should no philosophical difference between publicly observable processes such as actions and privately observable processes such as thinking and feeling. Behavior change theories describe the reason behind the alteration in the behavior pattern of the individual. These theories state that environmental, personal and behavior characteristics are major factors in behavior determination. This study analyzed a few behavior change theories, namely self-efficacy theory, learning theory, social learning theory, theory of reasoned action, and theory of planned behavior. Only one theory which was the most applicable to support the conceptual framework was chosen and detail justification was also provided.

The self-efficacy theory describes that behavior change is determined by the individual's impression of his ability to perform a task based upon prior success in performing the

related tasks, his physiological state and the persuasion from external sources (Bandura, 1977). This impression upgrades self-confident and predicts the amount of effort necessary to initiate and maintain the behavior change. In applying to safety behavior concept, self-efficacy provides a strong platform that self-confident is necessary for change but it lacks in many ways to address the mechanism of how a behavior can be influenced.

The learning theory describes that a complex behavior is learned gradually by modification of a simpler behavior which individuals learn through duplicating the behavior they observed and that rewards are essential to ensure repetitious of desirable behavior (Skinner, 1953). Although, the learning theory provides the basis to support the change mechanism in safety behavior that good safety behavior can be imitated and reinforced by reward system but it does not provide the mechanism how the inner behavior can be influenced. According to the behaviorism concept, inner behavior is equally important as the outer behavior.

Social learning theory explains that behavioral change is determined by environmental, personal and behavioral elements. The change in one factor affects the other two factors. The theory suggests that an individual's environment affects the development of his personal characteristics as well as the person's behavior and an individual's behavior may change the person's environment as well as the way the person's thinks or feels (Bandura, 1989). In application to safety behavior concept, a person's environment is the physical interaction between a person and his workstation, the employees and the system

in which the organization operates. As an example, a well maintained and clean workstation affects the thinking that cleanliness is crucial for safety and maintaining cleanliness is a must, not an option. Therefore, compare to leaning theory, this theory is more applicable to support the safety behavior conceptual framework because it explains the interaction between the factors that affect internal and the external behavior. However, this theory lacks of explanation on how does the environment affects the thinking which led a person to demonstrate a certain behavior pattern in agreement with the person's thoughts and beliefs.

The theory of reason action and the theory of planned behavior describe that individual's intention is crucial in determining the behavior and behavior change (Ajzen & Fishbein, 1980). In addition, these theories provide the mechanism of how to influence the intention and the behavior. For the theory of reason action, individual's attitude to the consequence of the behavior and the social pressure from his environments affects his intention and his behavior. Similarly, the theory of planned behavior complemented this theory by incorporating perceived behavior control in the model which is equally important to determine the intention and behavior. Therefore, this study selected the theory of planned behavior because it is the most applicable to support the safety behavior conceptual framework. The following paragraphs provide details explanation about the theory and the justification for its selection in this study.

The conceptual framework of this study was supported by the theory of planned behavior which was developed by Ajzen and Fishbein as an extension of the theory of reasoned

action (Ajzen & Fishbein, 1980). They suggested that a person's intention would determine the likelihood of a person to finally perform a behavior. This theory was tested by Ajzen and Madden in 1986 in two experiments involving 169 undergraduate college students enrolled in an introductory social psychology class (experiment 1) and 90 students enrolled in business administration (experiment 2). The first experiment examined the intention of the college students to attend the class while the second experiment determined the students' behavioral goal of getting an "A" in the course. The results were evaluated by means of hierarchical regression analysis and the finding indicated that the theory of planned behavior predicted the intention and goal attainment more accurately than the earlier theory of reasoned action (Ajzen & Madden, 1986).

The basic concept of the theory of planned behavior is based on the fundamental construct of intention to perform a behavior which is influenced by the attitude toward the behavior and the subjective norm. The attitude is the evaluation step of a behavior and it could be favorable or unfavorable depending on the salient information or beliefs linking the behavior to the outcomes such as cost and injuries incurred as a result of performing the behavior. In addition, the intention is also influenced by subjective norm which is a belief of perceived social pressure coming from the colleagues, bosses, parents, etc expecting the behavior to be performed or not to be performed by the person. In spite of the success of attitude and subjective norm as antecedents to predict a behavior, fundamental issues related to boundary conditions were identified (Ajzen & Madden, 1986). It was argued that during the transition between the intention and performing actual behavior, three conditions must be fulfilled. First, the intention must

be specific only to the behavior in question; second, this intention must not have changed during the transition and finally the duration of time interval between the intention and the behavior. It was found that the accuracy of the prediction varies inversely with the time interval between measurement of the intention and observation of the behavior (Ajzen & Madden, 1986). Therefore, additional determinant to address the issue relating to behavior control was introduced in the theory of planned behavior as explained in more detail in the following paragraph.

Ajzen and Madden (1986) discussed that the prediction of a behavior relying solely on attitude and subjective norm is sufficient when a person has a complete control of his behavior. However, this is not always the case because many factors can interfere with control over intended behavior. An internal factor such as competency and the availability of resources may impede a person's control of his or her behavior. It is therefore necessary to access the extent of this control to ensure accurate prediction of a behavior. For this reason, the theory of planned behavior was constructed to include perceived behavioral control and together with attitude and subjective norm ensure accurate prediction of a behavior (Ajzen & Madden, 1986). This theory as shown in Figure 2.1 suggests that attitude toward the behavior, subjective norm and perceived behavioral control exert an independent effect on behavioral intention as well as mediates the relationship between these three antecedents with the behavior. In addition, this theory also suggests that the person's perceived behavioral control, influenced by the availability of resources (e.g., skill, knowledge) and opportunities, can predict the behavior directly independent of the intention.

In supporting the theoretical framework for predicting safety behavior, the intention to perform a behavior is explained by safety commitment while attitude, subjective norm, and perceived behavioral control are explained by employees' conscientiousness, safety motivation and employees' competency, respectively.

In explaining behavioral intention to support safety commitment, Cooper (1998) stated that safety commitment characterizes a strong belief and acceptance of safety goals at the workplace and therefore crucial for organizational safety. It reflects the attitude and safety behavior of the employees. It's expected that successful safety practices require employees' safety commitment and this is determined by their attitude (Abd Aziz, 2008). Johnson (2003) stated that "when people are committed to an organization, a higher likelihood exists that they will behave according to institutional norm". Accordingly, employees are more committed when their personal values match with their perception of organizational values are more committed. Personal commitment strengthens the intention and inspires willingness to perform safe behavior according to safety standard enforced by the organization (Johnson, 2003).

In this study, the attitude component is explained by employees' conscientiousness. This is a personality trait of the Five Factor Model describing the unique quality of a person in comparison with other persons. The attitude of a conscientious employee is associated with qualities that reflect dependability and need for achievement (Hough et al., 1990; Barrick, Mount, & Strauss, 1993). They are generally hardworking, reliable and self-motivated to give full commitment to achieve individual and organizational goals. With

the right attitude, conscientious employees drive positive safety behavior and committed to participate in all safety programs. This is crucial because the right attitude is expected to impact safety commitment and consequently the safety behavior of the employees (Abd Aziz, 2008). In addition, Salgado (1997) found conscientiousness was a valid and true predictor for all jobs and criteria. Conscientious employees are goal-driven and they demonstrate high commitment to achieve them (Stewart, 1999). Barrick, Mount, and Strauss (1993) in a study among sales representative found conscientiousness was related to individual's commitment to goals and positively related to increase in sales volume. In occupational safety, Wallace and Vodanovich (2003) found conscientious employees caused fewer unsafe behavior and workplace accidents. They're aware about the risks and cautious about their conducts while performing the job to protect themselves against injuries.

Wright (1986) suggested that employees typically associate normal working practices with the work practices that every other employee does. In high risk industries, the subjective norm can be explained by self regulation enforced by regulatory bodies as well as the organizations to generate safe working environment. According to Reason (1997), only highly skill and motivated employees are recruited to perform the job in hazardous working environment and management expects these employees to exhibit safe working at all times and aware of the hazards around them. Safety rules and procedures are established to ensure behavior is guided and to ensure employees are more independent and self-regulated (Reason, Parker, & Lawton 1998). Rewards for compliance and punishment for violation to safety rules and procedures indicate seriousness by the

management. In other words, an employee is expected to behave according to organizational norm to ensure compliance with safety rules and regulations. Only motivated employees shall be able to meet this expectation. Geller (2001) stated that employees' motivation is a driving force to influence safety behavior among the employees at the workplace. Additionally, Geller suggested that the consequence of not getting injured as a result of behaving safely is a true motivator for safe behavior. Cooper (1998) stated that "proven strategies that harness group processes can be brought to bear to motivate people to behave safely and help each work group to positively redefine their safety related norms".

Beside attitude and subjective norm, the behavior of the people is strongly influenced by their confidence in their ability to perform (Bandura, Adams, & Beyer, 1977). This is attributed to how people perceived the control over the intended behavior which relies on the availability of resources, competency, support from other people and past experience with the behavior in question. The confidence may arise once the perceived control over the behavior is in place. In this study, perceived behavior control is explained by employees' competency and this is described as employees having adequate skill, knowledge and ability to execute the behavior will have better control on the behavior. It is believe that employees who have adequate competency are more motivated and willing to demonstrate strong commitment to handle the tasks and in a position to behave according to organizational safety norms (Spencer & Spencer, 1993). A competent employee reflects the right attitude and high values on job efficiency, productivity and more importantly on safety.

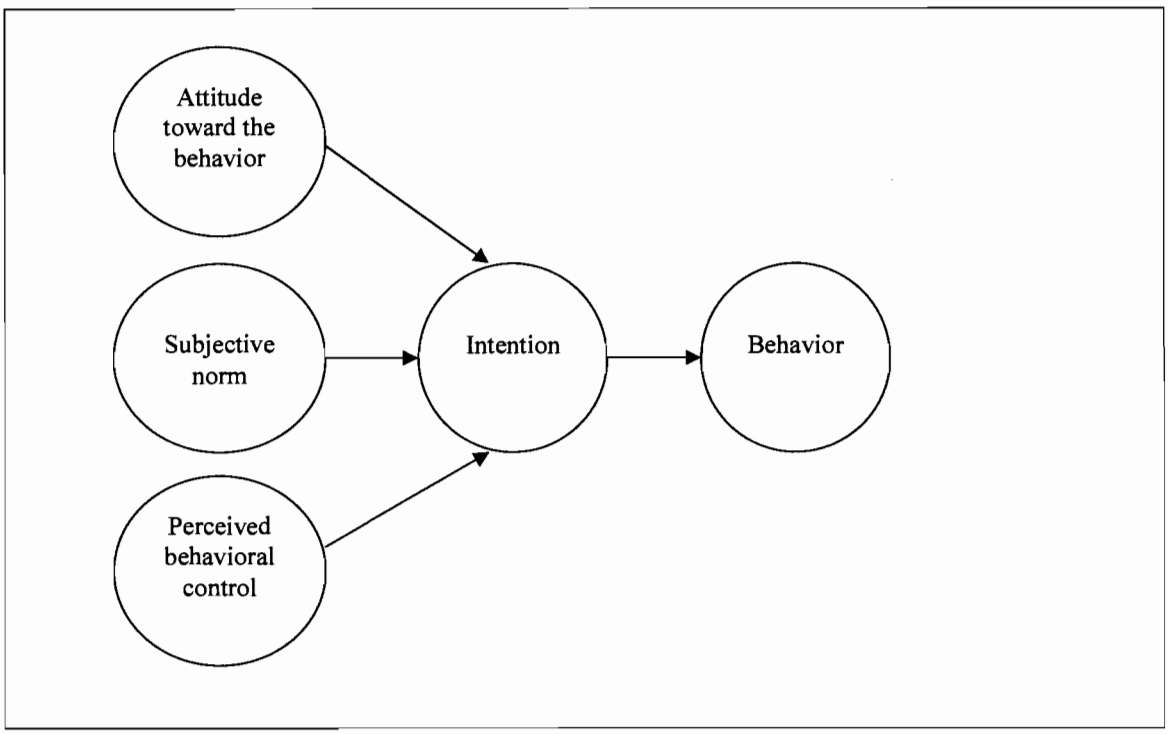

Figure 2.1
The Theory of Planned Behavior Model (Ajzen & Fishbein, 1985)

Figure 2.2 shows the theoretical framework for this study. The focus is on the individual safety behavior for the employees working in the Malaysian's petrochemical industry. The "employees" include staff working under company's payroll and the contractors working inside the company's premise (Occupational Safety and Health Act 1994 and Regulations, 2007). The variables in the framework include safety behavior, employees' conscientiousness, competency, safety motivation and safety commitment as a mediating variable.

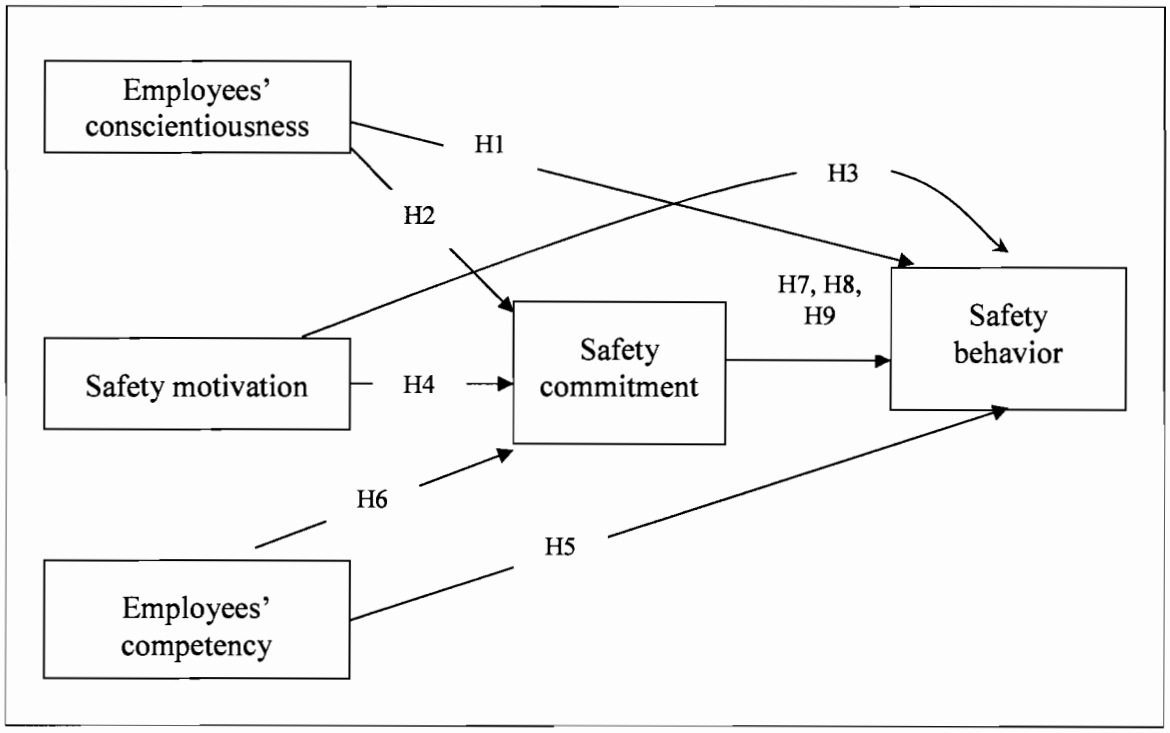

Figure 2.2
The theoretical framework supported by the theory of planned behavior

2.8 SUMMARY

The literature review started with the explanation about the development of Occupational Safety and Health (OSH) in Malaysia. Two Acts are currently enforced by the Department of Safety and Health (DOSH), namely the Factory and Machinery Act (FMA), 1967 and the Occupational of Safety and Health Act (OSHA), 1994. Under the FMA, there are 15 regulations covering the safety of the machineries and the competency of the person in charge of operating the machines. Several deficiencies were identified in this Act in relation to industrial safety. First, it covers only 23 percent of the workforce (Malaysia Trade Union Congress, 2008); second, the Act is prescriptive in nature which use checklist to identify hazards and to make corrective actions; and third, its

effectiveness depends on command and control approaches by the enforcement agencies. More importantly, the Act does not address safety behavioral issues of the employees at the workplace.

The Occupational Safety and Health Act 1994 cover a wider employee base with the exception of the arm forces and workers on board of the sips. This Act emphasizes on self-regulation and specifies the duties of the employers, employees, and the manufacturers. Section 24(1) states that employees are responsible for his safety and they also must comply with safety instructions instituted by their employers. However, the Act does not specify the method for influencing employees towards safety behavior and therefore this issue remains an open item for occupational safety in the industry. This study complements the legislative requirements by going deeper into understanding the safety behavior of the employees and the factors influencing it.

The fact was established that 95 percent of workplace accidents were caused by employees' unsafe act (Geller, 2000; Wikipedia, 2008). If it goes untreated, unsafe acts will reinforce unsafe behaviors and eventually unsafe behaviors may lead to serious accidents. In this study, safety behavior is described by employees' compliance behavior and voluntary participation in safety programs. Reason et al. (1998) suggested 10 rules to guide behaviors to pathway that ensures safety compliance to the requirement of the organizational safety rules. Many studies on safety behavior focused on the organizational factors such as safety culture, safety climate and organizational commitment to influence and drive safe behavior among employees (Neal & Griffin,

2000; Wyld, 2002; Zohar, 2002). It is the aim of the organization that these efforts on safety shall promote safety ownership which drives employees to develop stronger norms on safety behavior and engage in fewer unsafe behaviors. In comparison, the individual factors driving safety behaviors such as individual commitment to safety, employees' competency and their conscientiousness as well as their safety motivation received less attention in the literature and therefore this study was aiming to fill this gap.

The theoretical framework of this study was supported by the Theory of Planned Behavior (TBP) whose fundamental construct explains that the intention to perform a behavior is influenced by the attitude, subjective norm and perceived behavioral control. The attitude is the evaluation step of a behavior which could be either favorable or unfavorable depending on the individual's beliefs about the behavior-outcomes relationship. A subjective norm is a perceived social pressure exerted by the people surrounding the individual expecting him to perform or not to perform a behavior. In addition, perceived behavioral control reflects a person confident level and ability to perform a behavior. As an example, an intention to perform safe behavior is more favorable when a person perceived it can reduce occupational accidents (attitude) and this behavior is expected by the employer (subjective norm) and when this person is confident to perform this behavior (perceived behavior control).

In this framework, an intention represents an intention to perform safety behavior. A strong commitment would have a strong influence on safety behavior and would be translated in compliance and participating behavior in accordance organizational safety

goals. Employees' conscientiousness reflects the attitude towards safety which is associated with the characteristics of a person. Conscientious employees are reliable, motivated and committed to drive safe behavior at the workplace. The motivation of the employees to fulfill the expectation from the employers and the authorities towards safety compliance behavior represent the subjective norm or social pressure. Finally, perceived behavioral control represents employees' competency and this is described as employees having adequate skill, knowledge and ability to execute the behavior will have a better control on the intended behavior.

CHAPTER 3
METHODOLOGY

3.1 INTRODUCTION

This study examined the relationships between employees' conscientiousness, safety motivation, employees' competency, safety commitment, and safety behavior in the petrochemical industry in Malaysia. This chapter describes the methodology for the study, including the hypotheses development, research design, a description of the population and sample, the survey instruments, the operationalization of the research variables, validity and reliability tests, and the data collections and analysis.

3.2 HYPOTHESES DEVELOPMENT

3.2.1 Employees' Conscientiousness and Safety Behavior

Previous study by Hurt and Donovan (2000) found that conscientiousness influenced the job performance across a variety and level of occupations. This study was supported by Salgado (1997) and Stewart (1999) who cited the same findings. Hampson et al (2007) found conscientious student did better in school and lived a healthy life. Fallon et al (2000) stated that conscientiousness was significantly correlated with productive behaviors. In addition, conscientious salespersons were found to be more committed to their jobs and set high goals for themselves (Barrick, Mount & Strauss, 1991). They generated greater sales volume and received excellent supervisor ratings. In workplace

safety, Wallace and Vodanovich (2003) found conscientiousness had significant negative relationship with safety behaviors and workplace accidents. The present study intends to examine the relationship between employees' conscientiousness and safety behavior, thus H1 is presented below:

Hypothesis 1: Employees' conscientiousness will have a positive relationship with safety behaviors.

3.2.2 Employees' Conscientiousness and Safety Commitment

The employees' conscientiousness is believed to influence their commitment to the organizational goals. Barrick et al (1991) found conscientious salespersons were more committed to their job. Lounsbury, Smith, Levy, Leong and Gibson (2009) found conscientiousness correlated significantly and positively with life satisfaction and the commitment among students majoring in business studies compare to nonbusiness majors. Accordingly, they stated that "people flourish in environments where there is a good fit between their personality and environments in which they function." In business, conscientiousness activities involve honoring commitment to ensure its success. Jin, Watkins and Yuen (2009) found conscientiousness related significantly to the commitment to the career choices among Chinese graduate students. Those students with high commitment level would have clear occupational preferences and prepared themselves for achieving their career goals. However, there were no previous studies

correlating employees' conscientiousness and safety commitment. Thus H2 is presented as:

Hypothesis 2: Employees' conscientiousness will have a positive relationship with safety commitment.

3.2.3 Safety Motivation and Safety Behavior

Motivation is a driving force that stimulated someone to take actions. It is an internal state that arouses individuals to take action, pushes them in particular directions, and keeps them engaged in certain activities. This force is believed will influence the behavior and the expected results. Vohs et al (2007) found that in economic transaction, motivated people were cautious and adopted aversive approach to avoid being cheated. Similarly, motivation were found to be significantly related to effective transferring of knowledge (Cheng & Ho, 2001), workplace deviance (Diefendoff & Mehta, 2007), and job performance (Klehe & Anderson, 2007). Likewise safety motivation was associated with compliance to safety rules and procedures and voluntary self-engaging in safety initiatives (Neal & Griffin, 2006; Probst & Brubaker, 2004; Hinsz, Nickell & Park, 2007). It is believed that motivated employees shall demonstrate positive behavior and display the can-do attitude. Thus, H3 is presented as:

Hypothesis 3: Safety motivation will have a positive relationship with safety behaviors.

3.2.4 Safety Motivation and Safety Commitment

A study on absenteeism conducted by Burton, Lee, and Holtom (2002) among the retailers revealed that motivation to attend was strongly related to their commitment to the organization. Similarly, Chonko (1986) found commitment among the sales force was influenced by the rewards motivation systems which drove them for excellent performance. Tsui, Lee, Fu, Wu, Zhang, and Li (2009) suggested the relationship between employees and the organizations motivated the employees to demonstrate their commitment and loyalty. These studies concluded that motivation is positively relation to the commitment. However, no studies have examined the relationship between safety motivation and individual safety commitment in the organization. Therefore, H4 is presented below:

> Hypothesis 4: Safety motivation will have a positive relationship with safety commitment.

3.2.5 Employees' Competency and Safety Behavior

Operators of petrochemical industries are required to have a minimum competency level to operate the plants safely. This is a policy set by the management for hiring new employees. It includes both mental and physical competencies. Besides the organizational policy, the government also regulates the employers to have competent persons as Safety Officers to enforce the safety regulations in the organization.

Competent employees are expected to have more knowledge about safety which shall be able to motivate them to be more conscious while on the job and avoid unsafe behaviors. Previous studies suggest there are differences in individual competencies (e.g., Matthews, Jones, & Chamberlain, 1992) but the findings show significant positive relationship with the job performance (Loven & Helander, 1997; Lind & Nenonen, 2008). Since safety behavior is also a performance indicated by the compliance and safety participation, H5 is presented as:

> Hypothesis 5: Employees' competency will have a positive relationship with safety behavior.

3.2.6 Employees' Competency and Safety Commitment

Competencies and employees' safety commitment are imminent in petrochemical industry because of the hazards and risks inherent in this industry. It reflects the knowledge, skill and ability of a person to perform a task according to the acceptable standard of performance (Cooper, 1998). These individuals must have an acceptable level of mental and physical ability to be called as competent persons (Spencer & Spencer, 1993) and they shall be able to understand the work condition and the technicalities involved. These individuals are certified professionals who know their job better than anyone else in this industry (Cox & Cox, 1996).

The competency approach has been applied for various purposes and various professions (Abd Aziz, 2008). Loven and Helander (1997) find competent manufacturing operators improved the quality of the production. Lind and Nenonen (2008) review accident data for the last 10 years and concluded 40 percent of fatal accidents in industrial maintenance was due to lack of competency. Wilk, Desmarais and Sackett (1995) discussed the matching between the individual ability and the job. According to these authors, the individuals, over the course of their working experience, will sort themselves into jobs that are compatible with their interests, values, and abilities

Competent employees are more confident and have better control over the tasks. It affects their commitment to the jobs and to their employers. For safety, this is crucial to ensure they know how to protect themselves against any danger at the workplace. Therefore, H6 is presented below:

> Hypothesis 6: Employees' competency will have a positive relationship with safety commitment.

3.2.7 Safety Commitment as Mediator

Wallace and Vodanovich (2003) find significant positive relationship between conscientiousness and cognitive failure with unsafe behaviors. The authors suggested further investigations are needed in identifying mediating and additional constructs that may affect accident rates. Their suggestions are supported by Barron and Kenny's (1986)

recommendation who state a mediator is present when there is a significant relationship between independent and dependent variables.

The commitment, in general, represents the intention to perform a behavior and this is influenced by a person's attitude, the social pressure from peers and the perceived control over his own behavior (Ajzen & Fishbein, 1986). Johnson (2003) suggests the relationship between and attitude and subjective in behavioral model is mediated by a commitment. It is stronger when a person is motivated, competent and conscientious about safety and shall lead him to demonstrate high standard of safety behavior. Likewise, it is believed that the safety commitment is less strong when a person is not motivated, less competent and not confident to handle his job. The study to test safety commitment as mediator is yet to be conducted and therefore this study proposes safety commitment mediates the relationship between employees' conscientiousness, safety motivation, employees' competency and safety behavior. Therefore, H7 is presented as follow:

Hypothesis 7: Safety commitment will mediate the relationship between employees' conscientiousness and safety behavior.

Hypothesis 8: Safety commitment will mediate the relationship between safety motivation and safety behavior.

Hypothesis 9: Safety commitment will mediate the relationship between employees' competency and safety behavior.

3.3 RESEARCH DESIGN

This study identified the extent to which selected human related factors (conscientiousness, motivation, competency, and commitment) can influence the safety behavior of the employees handling hazardous materials and exposing themselves to potential major accident hazards in the petrochemical industry. Since the hope from the industry is high that such a study shall resolve the issue of the workplace injuries, every step in the process is crucial to ensure the study is complete, reliable and more importantly applicable. In this case, the general pattern in the research process is defining the problem, reviewing relevant literature, planning a research design, planning a sample, collecting data, analyzing data and formulating the conclusions and preparing report (Zikmund, 2003).

The research design involving quantitative, cross-sectional and survey type was employed for this study because it was the most appropriate method due to its economy of design and a rapid turnaround in data collection (Creswell, 2003). Anderson, Sweeney and Williams (2000) argue that a quantitative research approach can reliably determine if one idea or concept is better than the alternatives. Furthermore, quantitative multivariate methods enable researchers to measure and control variables. Leedy and Ormrod (2005) suggest that quantitative research is used to answer questions about relationships among

measured variables with the purpose of explaining, predicting, and controlling phenomena. Therefore, quantitative research design met the needs of this study, as the researcher sought to provide reliable and valid outcomes.

The setting for this study was non-contrived. No manipulation of variables or manipulation of outcomes occurred. The study occurred in a real-life setting and it was conducted in the field with individuals responding to a questionnaire that asked participants to respond to the questions from their own personal experience.

3.4 POPULATION AND SAMPLING

The population in this study includes all staff and contractors directly and indirectly involve in the manufacturing, marketing, and distribution of petrochemical products in Malaysia. The target respondents or the sampling units were the manufacturing or operation employees and contractors working in petrochemical industry in Peninsular Malaysia only. By OSHA definition, an employee includes a person who is directly employed by the principal employer, leased or contracted for the service (Occupational Safety and Health Act 1994 and regulations, 2007). Leased employees are employed by the third party (immediate supervisor) but work under the supervision of the principal employer while contractors are supervised directly by their immediate employer. Those who are attached in the operation of the plant would be exposed to the material and occupational hazards and therefore they are the most suitable candidates for this study. The number of registered workforce in this category for Peninsular Malaysia is estimated

to be more than 5,000 people (Malaysian Petrochemicals Association, 2006). The biggest petrochemical integrated sites are found in Peninsular Malaysia located in Gebeng (Pahang) and Kerteh (Terengganu) where National Oil Company (Petronas) had set up its base. Other petrochemical sites that are comparable in size are located in Pasir Gudang (Johor) and Port Dickson (Negeri Sembilan). Accordingly, the samples collected from these sites were believed to be representative of this industry in the country.

The sample size should be adequate to the research by being large enough to approximate the characteristics of the population satisfactorily and provide a credible result (McMillan & Schumacher, 2001). According to Gay and Airasian (2003), when the population size in about 5,000 or more, the sample size of 400 should be adequate. Therefore, to meet the objectives of this study, a sample size of 400 is appropriate and sufficient for further analysis.

In order to reach valid conclusions about population from samples, random sampling is the best way to reduce bias and gain the ability to generalize (Sekaran, 2000). The disadvantage of this method is that the process is cumbersome and expensive. Because of time and budget constraints, this study adopted the availability sampling method, which is an alternative to random sampling (Keppel, Saufley & Tokunaga, 1992). This method collects from the companies that are willing to participate in the research. Therefore, the subjects are free to decide whether they want to participate or not in the research.

3.5 INSTRUMENTS AND OPERATIONALIZATION OF THE VARIABLES

3.5.1 Instruments

This study applied quantitative approach in data collection process. A survey method was used to collect the data from the respondent because this is the most appropriate method due to the economy of design and a rapid turnover in data collection (Creswell, 2003; Anderson, Sweeney, & Williams, 2000; Leedy & Ormrod, 2005; Oppenheim, 2000). The survey questionnaire used in this study was adopted from previous studies and represents a compilation of survey items already tested for reliability and used in the earlier empirical studies by other researchers in the field. As recommended by O'Sullivan, Rassel and Berner (2003), the questionnaires were evaluated by three dimensions of reliability: stability, equivalence, and internal consistency. To establish operational validity, a minimum of three questions were developed to measure a given variable.

The survey questionnaire utilized the closed-ended question format that gives a uniform frame of reference for respondents to decide their answers (Weisberg & Bowen, 1977). According to Folz (1995), the hallmarks of survey questionnaire are clarity, simplicity, and attractiveness. Clear and logical questions with suitable response choices foster accurate and consistent responses. The flow of questions should be logical, so that the respondents would be able to see easily the relationship between the questions asked and the stated objectives of the research (Casley & Kumar, 1988).

This survey questionnaire was developed with specific questions to answer the research questions and to test the hypotheses. The questionnaire was divided into six sections. Section A measured safety behavior (11 questions), section B measured safety motivation (4 questions), section C measured employees' conscientiousness (20 questions), and section D measured the safety commitment (21 questions) and section E measured employees' competency (10 questions). Demographic questions were included in section F to provide a profile of the respondents. To measure the intensity of the respondent's views, a five-point Likert scale was employed.

The questionnaire was reviewed by a couple of faculty members and doctoral students of Universiti Utara Malaysia for detecting content validity of measurement items. The idea was to identify and correct weaknesses, ambiguity, and invalidity of the questions. This would assist the researcher in determining the strengths and weaknesses of the questionnaire as it related to question format, wording, and order. After the review was completed, the researcher diagnosed problems and revised the wording of questions to solve problems. A clear, easy answering, comprehensive, and professional survey questionnaire was obtained. Face and content validity of the questionnaire was achieved through the review.

The questionnaire was also translated into Bahasa Melayu by an expert language translator. The questionnaire was then reviewed by the researcher and his supervisor, for any anomalies that might be found due to the limited exposure of this translator with respect to the standard use of particular business and management terms. Once the

questionnaire was edited for these anomalies, it was then sent back to another translator and was translated back into English to assure consistency in language to the extent possible.

3.5.2 Operationalization of Variables

Operationalization of variables is the development of specific research procedures that will result in empirical observations representing those concepts in the real world (Babbie, 1992). More simply, it is stating how variables will be measured. Five variables were measured in this study, namely: safety behavior, safety motivation, employees' conscientiousness, employees' competency and safety commitment. The operational definitions of the variables are described below:

Safety behavior

Safety behavior was measured by safety initiative and safety compliance. Three items adopted from Neal et al. (2006) were used to measure safety compliance. In addition, safety initiative was measured using eight items adopted from Zacharatos (2001). Safety initiative describes the behavior that support safety such as participating in safety programs while safety compliance explains the core activities that need to be carried by employees to ensure the area is protected from injuries such as complying with safety rules and safety procedures. All of these items were measured using a 5-point Likert

scale, and were coded on a scale of 1 (strongly disagree) to 5 (strongly agree). The scale items are listed in Table 3.1 below:

Table 3.1
Safety Behavior Scale

1.	I use all the necessary equipment to do my job.
2.	I use the correct safety procedures for carrying out my job.
3.	I ensure the highest levels of safety when I carry out my job.
4.	I am involved in improving safety policy and practices.
5.	If I think it will make work safer, I initiate steps to improve work procedures.
6.	If I see something unsafe, I go out of my way to address it.
7.	I voluntarily carry out tasks or activities that help to improve workplace safety.
8.	I often make suggestions to improve how safety is handled around here.
9.	I often try new approaches to improving workplace safety.
10.	I often try to solve problems in ways that reduce safety risks.
11.	I keep abreast of changes to do with safety.

Safety motivation

Four items measure employee safety motivation. Three items derived from Neal et al. (2000) and one item derived from Zacharatos (2001). A sample item is "I believe that it is important to reduce the risk of occupation accidents and incidents". Responses were measured on a 5-point Likert type scale and ranged from "Strongly disagree" (1) to

"strongly agree" (5). Higher scores reflect higher employee motivation. The scale items on safety motivation are listed in Table 3.2 below:

Table 3.2
Safety Motivation Scale

1.	I feel that it is worthwhile to put effort to maintain or improve my personal safety.
2.	I feel it is important to maintain safety at all times.
3	I believe that it is important to reduce risk of occupational accidents and incidents.
4.	I believe that workplace health and safety is an important issue.

Employees' conscientiousness

The items that measure employees' conscientiousness derived from Goldberg (1999) and contained twenty items. The items were also measured on a five point Likert scale, where 1 indicated 'strongly disagree' and 5 indicated 'strongly agree'. The scale items on employees' conscientiousness are listed in Table 3.3 below:

Table 3.3
Employees' Conscientiousness Scale

1.	I normally follow the rules and regulations.
2.	I get others to do my duties.
3.	I completed my duties on time.
4.	I listen to my conscience.
5.	I break the rules.

6. I go straight for the goals.
7. I break my promises.
8. I do more that what is expected of me.
9. I keep my promises.
10. I normally misrepresent the facts.
11. I demand for quality.
12. I work hard.
13. I put little time and effort into my work.
14. I plunge into tasks with all my heart.
15. I do the opposite of what is asked.
16. I set high standards for myself and others.
17. I turn plans into actions.
18. I am not highly motivated to succeed.
19. I do just enough work to get by.
20. I tell the truth.

Safety Commitment

Safety commitment was measured by twenty one items derived from Abd Aziz (2008). There are three dimensions in this measurement tools which are priority on safety, safety involvement and safety compliance. All of these items were measured using 5-point Likert scale. The scale items on safety commitment are listed in Table 3.4 below:

Table 3.4
Safety Commitment Scale

1.	I would not be worried about the hazard and risk at my workplace.
2.	I really care about the safety procedures and regulations at my workplace.
3.	Near miss accidents are not important in safety records.
4.	I am willing to put great effort beyond that normally expected in order to be a competent worker.
5.	I would ensure the risks are assessed before starting my work.
6.	It is very important to work in a safe environment.
7.	I never give cooperation to my supervisor about safety issues.
8.	I am willing to put in great effort to achieve safety goals.
9.	I would like to obey the safety regulations in order to keep workplace safe.
10.	All employees should be actively involved in safety promotion activities.
11.	I think putting more effort into understanding all safety rules is a waste of time.
12.	I am extremely glad if I am selected to be a member of a safety committee at my workplace.
13.	Safety procedures and regulations reflect the safest techniques of doing a job.
14.	It is an employee's duty and responsibility to support and encourage their colleagues to obey the safety rules/procedures/regulations.
15.	I always ensure that the safety equipment is working properly before I start a job.
16.	I am willing to do extra jobs in order to improve the safety performance at my workplace.
17.	I would not feel guilty if I used a 'short cut' while completing my work.

18. I would like to be involved in safety discussions at my workplace.
19. I am ready to involve myself in the organizational safety activities.
20. I really would like to take part in occupational safety rule/procedure/regulation reviews.
21. I would like to be involved in the safety goal planning at workplace.

Employees' Competency

Employees' competency was measured using 10 items adopted from safety climate tools questionnaires (Davies, Spencer & Dooley, 2001). Item 1, 3, 4, 8, 9 and 10 were adopted from Health and Safety Climate Survey Tool, item 7 was adopted from Offshore Safety Questionnaire, item 2 and 5 were adopted from Loughborough Safety Climate Questionnaire and finally item 6 was adopted from Quest Safety Climate Questionnaire (Davies, Spencer & Dooley, 2001). All of these items were measured using 5-point Likert scale. The scale items on safety commitment are listed in Table 3.5 below:

Table 3.5
Employees' Competency Scale

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1. I fully understand the safety procedures / instructions associated with my job.
2. I understand the safety rules for my job.
3. Sometimes I am uncertain what to do to ensure safety in the work for which I am responsible.

4. I am confident that I can identify the safety risks associated with the work for which I am responsible.

5. I am clear about what my responsibilities are for safety.

6. I understand the nature of all the hazards I am likely to encounter during my work.

7. Sometimes I am confused about what I am supposed to do.

8. I have a poor understanding of the risks associated with my work.

9. I am good at detecting unsafe behavior during performing the job.

10. I am not very effective at ensuring safety in the work for which I am responsible.

3.6 VALIDITY AND RELIABILITY

All the variables used were tested by previous researchers for validity and reliability. Validity is defined as the degree to which a measurement scale measures what it is intended to measure (Nunnally, 1978). The commonly used types of validity in research are content validity and construct validity. Content validity assesses the extent to which the instrument provides adequate coverage of the research questions (Cooper & Schindler, 2006). The assessment of content validity has been described as mainly subjective and based essentially on judgment (Green, Tull & Albaum, 1988). This study addressed content validity through an extensive review of literature. Construct validity is

described as the extent to which measures represent it is assumed they measure (Bohrnstedt, 1970). Construct validity is this study was determined by factor analysis technique. Factor analysis examines the interrelationships among a large number of variables and then attempts to explain them in terms of their common underlying dimensions (Babbie, 1991). The meaning of each factor will be determined based on how those variables load. Two criteria were taken into account; a factor must explain a relatively large portion of the variance found in the variables, and each factor must be independent of each other factor.

Reliability describes the degree to which the measurement instrument accurately and repeatedly measures the intended construct (Churchill, 1979). Reliability of the results of this study were tested using Cronbach alpha, a coefficient of reliability which measures how well each item in a scale correlates with the sum of the remaining items. It measures consistency among items in a scale. This technique is the widely used internal consistency coefficient.

3.7 DATA COLLECTION PROCEDURES

A major weakness of a questionnaire survey is non-response bias, which may lead to a poor sample and affect both the reliability of the research and the types of data analysis (Emery & Cooper, 1991; Davis & Cosenza, 1993; Neuman, 1994). Non-response bias may be reduced through proper design of data collection procedures, such as the avoidance of ambiguous questions, and the use of preliminary notification and follow ups

(Armstrong & Overton, 1977; Churchill, 1995). To overcome the difficulties of a low response rate, an administered-on-site method was used to collect the questionnaires. Snow and Thomas (1994) suggest the use of an administered-on-site method to improve the response rate. This method requires the researcher to meet the respondents face-to-face and ask the respondents to complete the questionnaire during this meeting.

The process of data collection began when the researcher explained the details of the study to the key contact persons at the rank of executive level in each participating petrochemical company. They volunteered to distribute the questionnaires on behalf of the researcher. In order to get accurate information and minimize social desirability, a rich explanation of the significance of the research was presented in the beginning of the survey (Wei, 2006). The respondents were also explained to fill in the questionnaires based on simple facts rather than past opinions or beliefs from reading the introduction of the questionnaire. This is to reduce the complexity, ambiguity burden, and consistency for judgment. The respondents were also instructed to answer each question in terms of the actual situation rather than the ideal situation. In addition, they were reminded that there were no rights or wrong answers to the questions. A guaranteed confidentiality statement was also included in the questionnaire.

A total of 17 petrochemical firms located in Port Dickson (Negeri Sembilan), Gebeng (Pahang) and Kerteh (Pahang) agreed to participate in this survey. Permission was given by respective Senior Managers at each firm for the key contact person to conduct the survey at the firm's premise. On estimate, at least 50 respondents were required for each

firm's participation and they were selected randomly. Detailed explanations were given to the participants on how to complete the questionnaire. It was made clear to these employees that the survey was optional and choosing not to participate would not affect their jobs in any way. The participants were then asked to hand in completed questionnaires to the key contact person who contacted the researcher for collection. A total of 671 usable questionnaires were received, representing 66 per cent response rate. This response rate is relatively high in a survey research. It was the researcher's connection with the key contact persons that had helped to gain such a high response rate. Given the on-site data collection, a test of response bias by comparison of early and late respondents was not appropriate.

3.8 DATA ANALYSIS

Statistical Package for Social Science (SPSS) version 11 software was employed for the data analysis. The first process was to conduct a pilot test and to determine the reliability of the items used in the questionnaire. The alpha coefficient of more than 0.60 is acceptable according to Sekaran (2000). Later, an exploratory factor analysis was utilized to check the measurement equivalence across all items. Factor analysis is a useful method for analyzing many variables that belong together and have overlapping measurement characteristics (Cooper & Schindler, 2001). The factor analysis used the principal components method with a Varimax rotation. Principal component analysis is an exploratory technique that provides a better understanding of the interrelationships among the variables by simplifying the description of those variables (Afifi, Clark &

May, 2004). The main advantage of using principal component analysis is reducing the dimensionality of the problem without losing much of the information. Principal component analysis transforms the original measures into a smaller set of linear combinations with all of the variance being used.

Multiple regression analysis was used to test all the hypotheses in this study. Multiple regression analysis indicates the strength of the relationships between the variables. It also measures how much variance in the dependent variable is explained by independent variables. Before confirming these relationships, this study also attempts to detect the underlying assumptions of regression analysis, such as normality, homogeneity, multicollinearity, and linearity. In addition, frequency distributions of the variables were examined and they are presented in tables.

To test the mediation effect, a four step multiple regression procedure developed by Barron and Kenny (1986) was employed. The procedure uses three regression equations to establish a mediation relationship between a predictor variable and an outcome variable. The model of the mediation relationships is shown in Figure 3.1 below. Accordingly, Barron and Kenny (1986) discussed four steps in establishing mediation:

Step 1: Show that the initial variable is correlated with the outcome. Use Y as the criterion variable in a regression equation and X as a predictor (estimate and test patch c). This step establishes that there is an effect that might be mediated.

Step 2: Show that the initial variable is correlated with the mediator. Use M as the criterion variable in the regression equation and X as a predictor (estimate and test path a). This step is essentially treating the mediator as if it were an outcome variable.

Step 3: Show that the mediator affects the outcome variable. Use Y as the criterion variable in a regression equation and X and M as predictors (estimate and test path b). Correlating the mediator and the outcome is not sufficient because the mediator and the outcome may be correlated because both variables are caused by initial variable X. Thus the initial variable X must be controlled in establishing the effect of the mediator on the outcome.

Step 4: To establish that M completely mediates the X-Y relationship, the effect of X on Y controlling for M (path c') should be zero.

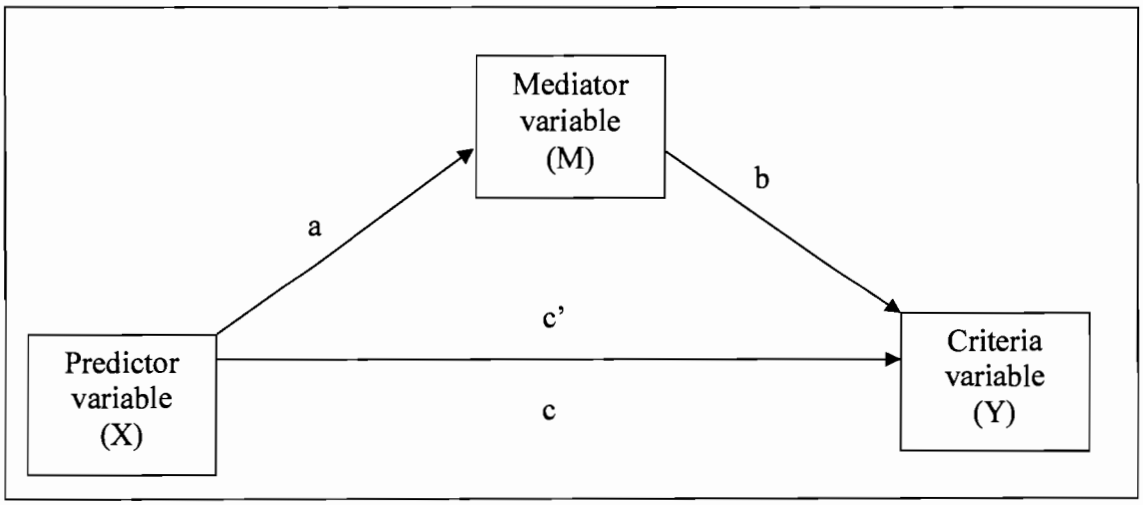

Figure 3.1
Mediation model by Barron and Kenny (1986)

3.9 PILOT STUDY AND RELIABILITY MEASUREMENT

Reliability measurement provides information about consistency of the variables used in the measurement tools (Hair et al, 2006; Pallant, 2007). Two most common measurements of reliability of scale are test-retest reliability and internal consistency. The method of assessing the test-retest reliability is by administrating the scale to the same people on two different occasions and comparing the two scores. High correlations of these two scores indicate a reliable scale. However, the correlation is likely to be lower because the mood of the respondent may change from one occasion to another occasion. In addition, getting the same group of respondents to agree on completing the same scale over two different occasions might not be practical. Thus, the reliability of measurement tools for the present study was assessed using internal consistency method. It measures the degree to which the items in the scale measure the same underlying attribute (Pallant, 2007) and measured in term of Cronbach's coefficient alpha which is the most popular test (Cavana et al., 2001; Sekaran, 2000) and is widely accepted (Bryman & Cramer, 1990).

Prior to mass distribution of the survey questionnaire, a pilot study was conducted to ensure the questionnaires were understood, reliable and usable to collect data from a large scale population. A total of 70 questionnaires were distributed to the respondents via email and 30 completed questionnaires were returned (43 percent returned rate). The respondents consisted of 27 males and 3 females. The Malays respondents formed a majority group (28) followed by the Chinese (2). The highest number of respondents was

between 18 to 25 years old (25) and 26 respondents were diploma or degree holders. In term of job category, 19 respondents were in the middle management while 9 and 2 of them were in the technician and senior management category, respectively. Majority of them (25) were permanent staff while the remaining was contractors. In term of working experience, 26 or the respondents had less than 5 years of working experience and the remaining 4 of the respondents had worked between 6 to 10 years.

All items in the questionnaires were adopted from previous research studies. Safety behavior scale was adopted from Zacharatos (2001) and Neal et al (2006). It consists of 3 items measuring safety compliance and 8 items measuring safety participation. Safety motivation scale was assessed using 4 items adopted from Zacharatos (2001) and Neal et al (2006). Employees' conscientiousness scale was measured using 20 items adopted from Goldberg (1999). Employees' competency scale was assessed using 10 items adopted from safety climate tool questionnaires. Safety commitment scale was measured using 21 items adopted from Abd Aziz (2008) safety commitment measurement tools. All items were measured using 5-point Likert scale and ranged from "1-strongly disagree" to "5-strongly agree".

The internal consistency of the measurement tools were analyzed using SPSS version 11 by determining the Cronbach's alpha coefficient. Sekaran (2000) recommended a value above .6 for good internal consistencies. Table 3.6 shows the results of the reliability analysis which shows all Cronbach's alpha coefficient values were above .6. In fact, all values were above .7, an ideal for good internal consistencies (DeVellis, 2003). It was

concluded that the measurement tools were consistent, reliable and usable to be used for data collection survey.

Table 3.6
The results of the internal consistencies analysis for the pilot test

Dimension	Number of items	Label	Cronbach alpha coefficient
Safety behavior	11	A1 to A11	.907
Safety motivation	4	B1 to B4	.990
Employees' conscientiousness	20	C1 to C20	.874
Safety commitment	21	D1 to D21	.750
Employees' competency	10	E1 to E10	.870

For data collected from the survey, all items in Section A, B, C, D, and E were subjected to the reliability test. In addition, the overall reliability level for the total items in the questionnaire was also assessed. Measurement tool in Section B contains only four items and according to Pallant (2005) it is common to find measurement tool contains less than ten items register low Cronbach values (e.g., 0.5). Accordingly, Pallant (2007) recommended for such a case, the mean inter-item correlation for the items to be reported. Briggs and Cheek (1986) recommended an optimal range for the inter-item correlation of 0.2 and 0.4. For this purpose, the reliability analysis will adopt the recommendation from Sekaran (2000) and Hair et al (2006) for acceptability of Cronbach coefficient value and Pallant (2007) for measuring the inter-item correlations. A

Cronbach alpha value of 0.6 to 0.7 is the lower limit of acceptability (Hair, 1998; Sekaran, 2000). Pallant (2007) recommends value of 0.7 as acceptable; however, values above 0.8 are preferable. To check for consistencies with previous findings since all items used in the present study were adopted, the Cronbach coefficient values were compared with findings from previous studies. The findings of the reliability test for each section of the questionnaire are explained in Table 3.7.

Table 3.7
The Cronbach coefficient alpha value for reliability test for each section of the questionnaire

Section of questionnaire	Measurement tool	Cronbach coefficient alpha value
A	Safety behavior (11 items)	0.889
B	Safety motivation (4 items)	0.854
C	Employees' conscientiousness (20 items)	0.851
D	Safety commitment (21 items)	0.885
E	Employees' competency (10 items)	0.824
	Overall reliability (66 items)	0.950

The Cronbach alpha for each measurement tool exceeded the acceptable and preferable recommended values. None of the items was deleted because the alpha values showed good internal consistency. Items in Sections B were further analyzed to determine the mean inter-item correlations and the minimum to maximum range since the items were less than ten. The result of the analysis is presented in Table 3.8. The mean inter-item correlation was 0.5968, with values ranging from 0.5241 to 0.6599. Briggs and Cheek (1986) recommended an optimal range for the inter-item correlation of 0.2 and 0.4. This finding suggests quite a strong relationship among the items and therefore indicated a good internal consistency.

Table 3.8
The mean inter-items correlation for safety motivation measurement tool

Mean	Minimum	Maximum	Range	Max/Min
0.5968	0.5241	0.6599	0.1358	1.2591

Previous studies found approximately similar levels of reliability coefficients for all measurement tools. For workplace safety behavior scale, Wallace and Vodanovich (2003) reported internal consistency of 0.83 in their study of workplace safety behavior and performance among production workers. Similarly, Hoffman and Stetzer (1996) reported internal consistency of 0.89. In addition, Neal (2006) in a study in an Australian hospital reported internal consistency from 0.86 to 0.92. For items measuring conscientiousness, Wallace (2004) in a study among workers in a large facilities department published reliability coefficients from 0.7 to 0.8. Neal (2006) reported alpha value from 0.85 to 0.92 for motivation measurement tool.

3.9.1 Corrected Items-Total Correlations

The purpose of corrected item to total correlations analysis is to show the correlation between each item of the measurement scale and the total score. It provides an indication of the degree to which each item correlates with the total score. In this analysis, the findings for all sections of the measurement tool are shown, but the discussion focuses mainly on the safety commitment measurement tool and safety behavior because these are the tools most closely related to the objectives of this study. The value of the corrected item-total correlation that this analysis provides is the indicator for retaining or

omitting items statements in the scale. Table 3.9 shows the detailed results of the item analysis for the safety commitment measurement tool. According to Pallant (2007), a good scale would have a corrected item-total correlation values above 0.3. Accordingly, Pallant (2007) recommended removing items with low item-total correlations (less than 0.3) if scale's overall Cronbach alpha is less than 0.7. All item values of corrected item-total correlation in Table 3.9 are higher than 0.3 except item D1 but the overall Cronbach alpha value was above 0.7. Therefore, all items in safety commitment measurement tool were retained.

Table 3.9
Result from item analysis for the safety commitment measurement tool

Item number	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach Alpha if Item Deleted
D1	85.0633	57.7150	**0.2172**	0.8939
D2	84.8522	56.7636	0.5965	0.8779
D3	84.819	57.0548	0.3549	0.8854
D4	84.9804	57.0313	0.5770	0.8785
D5	84.9774	56.8076	0.6175	0.8776
D6	84.6063	57.8735	0.5213	0.8802
D7	84.7858	56.1081	0.4368	0.8825
D8	84.8643	56.6130	0.6474	0.8770
D9	84.8477	56.5311	0.5522	0.8786
D10	84.8386	56.6068	0.5731	0.8782
D11	84.7707	56.8658	0.3445	0.8863
D12	85.3831	55.6536	0.5243	0.8792
D13	84.9291	57.2744	0.4806	0.8806
D14	84.9170	56.4780	0.5716	0.8782
D15	84.8552	57.1512	0.5238	0.8796
D16	85.1433	56.0837	0.5460	0.8786
D17	85.1961	55.1851	0.4461	0.8830
D18	85.1599	56.5363	0.5716	0.8782
D19	85.1493	56.4988	0.5787	0.8781
D20	85.1976	56.3129	0.5795	0.8779
D21	85.1584	56.5262	0.5690	0.8783

Overall Cronbach alpha 0.885

Similarly, all item values of corrected item-total correlation in Table 3.10 are higher than 0.3 and the overall Cronbach alpha value was above 0.7. Therefore, all items in safety behavior measurement tool were retained.

Table 3.10
Result from item analysis for the safety behavior measurement tool

Item number	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach Alpha if Item Deleted
A1	41.9744	23.1670	0.5379	0.8831
A2	41.9985	23.0831	0.6186	0.8787
A3	41.9382	23.0400	0.5838	0.8805
A4	42.3937	21.6469	0.6070	0.8801
A5	42.0452	23.1883	0.6239	0.8787
A6	42.0995	22.3133	0.6514	0.8763
A7	42.2157	23.1090	0.5239	0.8841
A8	42.3394	21.8620	0.6991	0.8731
A9	42.4208	21.7033	0.6706	0.8749
A10	42.1991	23.3561	0.5671	0.8815
A11	42.3575	21.8675	0.6415	0.8769
Overall Cronbach alpha 0. 889				

3.10 SUMMARY

The research design for this study employed a quantitative, cross-sectional and survey type because this method was the most appropriate for economy of design and a rapid turnaround in data collection process (Creswell, 2003). In addition, quantitative method was appropriate for answering questions about relationships among measured variables with the purpose of explaining, predicting and controlling phenomena (Leedy & Ormrod, 2005). This method is reliable to determine which idea or concept is better among various alternatives (Anderson, Sweeney, & Williams, 2000). This study was conducted

in a real-life work setting and it was conducted in the field with individuals responding to questionnaires from their own personal experience. Using cross-sectional method, the feedback represents the views of individuals across of different backgrounds which provided meaningful insight of their safety attitude and behavior.

The population for this study was the employees and contractors working in petrochemical companies in Peninsular Malaysia. The three biggest petrochemical sites were in Gebeng Industrial Estate, Pahang, Kerteh, Terengganu and Pasir Gudang, Johor. The respondents were those people who operated and maintained the plants. They were the most suitable candidates for this study due to the nature of their work involving hazardous chemicals and high risk plant operation. An estimated of 10,000 people were employed to work in this industry (Malaysian Petrochemicals Association, 2007). For a population of 5,000 or more, the sample size of 400 was adequate and sufficient for further data analysis (Gay & Airasian, 2003). The samples were collected using the availability sampling technique which was relatively easy to carry out compare to other methods and appropriate due to time and budget constraints (Keppel, Saufley, & Tokunaga, 1992).

The survey questionnaires used in this study were adopted from the survey items already tested for its reliability and were used for empirical studies by other researchers. The questions were closed-ended and its flow was clear and logical to foster accurate and consistent responses. The questionnaire was divided in six sections; each measured the respective independent or dependant variable and the demographic profile of the

respondents. Altogether, there were 66 questions measuring continuous variables while 11 questions asked the background of the respondents. Likert scale was employed to indicate the intensity of respondents' views for each question in the survey.

The questionnaires were reviewed by several faculty members and doctoral students of Universiti Utara Malaysia to ensure the format and the wordings were easily understood and comprehensive. After that, the questionnaires were translated from English to Malay by an expert translator. Further reviews were conducted by the researcher and his Supervisors to detect any anomalies that might be found due to limited exposure of the expert translator with respect to the standard use of the business and management terms. The questionnaires were translated back to English to ensure consistency with its original English version. The use of dual versions was able to improve the response rates because a significant number of contractors were more proficient and comfortable with the Malay version.

Five variables, namely safety behavior, safety motivation, employees' conscientiousness, employees' competency and safety commitment were measured in this study. Safety behavior was measured using 11 items adopted from Neal et al. (2006) and Zacharatos (2001). Safety motivation was measured using 4 items adopted from Neal et al. (2000) and Zacharatos (2001). Employees' conscientiousness was measured using 20 items adopted from Goldberg (1999). Employees' competency was measured using 10 items adopted from safety climate tool questionnaires (Davies, Spencer, & Dooley, 2001). Finally, safety commitment was measured using 21 items adopted from Abd Aziz (2008).

It is important to note that safety commitment measurement tool was used for the first time in this study after it was developed in 2008. All items were measured using 5-point Likert scale and ranged from 1-strongly disagree to 5-strongly agree. To ensure reliability of the measurement tools, a pilot study was conducted before the questionnaires were distributed to the respondents. The reliability analysis revealed all Cronbach's alpha coefficient values were above .7 which showed the measurement tools have good internal consistencies (Sekaran, 2000; DeVellis, 2003).

An administered-on-site method was used to collect the data from the participating firms. This method was suggested to improve the response rate (Snow & Thomas, 1994). To overcome the difficulty of entering the site, the researcher appointed an Executive in the respective firm to help distribute and collect the questionnaires. Prior to that, they were explained in details about the purpose of the study and how to fill up the questionnaire. It was made clear that the survey was optional and choosing not to participate would not affect their jobs. The instruction and this information were conveyed to the respondents during the survey distribution process. Altogether, 1,019 employees and contractors from 17 petrochemical firms located in Kerteh, Gebeng and Port Dickson participated in the survey. A total of 671 completed questionnaires were received, representing 66 percent of response rate. This response rate is relatively high in a survey research and given the on-site data collection, a test of response bias by comparing early and late respondents was not appropriate.

Data collected were analyzed using the Statistical Package for Social Science (SPSS) version 11 software. The process began by screening and analyzing the data followed by descriptive analysis, reliability and validity analysis, factor analysis, and finally linear and multiple regression analysis for hypotheses testing. The testing for mediation was performed according to the four-step multiple regression procedures recommended by Barron and Kenny (1986).

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter describes the results of the statistical analysis of the quantitative data gathered from the survey questionnaires. The findings include data screening and transformation, descriptive analysis, measure of reliability and validity, factor analysis, regression analysis and finally the hypothesis testing results. Figure 4.1 shows the process flow diagram of the data analysis.

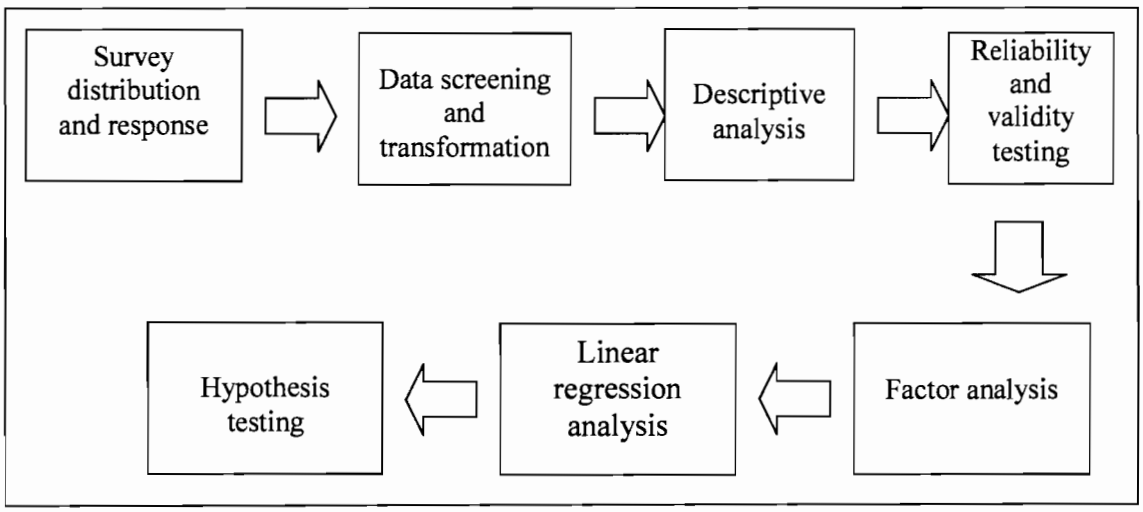

Figure 4.1
Process flow diagram for data analysis

4.2 SURVEY DISTRIBUTION AND RESPONSE

Table 4.1 shows the summary of the distribution of surveys and the response from the respondents. The survey questionnaires were prepared in Malay and English version to give flexibility for the respondents to respond in either medium they were comfortable with. Prior to distributing the surveys, an employee at the executive level in each participating firms was contacted and was explained about the details of the survey procedure. The time limit for collection was given as one month, however late responses were still acceptable. The key contact persons were asked to contact the researcher once they had collected some of the questionnaires. However, the minimum number was not specified as to give flexibility and less pressure to them. Accordingly, this technique was the most effective approach for gaining high response rate from a large sample size with minimum cost and time (Oppenheim, 2000; Sekaran, 2000). Starting from 2nd June 09 to 27th June 09, a total of 1,019 survey questionnaires consisted of 711 Malay version (70 percent) and 308 English version (30 percent) were handed over to the key contact persons for distribution. Progressively, 519 questionnaires (51 percent) were handed over in the first week followed by 305 questionnaires (30 percent) on the second week, 160 questionnaires (16 percent) on the third week and 35 questionnaires (3 percent) on the remaining days of Jun 09. The collection of the questionnaires from the contact persons began on the 2nd June 09 and extended until 27th August 09. The distance (e.g., Seremban, Port Dickson) was the reason for a slight time extension because researcher preferred to meet up with the contact persons and collect the questionnaires himself instead of using the mail. Altogether, 671 usable questionnaires (66 percent) consisting

of 500 Malay version (49 percent) and 171 English version (17 percent) were collected back during this time period.

Table 4.1
Summary of the survey distribution and response

Description	N	%
Total questionnaires distributed to key contact persons	1,019	
Malay version	711	70
English version	308	30
Progress of questionnaires distribution:		
1st week	519	51
2nd week	305	30
3rd week	160	16
4th week	35	3
Total questionnaires collected from the key contact persons	671	66
Malay version	500	49
English version	171	17

4.3 DATA SCREENING AND TRANSFORMATION

Table 4.2 shows the summary of data during screening and cleaning stage. The raw data collected from the survey questionnaires were entered into the Statistical Package for Social Science (SPSS) version 11.0 worksheet for analysis. This step involved screening and cleaning of the data from errors in data entry and missing data. The analysis revealed that 87 data points (0.17 percent) were missing and were replaced using the respective items mean values. This is one of the techniques recommended by Hair et al. (2006) for treating missing data especially when missing data is relatively low. The statement "I go straight for the goal" on employees' conscientiousness scale registered the highest missing data points (8 points). The trend showed the number of missing data points was proportional to the number of items in the variables. For example, the safety motivation

scale which contained the least items (4 items) did not register any missing data. However, employees' conscientiousness (20 items) and safety commitment (21 items) scored the highest number of missing data, 30 points (0.23 percent) and 25 points (0.18 percent), respectively. Comparing the missing data between the variables in Section A (safety behavior) and Section F (background information), the analysis revealed that Section F which was placed at the end of the questionnaire scored higher missing data points (16 points) even though both variables had the same number of variables (11 items). It could be concluded that the interest and motivation of the respondents to answer the questions slowly diminishing as they moved towards the end of the questions.

At the same time, the negative statements in the questionnaire were recoded before further multivariate analysis was conducted. Eight items from employees' conscientiousness were recoded while safety commitment and employees' competency had five and four items recoded, respectively. Items from safety behavior and safety motivation had only positive statements. Altogether, 17 negatively worded items were recoded.

Table 4.2
Data screening and transformation (N=663)

Variables	No. of missing data points	No of items in the variable	Negative items recoded	Total data points (N x no. of items)	Percent missing data points
Safety behavior	8	11	None	7,293	0.11
Safety motivation	0	4	None	2,652	0.00
Employees' conscientiousness	30	20	2,5,7,10,13,15,18, and 19	13,260	0.23
Safety commitment	25	21	1,3,7,11,and 17	13,923	0.18
Employees' competency	8	10	3,7,8,and 10	6,630	0.12
Background information	16	11	None	7,293	0.22
Overall	**87**	**77**	**17**	**51,051**	**0.17**

Next in the data cleaning and transformation process was determining the presence of outliers in the data distribution as these outliers might effect the results. Tabachnick and Fidel (2007) define outliers as cases with values well above or well below the majority of other cases. They stated that cases that have a standardized residual of more than 3.3 or less than -3.3 are outliers. In addition, Pallant (2007) stated that 1 percent of outliers are to be expected in a normally distributed sample. In this analysis as shown in Table 4.3, 9 outliers (1.3 percent) were detected and these cases were removed from the analysis. The remaining 663 cases were used for further multivariate analysis.

Table 4.3
Casewise diagnostics for outliers

Case Number	Std Residual	Mean value	Predicted value	Residual
155	**-5.393**	2.52	3.8347	-1.3109
177	**3.330**	4.81	4.0001	0.8094
230	**3.064**	4.62	3.8742	0.7449
348	**-3.112**	3.00	4.1666	-1.1666
424	**-3.049**	3.71	4.4553	-0.7411
464	**3.482**	4.52	3.6773	0.8465
476	**-3.008**	3.67	4.3979	-0.7312
523	**3.273**	3.81	3.0138	0.7951
565	**-4.418**	2.82	4.4971	-1.6789

4.4 SURVEY RESULTS

The questionnaire survey results comprise the outcomes from a normality test, descriptive analysis, factor analysis and multiple regression analysis.

4.4.1 Test of Normality

Normal distribution of scores is crucial for factor analysis and multivariate analysis (Pallant, 2007). Normality is described as symmetrical, bell-shaped curve which has the highest frequency of scores in the middle and smaller frequencies towards the extreme ends. There are several statistical methods available to assess the normality of these distributions. In this analysis, the normality was assessed by determining the value of kurtosis and skewness statistic as recommended by Ferguson and Cox (1993). The skewness value provides an indication of the symmetry of the distribution whereas kurtosis value provides information about the peakedness of the distribution. Perfectly

normal distribution yields kurtosis and skewness value of zero, but highly uncommon occurrence in social sciences (Pallant, 2007). With large sample size of more than 200, slight deviations would not make a substantive difference in the analysis (Tabachnick & Fidell, 2007). In addition to their argument, Muthen and Kaplan (1985) stated that some degree of univariate skew and kurtosis is acceptable for the majority of the variables if neither value exceeds ± 2.0. Ferguson and Cox (1993) stated that the percentage of variables adversely affected by either skew and/or kurtosis should be calculated and less than 25 percent of the variables adversely affected by either skewness or kurtosis are taken as cut off point for acceptability. Using these two recommendations for assessment of normality, the analysis found the response of 1 item of the questionnaires (item 46) indicated skewness statistic exceeding 2.0 while other 13 items (item 1, 3, 16, 20, 24, 26, 38, 42, 44, 46, 48, 49, and 62) showed kurtosis statistic exceeding 2.0. In total 14 items from the total of 66 items (21 percent) of the questionnaires were adversely affected by skewness and kurtosis however this value is less than 25 percent of the variables adversely affected and therefore the variations were still within the cutoff point for acceptability. It was concluded that the majority of the data in the distribution were normally distributed and that the data set was appropriate for parametric analysis. Table 4.4 shows details analysis of the data normality assessment.

Table 4.4
Data variable adversely affected by either skewness or kurtosis statistic outside ±2.0 range

Item number	Skewness		Kurtosis	
	Statistic	Std error	Statistic	Std error
1	-1.318	0.095	**3.227**	0.190
3	-1.256	0.095	**2.988**	0.190
16	-0.694	0.095	**2.217**	0.190
20	-1.725	0.095	**3.397**	0.190
24	-0.698	0.095	**2.136**	0.190
26	-0.757	0.095	**2.311**	0.190
38	-1.9203	0.095	**4.6447**	0.190
42	-1.9214	0.095	**4.3052**	0.190
44	-1.1545	0.095	**3.844**	0.190
46	**-2.0764**	0.095	**4.6661**	0.190
48	-0.8265	0.095	**2.7927**	0.190
49	-0.9263	0.095	**3.2744**	0.190
62	-0.3891	0.095	**2.2171**	0.190

4.4.2 Demographic Profile of the Respondents

Section F of the questionnaire provides the background information of the respondents. The profile includes gender, ethnicity, marital status, age, and the highest educational level. The information for the job includes job category, employment status, working experience, and number of years in the present company and in the present position. Finally, the respondents were also asked to indicate the estimate number of employees working in the companies they served (i.e., the size of the company).

This profile is tabulated in Table 4.5. The figures shows that 605 of the respondents were males and the remaining 58 respondents were females. The higher number of male population was visible in the operation of petrochemical manufacturing facilities in the locations where the questionnaires were distributed. Majority of them were shift workers

and this is normal to find male dominant employees operating continuous manufacturing process facilities especially in high risk industry in Malaysia. Female employees were in a smaller group and all of them worked during normal working hours. The Malays were the dominant groups (615) followed by Chinese (25), Indian (19) and 4 respondents belong to neither of these ethnic groups. Among the respondents, 477 or nearly three quarter of them indicated that they were married. 180 of them at the time of the sample collection stated that they were still singles while only 2 and 4 of them indicated they were widows and widowers, respectively. In the age category, there was quite a good mix among the young employees and those who were considered the veterans in the industry. The majority of the respondents were in the age between 26 and 33 years old (243) while those in the other age group were 18-25 years (120), 34-41 years old (190), 42-49 years old (87) and the respondents who were in the fifties or above consisted of 23 respondents. The high peak of the middle age groups (26-33 years old) in the employment time frame was clearly supported by the distribution of their working experience in which majority of them had worked between 6 to 15 years. Assuming the respondents entered the employment frame at the age of 18, this range of working experience between 6 to 15 years was equivalent to the age of 26 and 33 years old. They were permanent employees (541), contractors (104) and temporary staff (18). Permanent employees were hired and paid directly by the companies while temporary employees were either industrial trainees or temporary staff hired for a limited time. On the other hand, contractors worked and paid by external companies who provided their services in the maintenance and technical expertise to the participating petrochemical firms. On contractual basis, several of these external companies stationed their workers and materials inside the companies' premises

for the purpose of providing efficient services in the shortest time possible. During plant turnaround, the number of the contractors could swell from hundreds to thousands depending on the scale of the shutdown.

In term of the employment service, the highest number of the respondents had stayed with the present companies at the time of this survey within 6 to 10 years (259) followed by 1-5 years (221), 11-20 years (103), less than 1 year (73) and more than 20 years (7). Those loyalists who stayed within the same companies for more than 20 years were assumed would retire from those same companies. However, certain numbers of younger employees who were more dynamic and energetic were expected to leave the companies once they found better jobs and right packages elsewhere. During the time of the survey, petrochemicals companies in Malaysia were struggling to retain their employees as many of them moved to the Middle East due to lucrative packages. The figure showed 73 respondents from 17 participating companies were employed in less than a year. It is assumed that this figure of new hires will increase in the next few years as the demand for experience people operating petrochemical manufacturing facilities in the Middle East continues to grow.

A substantial number of respondents (315) had completed secondary schools and obtained SRP, SPM or STPM certificates. This was an important factor because the background knowledge from the schools would give them the platform to understand the technical part of operating the petrochemical manufacturing facilities. Similarly, many of them hold Diploma (224), Bachelor (95) or Master degrees or higher (7) which were

more appropriate as some manufacturing set a minimum academic qualifications (e.g., Diploma) for employment criteria. A few firms like Petronas and BASF provided grants for employees to pursue higher education.

In the job category distribution, the lower ranks consisting of operators and technicians made up a majority (375) followed by executives in middle management (202) and top management (16). The other job category (i.e., forklift drivers) made up of 70 respondents. It is expected that these organizations have a thin layer at the top compared to flat at the bottom for the reason that more workforce was required to man and operate the plants. Those who hold the responsibilities at the middle and top management level were normally the decision makers while the lower ranks execute the jobs on the field. However, lower rank employees were encouraged to contribute ideas and were invited to participate in safety meetings and safety programs.

Finally, the size of the firms was estimated using the number of employees as indicated by the respondents in the surveys. This will give a rough estimate of the background of the safety system in place because bigger companies (e.g., MNCs) were assumed to employ many people and practice better safety compared to the SMEs. In the data distribution, firms employed more than 300 people were the majority of those who agreed to participate in the survey. This followed by firms who employed 51-150 people (148), 1-50 people (123), and 151-300 people (70). 7 respondents stated that they did not relate as to state the number of employees in the firms. These people were considered self-

employed contractors who provided the serviced to the firms temporarily or no clue about the number of employees in the firms.

Table 4.5
The demographic profile of the respondents

Parameter		Frequency	Percentage
Gender	Male	605	91.3
	Female	58	8.7
Ethnicity	Malay	615	92.8
	Chinese	25	3.8
	Indian	14	2.1
	Other race	4	0.6
Marital status	Single	180	27.1
	Married	477	71.9
	Widow	2	0.3
	Widower	4	0.6
Age	18-25 years old	120	18.1
	26-33	243	36.7
	34-41	190	28.7
	42-49	87	13.1
	50 and above	23	3.5
Highest education level	Primary school certificate	22	3.3
	SRP / SPM / STPM	315	47.5
	Diploma or equivalent	224	33.8
	Bachelor's degree or equivalent	95	14.3
	Master's degree or higher	7	1.1
Job category	Non-executive (e.g., operator)	375	56.6
	First line supervisor	95	14.3
	Middle management	107	16.1
	Top management	16	2.4
	Others	70	10.6
Employment status	Permanent	541	81.6
	Contract	104	15.7
	Temporary	18	2.7
Working experience	0-5 years	196	29.6
	6-10 years	223	33.6
	11-15 years	122	18.4
	16-20 years	71	10.7
	20 years or more	51	7.7

Table 4.5 (continue)
The demographic profile of the respondents

Parameter		Frequency	Percentage
Number of years in the present company	0-5 years	73	11.0
	6-10 years	221	33.3
	11-15 years	259	39.1
	16-20 years	103	15.5
	20 years or more	7	1.1
Number of years in the present position	Less than 1 year	81	12.2
	1-5 years	319	48.1
	6-10 years	200	30.2
	11-20 years	57	8.6
	More than 20 years	6	0.9
Estimate number of employees in the present company	1-50 employees	123	18.6
	51-150	148	22.3
	151-300	70	10.6
	301 and above	311	46.9
	Not related	11	1.7

4.4.3 Factor Analysis

Factor analysis is a data reduction technique that summarizes a large set of variables into a smaller set of factors or components (Pallant, 2007). The primary purpose of this analysis is to determine the underlying structure among the variables in the analysis (Hair et al., 2006). All measurement tools in this study were adopted from previous studies and the variables were factorized; however, this study reaffirmed the previous findings by conducting another exploratory factor analysis. In addition, the confirmatory factor analysis was conducted on safety commitment measurement tool to confirm the previous finding by Abd Aziz (2008) who tested it for the first time on the workers in Malaysian railway system.

The literature revealed that the principal component analysis (PCA) and the common factor analysis (FA) are the two methods widely accepted in factor analysis (Pallant, 2007; Hair et al., 2006). These two sets of techniques are similar in many ways that both attempt to produce a smaller number of linear combinations of the original variables by capturing most of the variability in the form of correlations (Pallant, 2007). Accordingly, the two techniques produce similar results (Pallant, 2007); however, they differ in several ways and the selection of one method over the other is based on the objective of the factor analysis and the amount of prior knowledge about the variance in the variables (Hair et al., 2006). The obvious difference between the two methods is principal component analysis (PCA) considers the total variance in deriving the factors while the common factor analysis (FA) considers only the common or shared variance and excludes error variance in deriving the factors. Hair et al. (2006) suggests the following in the selection process:

Principal component analysis is the most appropriate when

1. *data reduction is the primary concern focusing on the minimum number of factors needed to account for the maximum portion of the total variance in the original sets of variables; and*

2. *prior knowledge suggests the specific and error variance represent a relatively small proportion of the variance.*

Common factor analysis is the most appropriate when

1. *the primary objective is to identify the latent dimensions or constructs represented in the original variables, and*

2. *the researcher has little knowledge about the amount of specific and error variance and therefore wishes to eliminate this variance.*

Comparing with principal component analysis which is a typical default method in many statistical programs when performing factor analysis, common factor analysis is viewed as more theoretical based and has its problem with factor indeterminacy. Factor indeterminacy is a characteristic of common factor analysis that several different factor scores can be calculated for any individual respondent, each fitting the number of estimated factor model and no single unique solution is found as in component analysis (Hair et al., 2006). The problems with common factor analysis have contributed to the widespread use of component analysis and for this reason as well as others presented above, the model of principal component was chosen for this study.

The first step in conducting the factor analysis was the assessment of the suitability of the data for factor analysis. Pallant (2007) stated that the assessment of suitability of the data for factor analysis should be subjected to the assessment of the sample size and the strength of the relationship among the variables or items. Hair et al. (2006) recommended the sample size of 100 or larger. They explained further that the minimum sample size is at least five times as many observations as the number of variables to be analyzed and the sample size in the ratio of 10:1 is more acceptable. This study has collected back 663 usable survey questionnaires and compare to 66 variables analyzed, the ratio was 10:1. Therefore this ratio is in accordance with Hair et al. (2006) recommendation. The next assessment criterion was to determine the strength of the inter-correlations among the items. The factor analysis is only appropriate when substantial number of correlations are greater than 0.3 (Hair et al., 2006; Pallant, 2007). Besides, the analysis also considered the partial correlations with the values above 0.7

indicate poor correlations and not suitable for factor analysis. Second, the factorability of the data was assessed by Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of Sphericity. The minimum value for KMO should be 0.6 and the Bartlett's test of Sphericity should be significant ($P < 0.05$) for the data to be factorably appropriate (Hair et al., 2006; Pallant, 2007).

The second step was to determine the number of factors to be retained in the factor analysis and this was based on the recommendation by Pallant (2007) who proposed the technique of the Kaiser's criterion, Scree test and the parallel analysis. Kaiser's criterion is the most common technique in this analysis and the decision to retain the factors depends on the Eigenvalue. The Eigenvalue explains the amount of variance explained by the variance and the factors which registered value of 1.0 or above would be retained for further analysis. This technique, however, has its shortcoming because sometimes it retains too many factors (Pallant, 2007). To overcome this shortcoming, the Catell's Scree test technique was used to assist in deciding the number of factors to be retained. This technique involved plotting each Eigenvalue of the factors and inspecting the curve to determine the point at which the shape of the curve changed direction and became horizontal (e.g., the elbow). The factors above the elbow were retained as these factors contribute the most to the explanation of the variance in the data set. Finally, the Monte Carlo parallel analysis was used as another alternative solution to determine the number of factors.

According to Pallant (2007),

> *"parallel analysis involves comparing the size of the eigenvalue with those obtained from randomly generated data set of the same size. Only those eigenvalues that exceed the corresponding values from the random data set are retained."*

Therefore, parallel analysis was conducted with all variables in data matrix, 663 respondents, and 100 replications for obtaining the random Eigenvalue output, which was then followed by a comparison with the Eigenvalues from the principal component analysis. Only factors with Eigenvalues exceeding the random eigenvalues output from parallel analysis were retained for the factor rotation.

The last step in the process was to interpret the factor structure and to decide a final factor solution. The Varimax rotation was conducted for interpretation. The Varimax matrix maximizes variance of loading on each factor and minimizes complexity and it is commonly used (Hair et al., 2006; Pallant, 2007).

4.4.3.1 Factor Analysis of Safety Behavior Survey Scale

The 11 items in the safety behavior scale were subjected to principal component analysis using SPSS version 11. Following the steps outlined above, the first step was to determine the assessment of the suitability of the data for factor analysis. Inspection of the correlation matrix showed the presence of many coefficients of 0.3 and above which indicated the data was appropriate for factor analysis. The Kaiser-Meyer-Olkin value was 0.90 exceeding the minimum value of 0.6 (Tabachnick & Fidell, 2007). The

Bartlett's test of Sphericity reached statistical significant (p<0.05), supporting the factorability of the correlation matrix.

The principal components analysis revealed the presence of two components with eigenvalues exceeding 1, explaining a total of 59.4 percent of the variance with component 1 contributing 47.8 percent and component 2 contributing 11.6 percent. Component 1 showed eigenvalue value of 5.26 while the value for component 2 was 1.27. A review of the screeplot revealed a clear break after the second component. Using the Catell's (1966) scree test, it was decided to retain the two components for further investigation. This finding was further supported by the results of the Parallel Analysis which showed only two components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (11 variables x 663 respondents; 100 replications).

Inspection of the unrotated loading revealed that all 11 items load quite strongly on component 1 (above 0.6) while 5 items in component 2 load more than 0.3. As described by Hair et al. (2006), factor loading shows the weight of each item with related factors in which higher loading represents greater underlying meaning for describing the factor. The guideline provided by Hair et al. (2006) for significant factor loading was for a sample size of more than 350, the minimum factor loading should be 0.3. This suggests that the loadings for each component fulfilled this guideline and would likely to be retained. To assist in the interpretation of these two components, Oblimin rotation was performed. According to Pallant (2007), Direct Oblimin is the most commonly used

oblique (correlated) technique for factor solution and she recommended starting the rotation analysis using Oblimin rotation as compared to orthogonal rotation (e.g., Varimax) because this provides information about the degree of correlation between the factors. The pattern matrix showed 8 items load above 0.5 on component 1 and the main loadings were on items 9 (0.864), 8 (0.819), 11 (0.766), and 10 (0.766). On component 2, all 3 items indicated high loadings with item 1 showed 0.882 followed by item 2 (0.865) and item 3 (0.787). This rotated solution revealed the presence of a simple structure (Thurstone, 1947) with both components showing a number of strong loadings and all variables loading substantially only on one component. The interpretation of the two components was consistent with previous research on safety behavior scale tested by Neal and Griffin (2006) using 3 items measuring behavioral safety compliance and Zacharatos's (2001) 8 items measuring behavioral safety initiatives. In this study the 3 items were grouped in component 2 and as described above the factor loadings were 0.882 (item 1), 0.865 (item 2) and 0.787 (item 3). Previously, the loadings reported by Neal and Griffin (2006) from their survey conducted on two separate occasions were 0.78 and 0.91 (item 1), 0.89 and 0.94 (item 2) and 0.92 and 0.87 (item 3). To recapture, item 1 corresponds to the statement "I use all the necessary safety equipment to do my job" while item 2 and item 3 corresponds to the statement "I use correct safety procedures for carrying out my job" and "I ensure the highest levels of safety when I carry out my job". There was a moderate positive correlation between the two factors (r=0.521) which supported the use of the behavioral safety initiative items and safety compliance items as separate scales, as previously tested by Neal & Griffin (2006) and Zacharatos (2001).

The results of the factor analysis can be found in Appendix E. The summary of the factor analysis for safety behavior scale is presented in Table 4.6, Table 4.7 and Table 4.8 below.

Table 4.6
Summary of factor analysis (principal component analysis) result for safety behavior items

No.	Factorability assessment	Results	Value required for factor analysis
1	KMO measure of sampling adequacy	0.904	Min. value is 0.6
2	Bartlett's test of Sphericity	Approx Chi Square 3194.892 df 55 Significant < 0.001	$P < 0.05$
3	Strength of inter-correlations among items	Almost all values greater than 0.3	Correlation coefficient > 0.3

No.	Method used to determine the number of factors	Results	Remarks
1	Kaiser's criteria	Two factors exceeded Eigenvalue of 1	Minimum Eigenvalue of 1 is acceptable to retain the factors
2	Catell's scree test	Two factors retained	These two factors were above the value of 1 and above the elbow of the curve
3	Parallel analysis	Two factors retained	These two factors extracted from PCA had Eigenvalue higher that the value extracted by parallel analysis

Table 4.7
The list of statement items in each factor for safety behavior scale (with questionnaire statement number given in the brackets)

Factor	Statement items
1	I am involved in improving safety policy and practices (4) If I think it will make work safer, I initiate steps to improve work procedures (5) If I see something unsafe, I go out of my way to address it (6) I voluntarily carry out tasks or activities that help to improve workplace safety (7) I often make suggestions to improve how safety is handled around here (e.g., plant areas) (8) I often try new approaches to improving workplace safety (9) I often try to solve problems in ways that reduce safety risks (10) I keep abreast of changes to do with safety (i.e., to know the recent facts (11)
2	I use all the necessary safety equipment to do my job (1) I use the correct safety procedures for carrying out my job (2) I ensure the highest levels of safety when I carry out my job (3)

Table 4.8
A comparison of the statement items in the safety behavior scale used by Neal et al. (2006) and Zacharatos (2001)

Factor	Statement items
1	I am involved in improving safety policy and practices (4) If I think it will make work safer, I initiate steps to improve work procedures (5) If I see something unsafe, I go out of my way to address it (6) I voluntarily carry out tasks or activities that help to improve workplace safety (7) I often make suggestions to improve how safety is handled around here (e.g., plant areas (8) I often try new approaches to improving workplace safety (9) I often try to solve problems in ways that reduce safety risks (10) I keep abreast of changes to do with safety (i.e., to know the recent facts (11)
2	I use all the necessary safety equipment to do my job (1) I use the correct safety procedures for carrying out my job (2) I ensure the highest levels of safety when I carry out my job (3)

4.4.3.2 Factor Analysis of Safety Motivation Scale

The 4 items in the safety motivation scale were subjected to principal component analysis (PCA) using SPSS version 11. Prior to performing PCA, the suitability of data for factor analysis was assessed. A review of the correlation matrix showed all coefficients were above 0.3 which indicated the data was appropriate for factor analysis. The Kaiser-Meyer-Olkin value for measuring the sampling adequacy was 0.81 exceeding the minimum value of 0.6 for a good factor analysis (Tabachnick & Fidell, 2007). The Bartlett's test of Sphericity reached statistical significant ($p<0.05$), supporting the factorability of the correlation matrix.

The principal components analysis revealed the presence of only one component with eigenvalues exceeding 1 (2.79), explaining 69.8 percent of the variance. A review of the screeplot revealed a clear break after the first component. Using the Catell's (1966) scree test, it was decided to retain only one component for further investigation. This finding was further supported by the results of Parallel Analysis which showed only one component with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (4 variables x 663 respondents; 100 replications).

Inspection of the component loadings revealed that all 4 items load strongly on component 1. Item 3 showed the highest loading (0.859) followed by item 2 (0.853), item 4 (0.831), and item 1 (0.798). The one component solution explained a total of 69.8 percent of the variance. However, the Oblimin rotation could not be performed since

only one solution was extracted. In comparison, Neal and Griffin (2006) reported quite a strong loading on item 3 (0.92), item 2 (0.96) and item 1 (0.84).

The results of this factor analysis can be found in the Appendix E. The summary of the factor analysis for safety behavior scale is presented in Table 4.9 below.

Table 4.9
Summary of factor analysis (principal component analysis) result for safety motivation items

No.	Factorability assessment	Results	Value required for factor analysis
1	KMO measure of sampling adequacy	0.813	Min. value is 0.6
2	Bartlett's test of Sphericity	Approx Chi Square 1157.575 df 6 Significant < 0.001	$P < 0.05$
3	Strength of inter-correlations among items	All values greater than 0.3	Correlation coefficient > 0.3

No.	Method used to determine the number of factors	Results	Remarks
1	Kaiser's criteria	One factor exceeded Eigenvalue of 1	Minimum Eigenvalue of 1 is acceptable to retain the factors
2	Catell's scree test	One factor retained	Only factor was above the value of 1 and above the elbow of the curve
3	Parallel analysis	One factors retained	Only one factor extracted from PCA had Eigenvalue higher that the value extracted by parallel analysis

4.4.3.3 Factor Analysis for Employees' Conscientiousness Survey Data

The prior assessment of the correlation matrix of employees' conscientiousness scale showed many correlation coefficients had values 0.3 and above which indicated the data was appropriate for factor analysis. The Kaiser-Meyer-Olkin value for measuring of sampling adequacy was 0.89, exceeding the minimum value of 0.6 for a good factor analysis (Tabachnick & Fidell, 2007). The Bartlett's test of Sphericity reached statistical significant ($p<0.05$), supporting the factorability of the correlation matrix.

The principal components analysis (PCA) revealed the presence of three factors which have eigenvalues exceeding 1, explaining a total of 47.6 percent of the variance. Factor 1 contributed 29.0 percent of the variance, component 2 contributed 11.6 percent and component 3 contributed 6.9 percent. A review of the screeplot showed a clear break after the third factor at which the shape of the curve changed direction and became horizontal. It was decided that all three factors would be retained for further investigation. This finding was further supported by the results of the Parallel Analysis which showed only three components had eigenvalues exceeded the corresponding criterion values for a randomly generated data matrix of the same size (20 variables x 663 respondents; 100 replications). The Parallel Analysis compared the eigenvalues originated from the PCA and the values generated from Monte Carlo for Parallel Analysis statistical program developed by Watkins (2000). The factors with eigenvalues higher than the values generated by Monte Carlo statistical program would be retained.

Inspection of the unrotated loading revealed that all items except item 4 loaded on factor 1, item 2, 4, 5, 7, 8, 10, 13, 15, 16, 18 and 19 loaded on factor 2 and item 2, 4, 9, 10, and 14 loaded on factor 3. This unrotated result also revealed many items appeared in more than one factor signaling the presence of cross-loading. Item 2, 4, 5, 7, 8, 9, 10, 14, 15, and 19 loaded on more than one factor and have significant loading values above 0.3 (Pallant, 2007). To assist further in the interpretation of these three factors, Oblimin rotation was performed. The pattern matrix showed item 1, 3, 6, 8, 9, 11, 12, 14, 16, 17, 19, and 20 were significantly loaded on factor 1, item 5, 7, 10, 13, 15, 18 and 19 were significantly loaded on factor 2, and item 2, 4, 8, 9, 13 and 19 were significantly loaded on Factor 3. Even after the rotation, cross-loadings were stilled detected but on smaller scale. 4 items (8, 9, 13, and 19) appeared in more than one factor as compared to 10 items before the rotation was performed. According to Ferguson and Cox (1993), the cross-loading issue arises when item load score is greater than 0.4 on two or more factors. They suggested that, if the difference between the two factors is higher than 0.2, the items can be retained and are allowed for factor loading scores. However, if the difference is less than 0.2, the item should be removed from further analysis. Item 8, 9, 13 and 19 load score was below 0.4 on at least on of the factors. However, three of the load scores showed the difference between the two factors was less than 0.2. A review of the communalities coefficients for item 8, 9, 13, and 19 revealed all values above 0.3. This showed that these items fit well with all the other items in the factors and therefore all were retained (Pallant, 2007). This existence of cross-loading provides an indicator of conceptual overlap, which means that the items were similar at the conceptual level (Ferguson & Cox, 1993). Finally, the rotated solution revealed the presence of a simple

structure with three factors showing a number of strong loadings and all variables loading substantially only on one factor.

The results of the factor analysis can be found in Appendix E. The summary of the factor analysis for employees' conscientiousness scale is presented in Table 4.10 below. Table 4.11 shows the list of statement items corresponding to each factor.

Table 4.10
Summary of factor analysis (principal component analysis) result for employees' conscientiousness items

No.	Factorability assessment	Results	Value required for factor analysis
1	KMO measure of sampling adequacy	0.897	Min. value is 0.6
2	Bartlett's test of Sphericity	Approx Chi Square 3943.977 df 190 Significant < 0.001	$P < 0.05$
3	Strength of inter-correlations among items	Almost all values greater than 0.3	Correlation coefficient > 0.3

No.	Method used to determine the number of factors	Results	Remarks
1	Kaiser's criteria	Three factors exceeded eigenvalue of 1	Minimum eigenvalue of 1 is acceptable to retain the factors
2	Catell's scree test	Three factors retained	Three factors were above the eigenvalue value of 1 and above the elbow of the curve
3	Parallel analysis	Three factors retained	Three factors extracted from PCA had Eigenvalue higher that the value extracted by parallel analysis

Table 4.11
The list of statement items in each component for employees' conscientiousness scale (with questionnaire statement number given in the brackets)

Factor	Statement items
1	I normally follow the rules and regulations (1) I completed my duties on time (3) I go straight for the goal (6) I do more than what is expected of me (8)* I keep my promises (9)* I demand for quality (11) I work hard (12) I plunge into tasks with all my heart (14) I set high standards for myself and others (16) I turn plans into actions (17) I do just enough work to get by (19)*
2	I tell the truth (20) I break the rules (5) I break my promises (7) I normally misrepresent the facts (10) I put little time and effort into my work (13)* I do the opposite of what is asked (15) I am not highly motivated to succeed (18) I do just enough to get by (19)*
3	I get others to do my duties (2) I listen to my conscience (4) I do more than what is expected of me (8)* I keep my promises (9)* I put little time and effort into my work (13)* I do just enough to get by (19)*

*** Items appear in more than one factor (cross loading)**

4.4.3.4 Factor Analysis of Safety Commitment Survey Data

The prior assessment of the correlation matrix of safety commitment showed the presence of many coefficients with values of 0.3 and above which indicated the data was appropriate for factor analysis. The Kaiser-Meyer-Olkin value for measuring of sampling adequacy was 0.93 exceeding the minimum value of 0.6 for a good factor analysis

(Tabachnick & Fidell, 2007). The Bartlett's test of Sphericity reached statistical significant ($p<0.05$), supporting the factorability of the correlation matrix.

The principal factors analysis revealed the presence of three factors which have eigenvalues exceeding 1, explaining a total of 51.8 percent of the variance with factor 1 contributing 35.1 percent, factor 2 contributing 10.5 percent and factor 3 contributing 6.3 percent. An inspection of Total Variance Explained revealed the eigenvalues for these three factors were 7.4 (factor 1), 2.2 (factor 2) and 1.3 (factor 3). A review of the screeplot showed a clear break after the third factor. Using the Catell's (1966) scree test to confirm the number of factors to be retained, it was decided that three factors would be retained for further investigation. This finding was further supported by the results of the Parallel Analysis which showed only three factors with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (21 variables x 663 respondents; 100 replications).

Inspection of the unrotated loading revealed that except for item 1, the other 20 items with significantly loading (above 0.3) appeared on factor 1, 9 items (1, 3, 6, 7, 11, 18, 19, 20, and 21) appeared on factor 2 and 4 items (1, 3, 7, and 9) appeared on factor 3. Many items appeared in more than factors with the difference loading scores from less than 0.2 to more than 0.2. To clarify further in the interpretation of these three factors, Oblimin rotation was performed. The pattern matrix showed 11 items (2, 4, 5, 6, 8, 9, 10, 13, 14, 15, and 16) with significantly loading scores appeared on factor 1, 5 items (1, 3, 7, and 11, and 17) appeared on factor 2 and 5 items (12, 18, 19, 20, and 21) loaded on factor 3.

Cross loading was not detected from the pattern matrix. Highest loading scores (above 0.7) were identified from item 9, 14 and 15 in factor 1; item 3 in factor 2; item 18, 19, 20, and 21 in factor 3. A review of the communalities coefficients indicated all items were above 0.3. This showed that these items fit well with all the other items in the factors and therefore all were retained. This rotated solution revealed the presence of a simple structure with three factors showing a number of strong loadings and all variables loading substantially only on one factor.

The results of the factor analysis can be found in Appendix E. The summary of the factor analysis for safety commitment scale is presented in Table 4.12 below and Table 4.13 while Table 4.14 shows the original items from the author who developed this questionnaire.

Table 4.12
Summary of factor analysis (principal component analysis) result for safety commitment items

No.	Factorability assessment	Results	Value required for factor analysis
1	KMO measure of sampling adequacy	0.926	Min. value is 0.6
2	Bartlett's test of Sphericity	Approx Chi Square 5604.594 df 210 Significant < 0.001	$P < 0.05$
3	Strength of inter-correlations among items	Almost all values greater than 0.3	Correlation coefficient > 0.3

No.	Method used to determine the number of factors	Results	Remarks
1	Kaiser's criteria	Three factors exceeded Eigenvalue of 1	Minimum Eigenvalue of 1 is acceptable to retain the factors
2	Catell's scree test	Three factors retained	Three factors were above the eigenvalue value of 1 and above the elbow of the curve
3	Parallel analysis	Three factors retained	Three factors extracted from PCA had eigenvalue higher that the value extracted by parallel analysis

Table 4.13

The list of statement items in each component for safety commitment scale (with questionnaire statement number given in the brackets)

Factor	Statement items
1	I really care about the safety procedures and regulations at my workplace (2) I am willing to put great effort beyond that normally expected in order to be a competent worker (4) I would ensure the risks are assessed before starting my work (5) It is very important to work in a safe environment (6) I am willing to put in great effort to achieve safety goals (8) I would like to obey the safety regulations in order to keep the workplace safe (9) All employees should be actively involved in safety promotion activities (10) Safety procedures and regulations reflect the safest technique of doing a job (13) It is an employee's duty and responsibility to support and encourage their colleagues to obey the safety rules / regulations / procedures (14) I always ensure that the safety equipment is working properly before I start a job (15) I am willing to do extra jobs in order to improve the safety performance at my workplace (16)
2	I would not be worried about the hazard and risk at my workplace (1) Near-miss accidents are not important in safety records (3) I never give co-operation to my supervisor / manager about safety issues (7) I think putting more effort into understanding all safety rules is a waste of time (11) I would not feel guilty if I used a shortcut while completing my work (17)

3	I am extremely glad if I am selected to be a member of a safety committee at my workplace (12) I would like to be involved in safety discussions at my workplace (18) I am ready to involve myself in the organizational safety activities (19) I really would like to take part in occupational safety rule / procedure / regulation reviews (20) I would like to be involved in the safety goal planning at workplace (21)

Table 4.14
The list of original statement from the scale author (Abd Aziz, 2008)

Factor	Statement items
1	I really care about the safety procedures and regulations at my workplace I am willing to put in great effort to achieve safety goals I would like to obey the safety regulations in order to keep workplace safe All employees should be actively involved in safety promotion activities I am willing to put great effort beyond that normally expected in order to be a competent worker It is very important to work in a safe environment Safety procedures and regulations reflect the safest technique of doing a job It is an employee's duty and responsibility to support and encourage their colleagues to obey the safety rules/procedures/regulations I always ensure that the safety equipment is working properly before I start a job
2	I am willing to do extra jobs in order to improve the safety performance at my workplace I am extremely glad to be a member of a safety committee at my workplace I would like to be involved in safety discussions at my workplace I am ready to involve myself in the organizational safety activities I really would like to take part in occupational safety rule/procedure/regulation reviews I would like to be involved in the safety goal planning at workplace I will ensure the risks are assessed before starting my work
3	I would not be worried about the hazard and risk at my workplace Near-miss accidents are not important in safety records I never give co-operation to my supervisor/manager about safety issues I would not feel guilty if I used a "shortcut" while completing my work I think putting more effort into understanding all safety rules is a waste of time

In addition to exploratory factor analysis (EFA), confirmatory factor analysis (CFA) was also conducted to verify the above finding that three factors were extracted for the safety commitment scale. According to Byrne (2010), CFA is appropriately used when the underlying latent variable structure in the measurement model is known. Subsequently, these three factors were analyzed using the Analysis of Moment Structure (AMOS) version 4 software to determine the goodness of fit between the safety commitment measurement scale and the sample data. The analysis showed the results of the Goodness-of-Fit Index (GFI) and the Comparative Fit Index (CFI) were 0.921 and 0.926, respectively. Byrne (2010) states that the minimum value of 0.90 for both indices indicate that the model fit the sample data fairly well. In addition, the result of the root mean square error of approximation (RMSEA) was 0.057. Browne and Cudeck (1993) elaborated on the cutoff points and noted that RMSEA values ranging from 0.05 to 0.08 represent reasonable error of approximation in the population. Thus, these results of the Goodness-of-Fit Statistics indicated that the measurement model of safety commitment measurement tool fits the data fairly well and therefore confirmed the EFA findings.

4.4.3.5 Factor Analysis of Employees' Competency Survey Data

Appendix E shows details of the factor analysis of the employees' survey data. Inspection of the correlation matrix revealed that 23 of the 45 correlation coefficients (51 percent) were above 0.3, which provides an adequate basis for proceeding to an empirical examination of adequacy for factor analysis (Pallant, 2007). The tabulation of the number of significant correlations per variable with the value above 0.3 found a range

from 1 (item 6, 8, 9) to 4 (item 1, 2, 4). The Bartlett's test of Sphericity found that the correlations were significant at the 0.0001 level, supporting the factorability of the correlation matrix. The measure of sampling adequacy (Table 27) values fell within the acceptable range (above 0.5) with the over all value as indicated by the Kaiser-Meyer-Olkin value was 0.82, exceeding the minimum value of 0.6 for a good factor analysis (Tabachnick & Fidell, 2007).

Once the assessment of the suitability for factor analysis was fulfilled, the scale was subjected to principal components analysis to determine the number of components to be retained for further analysis. This analysis revealed the presence of two components with eigenvalues exceeding 1, explaining a total of 58.5 percent of the variance with component 1 contributing 42.3 percent and component 2 contributing 16.2 percent (Table 26). The eigenvalue value is the sum of squared loading and represents the relative importance of each factor in accounting for the variance associated with the set of variables. In this analysis, the explanatory power was the strongest for component 1 (4.2) followed by component 2 (1.6). The total eigenvalue of the two factors was 6.8 and represented the total amount of variance extracted by the factor solution. Thus, the preliminary decision based on the principal component analysis was to retain 2 components. Further review of the screeplot (Figure 1) showed a break after the second component. However, the third component with value 0.91 was very close to 1 and therefore was considered to be included as the third factor. Using the Catell's (1966) scree test to confirm the number of components to be retained, it was decided that only two components would be retained for further investigation. This finding was further

supported by the results of the Parallel Analysis which showed only two components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (10 variables x 663 respondents; 100 replications). The Parallel Analysis compared the eigenvalues originated from the PCA and the values generated from Monte Carlo for Parallel Analysis statistical program developed by Watkins (2000). The factors with eigenvalues higher than the values generated by Monte Carlo statistical program would be retained.

Inspection of the unrotated component matrix revealed that the first component accounted for the largest amount of variance with all 10 items had high loadings (above 0.4). Item 1, 2, 3, 5, 6, 7, 8, 10 appeared on component 2 with half of the items had high loadings of above 0.4 (Hair et al, 2006). Many items appeared on both components and interpreting the results were difficult and less meaningful. Therefore, further step was to rotate the factor matrix to redistribute the variance so that interpretation would be meaningful. To assist further in the interpretation of these two components, Oblimin rotation was performed. The pattern matrix of the rotated factor solution showed the explanatory power shifted slightly to a more even distribution and no cross loading appeared. Items 1, 2, 4, 5, 6, and 9 with loadings 0.77, 0.86, 0.78, 0.83, 0.74 and 0.42 had significantly high loadings for component 1 while items 3, 7, 8, and 10 with loadings 0.71, 0.73, 0.82 and .81 were had significant high on component 2. Almost all loadings except item 9 were above 0.7 which explained that more than half of the variance was accounted for by the loading on a single factor. A review of the communalities indicated all items had values above 0.3 indicating these items fit well with all the other items in

the components and therefore all were retained. The communality for item 9 was the lowest (0.32) and this was also showed by its lowest value for the loading (0.42). The analysis of this rotated solution revealed the presence of a simple structure with two components showing a number of strong loadings and all variables loading substantially only on one component. The final analysis from the rotated solution was to determine whether the two factors were correlated and might have been conceptually linked. Table 26 showed the correlation between the two components and as suggested by Hair et al. (2006) it is reasonable to expect the perceptual dimensions would be correlated. The value of the correlation was 0.41 suggesting a moderate correlation between the two components.

Table 4.20 below itemized the statements appeared in component 1 and 2. At a glance, the statements in component 1 were all positive describing the skill (item 1), knowledge (item 2, 6, 9) and ability (item 4) of the competency. On the contrary, the statements in component 2 were all negative and consisted of item describing skill (item 10), knowledge (item 8) and ability (item 3, 7).

The results of the factor analysis can be found in Appendix E. The summary of the factor analysis for employees' competency scale is presented in Table 4.15 and Table 4.16 below.

Table 4.15
Summary of factor analysis (principal component analysis) result for employees' competency scale

No.	Factorability assessment	Results	Value required for factor analysis
1	KMO measure of sampling adequacy	0.820	Min. value is 0.6
2	Bartlett's test of Sphericity	Approx Chi Square 2642.014 df 45 Significant < 0.001	$P < 0.05$
3	Strength of inter-correlations among items	Almost all values greater than 0.3	Correlation coefficient > 0.3

No.	Method used to determine the number of factors	Results	Remarks
1	Kaiser's criteria	Two factors exceeded Eigenvalue of 1	Minimum Eigenvalue of 1 is acceptable to retain the factors
2	Catell's scree test	Two factors retained	These two factors were above the value of 1 and above the elbow of the curve
3	Parallel analysis	Two factors retained	These two factors extracted from PCA had Eigenvalue higher that the value extracted by parallel analysis

Table 4.16
The list of statement items in each component for employees' competency scale (with questionnaire statement number given in the brackets)

Factor	Statement items
1	I fully understand the safety procedures / instructions associated with my job (1) I understand the safety rules for my job (2) I am confident that I can identify the safety risks associated with the work for which I am responsible (4) I am clear about what my responsibilities are for safety (5) I understand the nature of all the hazards I am likely to encounter during my work (6) I am good at detecting unsafe behavior during performing the job (9)

2	Sometimes I am uncertain what to do to ensure safety in the work for which I am responsible (3) Sometimes I am confused about what I am supposed to do (7) I have a poor understanding of the risks associated with my work (8) I am not very effective at ensuring safety in the work for which I am responsible (10)

4.4.4 Regression Analysis and Hypothesis Testing

Regression analysis was tested individually for each predictor in the relationship. Prior to that, analysis was conducted to ensure assumptions for adequate sample size, multicollinearity, outliers and normality were met. For generalisability purpose, Tabachnick and Fidel (2007) recommended 82 cases for four independent variables. In this, there are 663 cases which therefore satisfied this recommendation. For testing of multicollinearity, Table 4.17 depicts the correlation analysis of the variables using the Pearson correlation. The table shows the independent variables correlated substantially with safety behavior (all above .3). The variables with significant relationships with safety behavior included safety motivation (.417), employees' competency (.553) and employees' competency (.525). Of those significant correlations, all independent variables had positive correlations with safety behavior. The correlations among independent variables showed all values were less than .7. These included the correlations between safety motivation and employees' conscientiousness (.489) and employees' competency (.342). Similarly, the correlation between employees' conscientiousness and employees' competency was .633. In addition to Pearson correlation analysis, the results of the tolerance and VIF (variation inflation factor) were analyzed to confirm multicollinearity did not present before regression was performed.

These two parameters indicate how much of the variability of the specified independent is not explained by the other independents variable in the model. The results showed the tolerance value for each independent variable is .759 (safety motivation), .515 (employees' conscientiousness) and .598 (employees' competency). The VIF values were 1.317 (safety motivation), 1.940 (employees' conscientiousness) and 1.672 (employees' competency). For multicollinearity to exist, Pallant (2007) suggested the value of Pearson correlation between independent variables and dependent variable to be below .3 and the correlation among variables to be above 0.7. Similarly, the tolerance value of less than .10 or the VIF value above 10 indicate the present of multicollinearity. In this analysis, the results obtained did not exceed the recommended values, indicating multicollinearity did not exist. Therefore all variables were retained for regression analysis. The assumption for normality, outliers and residuals were discussed in Section 4.1 and 4.2.1. These assumptions for conducting regression analysis were met.

Table 4.17
Analysis for multicollinearity by Pearson correlation, Tolerance and VIF values

Variable	1	2	3	4	Tolerance	VIF
1 Safety behavior	-	.417	.553	.525	-	
2 Safety motivation		-	.489	.342	.759	1.317
3 Empl. conscientiousness			-	.633	.515	1.940
4 Empl. competency				-	.598	1.672

This following section described the testing of each of the stated hypotheses. The acceptance or rejection of the stated hypotheses can be found in Table 4.21 at the end of this section. The standard multiple regression analysis was conducted to assess the direct and indirect relationships within the proposed model and the stated hypotheses. Each of the scales was aggregated to find an overall score for each of five variables under investigation including safety motivation, employees' conscientiousness, employees' competency, safety commitment and safety behavior.

Testing of the stated hypotheses for mediation was done so in accordance with Barron and Kenny's (1986) description of mediation. Figure 4.2 shows the illustration of the paths. Accordingly, Barron and Kenny (1986) discussed four steps in establishing mediation:

Step 1: Show that the initial variable is correlated with the outcome. Use Y as the criterion variable in a regression equation and X as a predictor (estimate and test patch c). This step establishes that there is an effect that might be mediated.

Step 2: Show that the initial variable is correlated with the mediator. Use M as the criterion variable in the regression equation and X as a predictor (estimate and test path a). This step essentially treats the mediator as if it were an outcome variable.

Step 3: Show that the mediator affects the outcome variable. Use Y as the criterion variable in a regression equation and X and M as predictors (estimate and test path b).

Correlating the mediator and the outcome is not sufficient because the mediator and the outcome may be correlated because both variables are caused by initial variable X. Thus the initial variable X must be controlled in establishing the effect of the mediator on the outcome.

Step 4: To establish that M completely mediates the X-Y relationship, the effect of X on Y controlling for M (path c') should be zero.

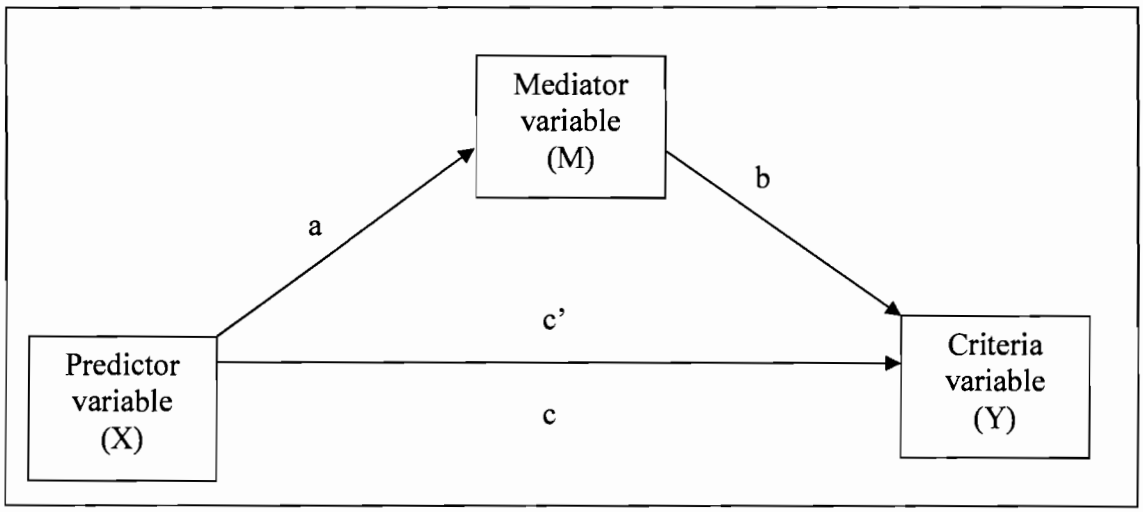

Figure 4.2
Mediation paths as described by Barron and Kenny (1986)

Hypothesis 1: Employees' conscientiousness will have a positive relationship with safety behavior. To access this relationship, a linear regression analysis was conducted and the results revealed an R2 = .306, $p < .001$. The direct relationship of employees' conscientiousness and safety behavior was found to be significant ($\beta = .553$, $t = 17.061$, $p < .001$). Hypothesis 1 was therefore accepted. Figure 4.3 depicts this direct relationship.

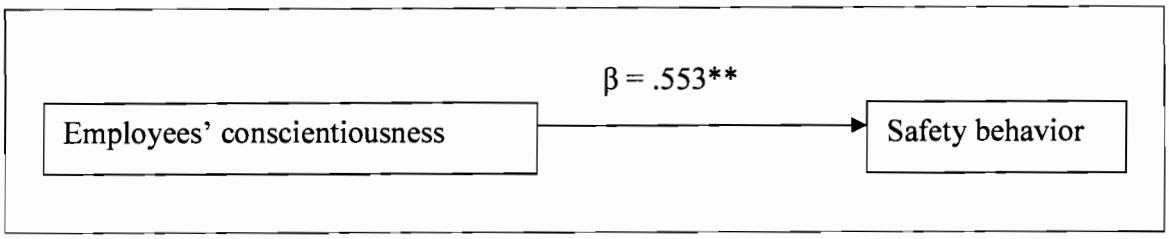

Figure 4.3
The direct relationship between employees' conscientiousness and safety behavior

Hypothesis 2: Employees' conscientiousness will have a positive relationship with safety commitment. To access this relationship, a linear regression analysis was conducted and the results revealed an R2 = .531, $p < .001$. The direct relationship of employees' conscientiousness and safety commitment was found to be significant ($\beta = .729$, $t = 27.369$, $p < .001$). Hypothesis 2 was therefore accepted. Figure 4.4 depicts this direct relationship

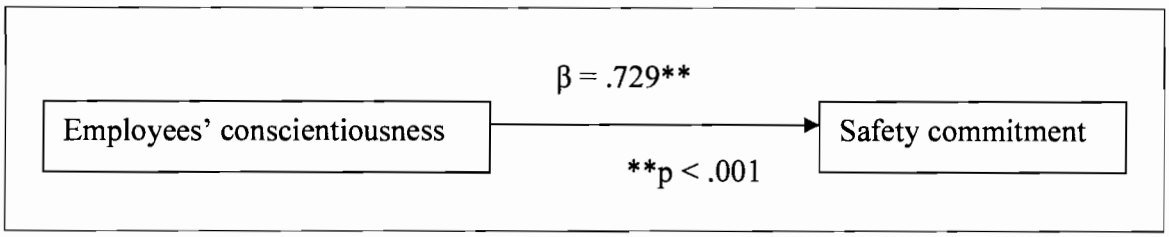

Figure 4.4
The direct relationship between employees' conscientiousness and safety commitment

Hypothesis 7: Safety commitment will mediate the relationship between employees' conscientiousness and safety behavior. To access this hypothesis, Barron and Kenny's (1986) criteria for mediation stated in Figure 1 above was followed. Path *c* was found to be significant (Figure 4.2, hypothesis 1) and therefore supported the first requirement. Next, for the second requirement for mediation, path *a* was assessed through a linear

analysis and revealed an R2 = .531, p < .001 and significant relationship (β = .729, t = 27.369, p < .001). In step 3, path b was assessed through a hierarchical regression analysis by controlling employees' conscientiousness variable. The results indicated a significant relationship (R2 = .379, β = .395, t = 8.821, p < .001). Finally, step 4 was assessing complete mediation (path c') by controlling path *a* and path *b*. The hierarchical regression analysis revealed the relationship between employees' conscientiousness and safety behavior was still significant (R2 = .379, β = .265, t = 5.912, p < .001), however there was a reduction in beta value. It was concluded that partial mediation had occurred in this relationship and therefore support the hypothesis that safety commitment will mediate the relationship between employees' conscientiousness and safety behavior. Figure 4.5 and Table 4.18 depict the significant the indirect relationship between employees' conscientiousness and safety behavior.

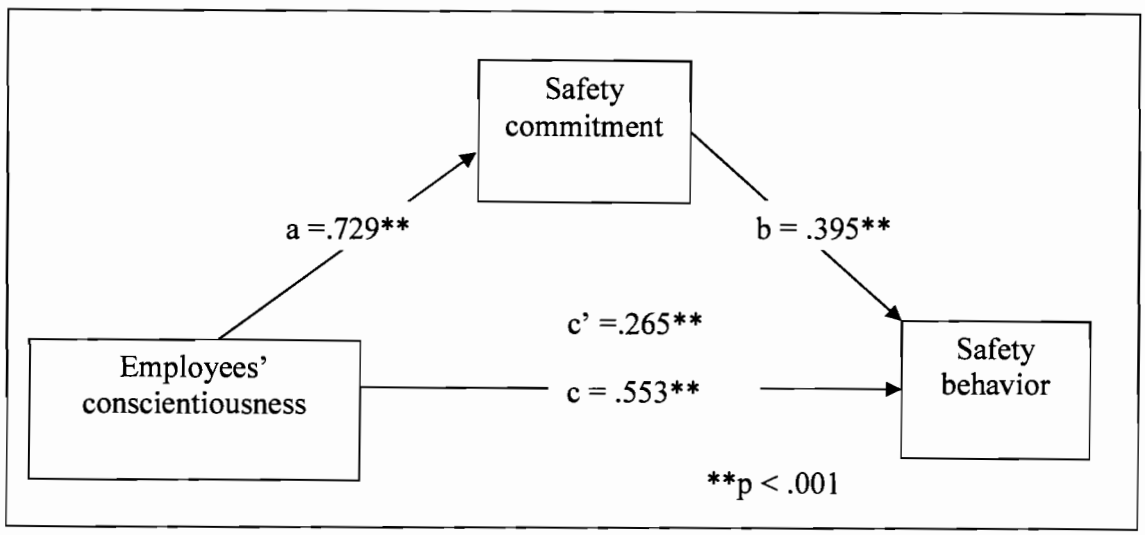

Figure 4.5
The mediation of safety commitment between employees' conscientiousness and safety behavior

Table 4.18
Summary of the regression analysis

Variable	Dependent variable = safety behavior		Conclusion
	Without mediator	With mediator	
Employees' conscientiousness	.553**	.265**	Partial mediation
Safety commitment		.395**	

** $p < .001$

Hypothesis 3: Safety motivation will have a positive relationship with safety behavior. To access this relationship, a linear regression analysis was conducted and the results revealed an R2 = .174, $p < .001$. The direct relationship of safety motivation and safety behavior was found to be significant ($\beta = .417$, $t = 11.811$, $p < .001$). Hypothesis 3 was therefore accepted. Figure 4.6 depicts this direct relationship.

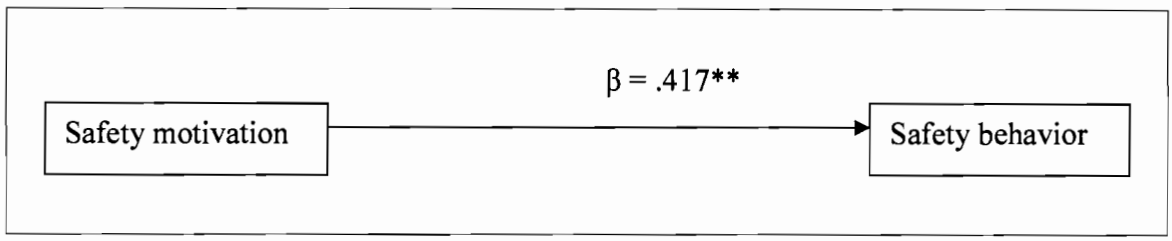

Figure 4.6
The direct relationship between safety motivation and safety behavior

Hypothesis 4: safety motivation will have a positive relationship with safety commitment. To access this relationship, a linear regression analysis was conducted and the results revealed an R2 = .331, $p < .001$. The direct relationship of safety motivation

and safety commitment was found to be significant (β = .575, t = 18.092, p < .001). Hypothesis 4 was therefore accepted. Figure 4.7 depicts this direct relationship

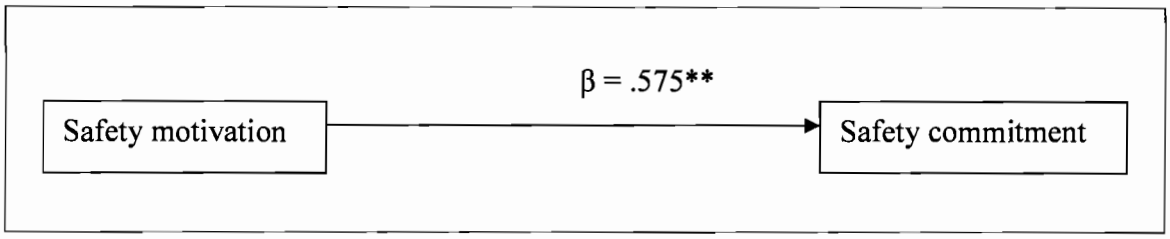

Figure 4.7
The direct relationship between safety motivation and safety commitment

Hypothesis 8: Safety commitment will mediate the relationship between safety motivation and safety behavior. To access this hypothesis, Barron and Kenny's (1986) criteria for mediation was followed. Path *c* was found to be significant (Figure 4.4, hypothesis 3) and therefore supported the first requirement. Next, for the second requirement for mediation, path *a* was assessed through a linear regression analysis and revealed an R2 = .331, p < .001 and significant relationship (β = .575, t = 18.092, p < .001). In step 3, path b was assessed through a hierarchical regression analysis by controlling safety motivation variable. The results indicated a significant relationship (R2 = .355, β = .520, t = 13.618, p < .001). Finally, step 4 was assessing complete mediation (path c') by controlling path *a* and path *b*. The hierarchical regression analysis revealed the relationship between safety motivation and safety behavior was still significant (R2 = .355, β = .118, t = 3.087, p < .01), however there was a reduction in beta value. It was concluded that partial mediation had occurred in this relationship and therefore support the hypothesis that safety commitment will mediate the relationship between safety motivation and safety behavior. Figure 4.8 and Table 4.19 depict the

significant the indirect relationship between employees' conscientiousness and safety behavior.

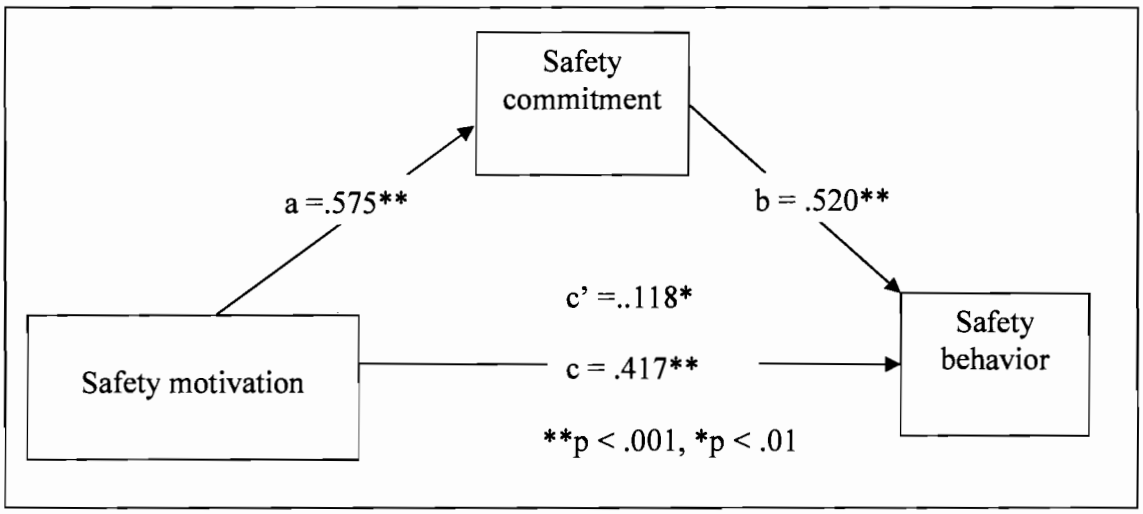

Figure 4.8
The mediation of safety commitment between safety motivation and safety behavior

Table 4.19
Summary of the regression analysis

Variable	Dependent variable = safety behavior		Conclusion
	Without mediator	With mediator	
Safety motivation	.417**	.118*	Partial mediation
Safety commitment		.520**	

** p < .001, *p < .01

Hypothesis 5: Employees' competency will have a positive relationship with safety behavior. To access this relationship, a linear regression analysis was conducted and the results revealed an R2 = .276, p < .001. The direct relationship of safety motivation and

safety behavior was found to be significant (β = .525, t = 15.855, p < .001). Hypothesis 5 was therefore accepted. Figure 4.9 depicts this direct relationship.

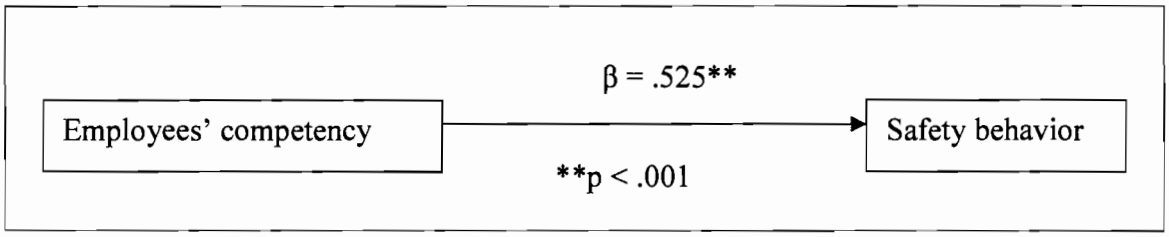

Figure 4.9
The direct relationship between employees' competency and safety behavior

Hypothesis 6: employees' competency will have a positive relationship with safety commitment. Hypothesis 4: safety motivation will have a positive relationship with safety commitment. To access this relationship, a linear regression analysis was conducted and the results revealed an R2 = .398, p < .001. The direct relationship of safety motivation and safety commitment was found to be significant (β = .631, t = 20.904, p < .001). Hypothesis 4 was therefore accepted. Figure 4.10 depicts this direct relationship

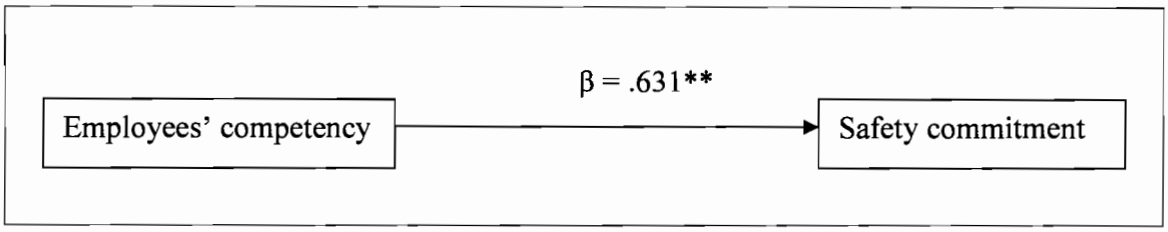

Figure 4.10
The direct relationship between employees' competency and safety commitment

Hypothesis 9: Safety commitment will mediate the relationship between employees' competency and safety behavior. To access this hypothesis, Barron and Kenny's (1986) criteria for mediation was followed. Path *c* was found to be significant (Figure 4.5, hypothesis 5) and therefore supported the first requirement. Next, for the second requirement for mediation, path *a* was assessed through a linear regression analysis and revealed an R2 = .398, $p < .001$ and significant relationship ($\beta = .631$, $t = 20.904$, $p < .001$). In step 3, path b was assessed through a hierarchical regression analysis by controlling employees' competency variable. The results indicated a significant relationship (R2 = .386, $\beta = .427$, $t = 10.860$, $p < .001$). Finally, step 4 was assessing complete mediation (path c') by controlling path *a* and path *b*. The hierarchical regression analysis revealed the relationship between safety motivation and safety behavior was still significant (R2 = .385, $\beta = .255$, $t = 6.495$, $p < .001$), however there was a reduction in beta value. It was concluded that partial mediation had occurred in this relationship and therefore support the hypothesis that safety commitment will mediate the relationship between employees' competency and safety behavior. Figure 4.11 and Table 4.20 depict the significant the indirect relationship between employees' competency and safety behavior.

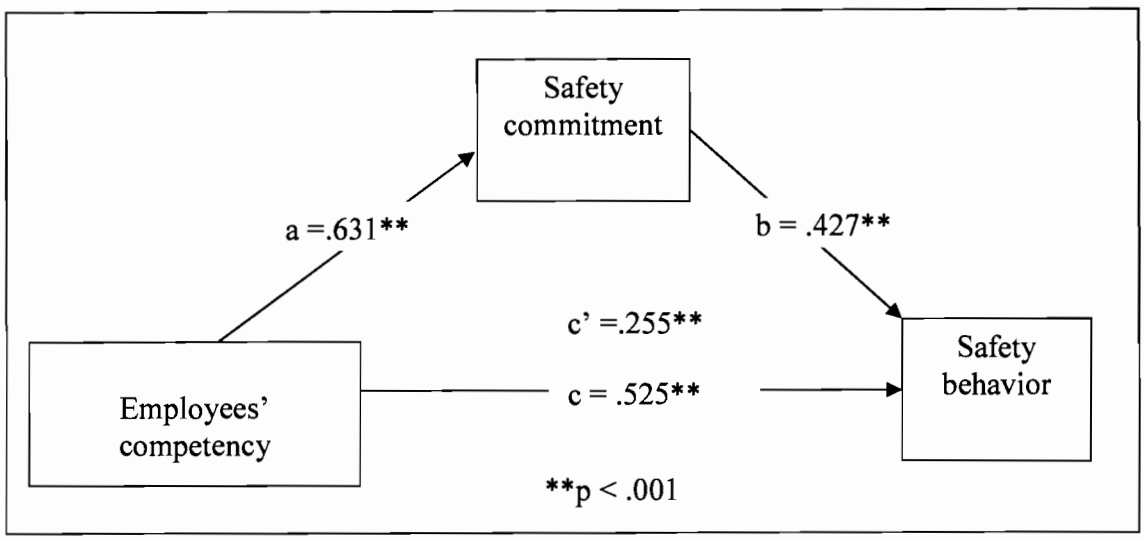

Figure 4.11
The mediation of safety commitment between employees' competency and safety behavior

Table 4.20
Summary of the regression analysis

Variable	Dependent variable = safety behavior		Conclusion
	Without mediator	With mediator	
Employees' competency	.525**	.255**	Partial mediation
Safety commitment		.427**	

** p < .001

Table 4.21 shows that all hypotheses were supported and thus accepted for this study.

Table 4.21
Acceptance or rejection of stated hypothesis

No	Hypothesis	Accept or reject
1	Employees' conscientiousness will have a positive relationship with safety behavior	**Accept**
2	Employees' conscientiousness will have a positive relationship with safety commitment.	**Accept**

3	Safety motivation will have a positive relationship with safety behavior	**Accept**
4	Safety motivation will have a positive relationship with safety commitment.	**Accept**
5	Employees' competency will have a positive relationship with safety behavior.	**Accept**
6	Employees' competency will have a positive relationship with safety commitment.	**Accept**
7	Safety commitment will mediate the relationship between employees' conscientiousness and safety behavior.	**Accept**
8	Safety commitment will mediate the relationship between safety motivation and safety behavior	**Accept**
9	Safety commitment will mediate the relationship between employees' competency and safety behavior	**Accept**

4.5 DISCUSSION

This section begins with an introduction and a summarized description of the thesis. Next, the background of the respondents will be discussed in more details followed by a review of the findings of each stated hypothesis.

4.5.1 Introduction

The aim of this research was to study the direct and indirect relationship of the selected human related factors (employees' conscientiousness, safety motivation, and employees' competency) with safety behavior. This is important because influencing behavior has a major impact on improving safety performance at the workplace (Reason et al., 1998); Geller, 2000; Glendon & Litherland, 2001; and Johnson, 2003). By understanding these relationships, it may provide tools and insight for practitioners and academicians to

continue improving occupational safety at the workplace. The antecedents presented in the construct reflected the attitudes and behavior of the employees toward individual safety commitment and organizational safety goals (e.g., zero lost time injury). For example, conscientiousness represents an attitude which is described by how well employees organize and conduct themselves at work. These are the individuals who are seriously committed to safety and behave according to social norm of the safety culture in the industry. It motivates them not only to comply but also drives them to participate actively in all safety programs. This in tandem with increasing self-reported safety behavior and reduction in unsafe behavior are all that any employers is expecting from the employees. It is the goals of the employers to attain zero incidents but it is the responsibility of the employers to produce safe employees. For this reason, employees have to be competent. They should have full knowledge of the tasks, skillful and have physical ability to carry out the job safely. This effort by the employers will only be fruitful if all employees are committed to safety and motivated to learn new skills and upgrade themselves to the next level of safe workers. Only with solid commitment and positive attitudes towards organizational safety goals can the mission to achieve competent and safe workforce in this industry will be viable.

The setting of this study involved the employees and contractors working in the petrochemical industry in Malaysia. Consider a young industry in the country, petrochemical industry deals with manufacturing of hazardous chemicals with several of them known to cause adverse effect to the human health and environment (e.g., monomers and alcohols). Employees and contractors who are involved in the operation

of the manufacturing facilities are exposed to these hazardous chemicals as well as the hazards originated from the process and installations (e.g., high temperature, high pressure, sharp object, etc). The government of Malaysia through its legislation regards petrochemical industry as high risk and mandated proper risk assessments to be carried out and reported to the authority. In mitigating the risk, the owners deploy various means and resources to ensure the risks associated with process and installation are reduced to minimum. However, safety behavior of the employees and contractors at the workplace are not totally within the employers' control because it largely depends on individual self-conduct. For this reason, this research focusing on safety behavior in this work setting would be a major breakthrough in occupational safety study.

4.5.2 Discussion of the Hypothesis

Hypothesis 1 proposed that there would be a positive relationship between employees' conscientiousness and safety behavior. This hypothesis was supported by the result of the regression analysis which revealed a strong positive relationship between these two variables ($\beta = .553$, $p < .001$). Conscientiousness reflects the attitude of the employees and this personality characteristic suggests that conscientious employees behave safely while performing the job at the workplace. They hold strong positive personal qualities such as dependable, hardworking and need for achievement which is essential to safety behavior because it motivates them to comply with safety rules as well as to participate in safety programs. The positive outcomes are to be expected from conscientious employees where safety climate will be established and each employee will work

together to achieve common organizational safety goals. It is expected that safety performance of the employees will increase and injuries will be reduced.

In comparison, previous research found positive relationship between employees' conscientiousness and job performance across a variety and level of occupations (Barrick, Mount & Strauss, 1993; Salgado, 1997; Stewart, 1999; Hurt & Donovan, 2000, Major, Turner & Fletcher, 2006; Hampson et al., 2007 and Jin, Watkins & Yuen, 2009). In occupational safety, previous research found negative relationship between conscientiousness and accidents and unsafe work behaviors (Arthur & Graziano, 1996; Cellar, Nelson, York & Bauer, 2001; Arthur & Doverspike, 2001 and Wallace & Vodanovich, 2003). The safety performance described as safety behavior in this study is regarded in a positive way as defined by Borman and Motowidlo (1993) in term of task performance (safety compliance) and contextual performance (safety participation) instead of accident rate and unsafe behavior. This result of this study showed a positive relationship between conscientiousness and safety behavior which is actually the reverse of the relationship between conscientiousness and accidents and unsafe work behavior. Examining closely, these relationships intended to prove the same ideas that safe behavior demonstrated by conscientious employees caused fewer accidents at the workplace. The safe work behavior is demonstrated by the employees voluntarily engaging themselves in safety programs and complying with organization safety rules and regulations. This finding indicated that none of this safe behavior is possible without conscientious employees who posses qualities that reflect dependability (e.g., thorough, careful, organized, responsible) as well as the need for achievement (Barrick & Mount,

1991; Hough, 1992; and Moon, 2001). It is assumed that conscientiousness relates to internal motivational processes and therefore more conscientiousness employees perform better as they have higher levels of work motivation (Schmidt & Hunter; Stewart, 1999). They behave more safely at the workplace due to the characteristics they possess and exhibit. They have desires to follow regulations (Hough, 1992) and this characteristic is especially important for dangerous work environment in which short-cuts and procedure violations can endanger employees' safety as highly conscientious individuals are methodical and practice effective time management (Moon, 2001; Stewart, 1999). This is important because safety at the workplace is definitely a concern and having employees possessing this characteristic might enable them to plan effectively to complete the tasks more accurately and safely in a specified amount of time. Finally, it is a desire of the organizations to employ conscientious individuals who are well organized and disciplined as this lead to goal striving during engaging and completing of tasks in a safer manner.

Hypothesis 2 proposed that employees' conscientiousness will have a positive relationship with safety commitment. The occupational safety practices seek to gain safety commitment from the management as well as the commitment from the employees because it forms the basis for achieving superior safety performance. The commitment to safety as defined by Cooper (1998) is the individual's involvement in safety activities and is characterized by a strong acceptance and belief in organizational safety goals. The key to commitment as defined by this definition is the involvement, acceptance and belief in safety. It may originate from the organizations, management as well as individual

employees; all must be interconnected to produce solid organizational commitment to safety. Individually, it requires a strong character to embrace all three conditions and only possible by conscientious employees who are set and motivated to go beyond achieving organizational safety goals. Their commitment is demonstrated through attitudes and behavior which are highly praised as safe workers.

Previous studies revealed there was a positive relationship between conscientious and job commitment (Barrick et al., 1991), education commitment (Lounsbury et al, 2009), and career commitment (Jin, Watkins & Yuen, 2009). However, there was previous study testing the relationship between employees' conscientiousness. The regression results of this study supported this hypothesis that employees' conscientiousness relate strongly with safety commitment ($\beta = .729$, $p < .001$). It implies highly conscientious employees have stronger safety commitment and reflected by their attitude and behavior towards safety. For petrochemical industry, employing and maintaining highly committed employees to safety is crucial to ensure smooth and productive operation without any mishaps. This is because petrochemical industry is risky to which employees might be injured due to exposure to hazardous material and hazardous working conditions. The guiding principles set by the employers to ensure safe operation have to be strictly followed. Only conscientious and committed individuals with the right attitude and mind-set will abide to this principle. More importantly, it provides a solid justification for the management to invest in programs that can influence employees' conscientiousness and commitment towards organizational safety.

The results of the regression analysis for safety motivation and safety behavior shows a strong positive relationship ($\beta = .417$, $p < .001$) and therefore supported hypothesis 3 and answered research question "What is the relationship between safety motivation and safety behavior?" The variance in the safety behavior explained by safety motivation was 17.4 percent. These results further strengthen the notion about the influence of person factors on safety behavior as discussed by several previous studies (Neal, 2000; Zacharatos, 2001; Neal & Griffin, 2000; Wallace & Vodanovich, 2003; Hinsz, Nickell, & Park, 2007). It relies solely on the influence of attitudes and subjective norms (Hinsz, Nickell, & Park, 2007). Accordingly, the source of energy for safety motivation may be triggered by responsiveness to reward and penalty scheme, desire to achieve superior safety performance and to perform better than other colleagues (Klehe & Anderson, 2007). The social pressure exerted by safety requirements enforced by government safety regulations and organizational safety policy shall influence the attitude of the employees to perform nothing but safe behavior at the workplace.

Motivated employees, according to this finding, shall do better in complying and participating in safety programs, improving personal safety, maintaining high standard of safety performance and reducing occupational risk. All of these actions are behavior related and safety motivation, according to Neal and Griffin (2006), shall drive individual to exert effort to enact safety behaviors and the valence associated with those behaviors. As an illustration to show how safety motivation can improve complying behavior to use personal protective equipment, one might think about avoiding injuries and its complications as a source of safety motivation. In response to this thought, one shall

choose to fully comply with the requirement to use personal protective equipment at all times where this rule is applicable. As suggested by Klehe and Anderson (2007), the persistence effort and high level of commitment shined by safety motivation shall produce superior safety behavior performance through the attitudinal influence.

In petrochemical industry, the motivational force for shaping the safety behavior of the employees can be derived from government regulatory requirement. Specifically, Regulation 5(2) of Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulation 1996 clearly defines the mandatory obligation of every employee to (a) co-operate with the employer in complying with these regulations; (b) act safely so as not to cause any danger to himself, other people and the property; and (c) notify employers and Safety and Health Officer when he realized about any potential hazards (OSHA Act and Regulations, 2007). This obligation is not by choice but mandatory. Therefore, according to Sackett et al. (1998), this is the stage where the maximum driving force is triggered by performers' explicit awareness of the law governing their actions in which every employee must comply with. The direct influence, as clearly supported by this strong relationship, will be the demonstration of safe behavior while performing the job and governed by all the points discussed above.

Further analyses of safety motivation revealed a strong direct positive relationship with safety commitment ($\beta = .575$, $p < .001$) and therefore supported Hypothesis 4 and answered research question "What is the relationship between safety motivation and safety commitment?" The variance in safety commitment explained by safety motivation

was 33.1 percent. This relationship shows the individual's commitment to safety can be influenced by individual's safety motivation whereby as the motivational force gets stronger, the stronger will be the commitment towards safety activities. It can be translated in many forms such as consistent safety behavior (Becker, 1960), involvement in safety activities (Brown, 1969), employees' identification (Hall et al., 1970), the binding between employers and employees (Allen & Meyer, 1990) and the organizational citizenship behavior (Becker & Randall, 1995). The recent study by Abd Aziz (2008) in Malaysia Railway System revealed safety commitment consists of priority to safety, safety involvement and safety compliance. Employees, when committed to safety, shall place the safety of the occupation at the highest level and they will very unlikely compromise safety for economic reason whereas safety involvement and compliance are two powerful commitment tools to achieve superior individual's safety performance.

Organizations having employees who are committed to safety shall gain immediate rewards in term of quality and profitability (Cooper, 1998). It will be visible when overall incident rate and cost associated with incidents are reduced. Together with abovementioned gains, the organization reputation for safety achievement would be enhanced and thus becomes a competitive advantage. The employees, on the other hand, would be more marketable and employable especially in petrochemical sectors. Thus, it is the commitment of the employers to create a healthy safety environment where employees feel safety is important. It must be supported by sound safety programs to nurture positive attitude towards safety and therefore gain their commitment.

The positive relationship found in this study shows how crucial safety motivation is to the petrochemical industry in order to influence employees' commitment because dealing with hazards due to the nature of its operation requires highly motivated employees who are committed to safety. In part, this role is played by technical training institutes and higher learning institutions in providing background knowledge on safety to future to be employees. It is a hope this theoretical knowledge will motivate the future to be employees to apply and to explore the good safety practices at the workplace. Together with the commitment to safety, the goals to achieve superior safety performance will be achieved.

Another important determinant influencing safety behavior proposed in this study was employees' competency. The results of the regression analysis showed a strong positive relationship ($\beta = .525$, $p < .001$) and therefore supported hypothesis 5 and answered research question "What is the relationship between employees' competency and safety behavior?" The variance in the safety behavior explained by employees' competency was 27.6 percent. This direct relationship shows that for every unit change in employees' competency, there will be a proportional change of about half a unit in safety behavior. Therefore, competency is paramount to influence safety behavior and the success of organizations in many industries (Stephens et al., 2009). The definition clearly states that competency is about attitude and behavior as defined by many authors as knowledge, skill, ability or characteristics associated with high performance on the job (Mirabile, 1997; Bartram, Roberson, & Callinan, 2002; Dole et al., 2005). Spencer and Spencer (1993) characterize a competent person as someone who has clear direction (motive),

self-control (trait), confident (self-image), information (knowledge), and analytical thinking (skill). It combines both physical and the mental ability of an individual to be called competent.

High performance accredited to competent persons can be viewed in many ways. It can be a high sales volume or ability to withstand the downturn effect of global financial crisis. In occupational safety, high performance of an individual can be viewed as complying with safe operating procedures, active in promoting safety programs and ability to identify risks and mitigate those risks to as low as reasonably possible. Ultimately, this is the kind of safety behavior expected from an employee. Notwithstanding the expectation, competency varies among individual and therefore the output changes accordingly. Therefore, achieving high safety performance is a timely process and has to begin with producing competent employees.

The Malaysian Occupational Safety and Health Act under Section 15(2b) places the responsibility on the employer to provide sufficient information and training to ensure employees are safe and healthy at workplace. In addition, the Act specifies, in Section 24(1a), that the duty of the employees is to take care of their own safety as well as other people who may be affected by their actions (Occupational Safety and Health Act and Regulations, 2007). Furthermore, the regulation which is applicable to petrochemical industry under the Control of Industrial Major Accident Hazards (CIMAH) discusses the requirement of the manufacturer to provide the people working on site with the information, training and equipment necessary to ensure their safety while on the job. All

these provisions can be interpreted as a signal on the requirement to have competent employees who are well-trained and have sufficient information about the risks and the protection against those risks so that they are able to take care of themselves and other people working with them. The strong positive relationship found in this study supports the notions that competent workers are safe workers. Moving towards self-regulation on safety, the Malaysian government hopes the organizations shall abide with the requirements and produce competent employees for good safety practices at the workplace.

By the same token, employees' competency was found to have positive relationship with safety commitment. The results of the regression analysis showed a strong and significant relationship ($\beta = .631$, $p < .001$) and therefore supported hypothesis 6 and answered research question "What is the relationship between employees' competency and safety commitment?" The variance in the safety commitment explained by employees' competency was 39.8 percent. This relationship indicates the important of competency in influencing employees' commitment to safety. Therefore, the attitude towards safety compliance and safety involvement shall increase in proportion with the increase in employees' competency level.

The final part of hypothesis testing was to determine the mediating effect of safety commitment in relationship between employees' conscientiousness, safety motivation and employees' competency with safety behavior. In theory of planned behavior, the commitment to safety is best explained as the intention to perform a behavior and the

likelihood depends on the intention level. The hypothesis proposed there must be a mediator relating the predictors to safety behavior. The results of the regression analysis using the method proposed by Barron and Kenny (1986) showed safety commitment partially mediated the employees' conscientiousness, safety motivation and competency with safety behavior. The results were therefore supported hypothesis 7, 8 and 9 and answered research question "To what extent does safety commitment mediates the relationship between employees' conscientiousness, competency and safety motivation with safety behavior? Previous study by Johnson (2003) suggested commitment mediates the relationship between subjective norm and attitude with the behavior. The study found partial mediation of safety commitment between subjective norm (i.e., safety motivation) and attitude (employees' conscientiousness) with safety behavior. Therefore safety behavior as shown by this relationship can be directly and indirectly influenced.

The support of Hypothesis 7, 8, and 9 provides a new direction for the organizations interested in influencing safety behavior of their employees. Since the finding showed partial mediation, it can be said that safety behavior can be directly influenced by employees' conscientiousness, competency and safety motivation. The findings also suggest that employees' conscientiousness, competency and safety motivation influence safety behavior by affecting safety commitment. Either way, organizations pursuing to improve the safety behavior of its employees have to focus on influencing attitudinal and safety commitment factors. It is believed gaining the commitment from employees by nurturing positive attitudes is more effective and long lasting. Employees who believe safety valued at the workplace shall act in a way to uphold this value. They voluntarily

promote good safety practices among their colleagues and comply with all safety rules and procedures. Their behavior is visible and can become a role model for others to behave in the same way.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The aim of this research was to determine the extent to which human factors influence safety behavior of the employees working in the petrochemical industry. The results of this study were crucial because the nature of work activities in this industry is high risk which may cause potential human exposure to hazardous substances and elevated process parameters. History had shown those accidents involving accidental released of toxic substances such as Bhopal tragedy and released of flammable gases were disastrous and the impact to the company and shareholders were tremendous. As the industry expanded and more people were employed, minimizing these risks was inevitable. To address this issue, the regulatory body introduced laws specifying the responsibilities of the employers and the employees in relation to occupational safety at the workplace. In addition, companies introduced various safety measures such as competency building and safety awareness program in order to produce safe workers. However, despite rigorous safety measures introduced by both parties, the general trend indicated that the number of reported occupational safety accidents in the industries was increasing. It can only mean one thing that these measures were ineffective. Meanwhile, literature review revealed that a number of safety behavior studies were focused on organizational factors and thus neglecting other important contributing factors such as persons, behavior, and environmental factors. In view of this issue, Reason et al (1998) stated that despite the fragility of the industry, past literature had shown that safety behavior studies in high risk

working environment had received little attention. Therefore, it was a compelling urge to examine the safety behavior of the employees in the petrochemical industry in Peninsular Malaysia. The outcomes of this study could assist the management to improve its safety performance while at the same time this study set a sound platform for future valuable work in this area.

It was interesting to discover that many companies were interested in the study and allowed their employees to participate. This was because of the growing concern due to increasing trend of reported accident cases in the industry in Malaysia and the adverse effect of such accidents to company's reputation, economic and financial performance. It was believe they are interested in the findings and learn how their employees' safety behavior can be improved further. To enhance participation, survey questionnaires were translated into Malay language from English version and both versions were distributed by the appointed representatives in the respective organizations. The target group was the individual employees who work directly and expose to various hazards in the plants. They include the technicians and the contractors who are more proficient with the Malay language. This method proved to produce encouraging results. A total of 1,017 survey questionnaires were distributed between Jun and Aug 2009 and 671 of them were returned (66 percent). The surveys conducted by other researchers (e.g., Neal & Griffin, 2000) in safety showed the returned rate was between 60 to 80 percent; therefore this finding was within the common range.

A review of the respondents revealed that male employees were dominant. The ratio of male to female was approximately 10:1 indicating males formed a majority group in the operation of petrochemical manufacturing facilities in Malaysia. This was visible during the plant visit and partly was attributed to the 24 hour shift rotation which was more appropriate to males. The Malays were more attracted to the job compared to the other races and significant number of them served in the technician level positions. Except for the high percentage of Malay population in the country, other factors explaining low participation rate among non-Malays in the operation of high risk industry is yet to be explored.

In term of the competency level, the analysis showed a good blend between the respondents who had college degrees and those who had secondary schools certificates. At the very least, they understood the content of the questionnaire and understood the basic safety requirement to protect themselves against danger at the workplace. There was also a good mixture between the most experienced respondents and those who had just started their career so that well-balanced responses were obtained from the survey. The important point was that they had technical background to operate the plant safely. The experienced employees passed down their knowledge and shared their experience with the juniors through informal method, mostly by verbal interaction and demonstrating the correct way to perform a job. This will enhance the competency level of newer employees in the plant operation. Some employers make it compulsory for employees working in this field to attend various competency trainings to improve the knowledge and skill such as hazard identification, behavior-based training, and technician

development program. It is crucial that they understand the risks and how to protect themselves. This can be only achieved by competent employees.

The safety behavior model presented in this study was based on the industrial statistical evidence that almost all incidents in the industries occurred because of human errors and unsafe behavior (Geller, 2001). The focus was on the human psychology and how does it relate to the behavior. It was believed that the psychological factor must have influenced the commitment before a behavior is finally executed. To support the model, the Theory of Planned Behavior (Ajzen & Fishbein, 1986), which states that the intention to perform a behavior is influenced by attitude, subjective norm and perceived behavioral control, was selected. The beliefs and the perception play a crucial role in evaluation steps prior to committing and finally executing the decision. In this model, safety commitment represents the intention to perform safe behavior and it is influenced by salient beliefs from individuals' conscientiousness about safety (attitude), motivation to meet organizational and regulatory requirements (subjective norm) and the competency level (perceived behavior control). Therefore, the Theory of Planned Behavior was the right selection as it provided a strong and an explainable concept to support the model.

Factor analysis revealed that the number of factors extracted were the same with the finding of the original authors. As an example, two factors determined from safety behavior measurement tools were similar to the finding from Neal and Griffin (2006). However, not all items in each factor were the same. In addition, the safety commitment measurement tool was tested for the first time after it was introduced in 2008 (Abd Aziz,

2008). The analysis extracted 3 factors which was similar with the numbers obtained by the original author, however not all items in each factor was the same. The result indicated the measurement tools are applicable to be used in different fields but the items in the questionnaire representing each factor might not be the same.

The results of the regression analysis supported all proposed hypotheses and therefore fulfilled the objectives of the study. Employees' conscientiousness, safety motivation, employees' competency were all have positive relationship with safety behavior. On top of that, the findings showed that safety commitment partially mediated these relationships. It can be concluded that the individual goals to fully comply with safety rules and safe operating procedures are viable by changing the attitude towards safety. Similarly, active self-participation in safety programs organized by the employers shall be possible with positive look about the important of safety at the workplace.

5.2 SUMMARY OF THE MAIN FINDINGS

This study found that safety behavior in the petrochemical industry is strongly influenced by individual conscientiousness, safety motivation, and competency. In addition, the individual commitment to safety is equally important to influence safety behavior and to reduce accidents at the workplace. The findings also verified the industrial statistical evidence which concluded that human error and unsafe behavior were the main cause of occupational accidents at the workplace (Geller, 2001; Cooper, 2009). Among the four variables studied, it appeared that the individuals who are dependable and self-motivated

to achieve personal and organizational safety goals showed the strongest influence on safety behavior (β=.553; R2 = .306; P < .001). They are highly committed to safety goals and act as change agents to ensure safety is valued and prioritized. This high standard quality of personality differentiates them from the other colleagues and their safety behavior represent.

This study also revealed that competency and the level of motivation towards safety at the workplace were equally important to improve safety behavior. The competency which is explained by skilful and knowledgeable employees are demanded in petrochemical industry because they are more discipline and inclined to exhibit safe behavior. It gave them self-confident and better control when they perform their work. Continuous assessment and improvement of competency programs are therefore imperative to generate a pool of highly competent employees to operate the production facilities. Similarly, motivation to work safely is the key driver for the employees to push safe behavior forward. It was explained that this driver is originated from the regulatory requirements and organizational safety goals mandating compliance from the employees.

5.3 DISCUSSION ON THE FINDINGS AGAINST RESEARCH OBJECTIVES

The results of the regression analysis supported all hypotheses and therefore fulfilled the objectives of this study. Employees' conscientiousness, safety motivation, and employees' competency were all have positive relationship with safety behavior. In

addition, employees' conscientiousness, safety motivation and employees' competency were also found to have positive relationships with safety commitment. Among the three antecedents used in this study, employees' conscientious appeared to have the strongest influence on safety behavior and safety commitment, followed by employees' competency and safety motivation. This is a clear indication that personality traits play a significant role in determining the safety behavior in the Malaysian petrochemical industry. However, this aspect is almost neglected by many practitioners in providing solution to occupational accidents. It would definitely have a great impact on safety behavior if this factor was taken seriously by the practitioners.

The findings also fulfilled the objectives that there is a mediating effect of safety commitment in the relationship between employees' conscientiousness, safety motivation, and employees' competency and safety behavior. Though partially mediated, this finding means that gaining commitment from employees is crucial for improving safety behavior because commitment represents an intention towards a behavior. Stronger commitment is influenced by conscientious, self-motivated and competent employees. All of these antecedents are interlinked and together they generate commitment which is crucial for safety behavior.

In addition to fulfilling the research objectives, this study also contributed to enhance the knowledge and the application of the Theory of Planned Behavior which was used extensively in marketing to predict consumer behavior but was hardly applied to predict safety behavior among employees in the industry. The respective element of the theory,

namely attitude, subjective norm, perceived behavioral control and intention, was explained by the respective variables of the model. The attitude toward a behavior was justified by individual's conscientiousness and was explained that conscientious individual have a more positive attitude and more committed toward a behavior. The subjective norm was justified by the social pressure exerted from the organization and the authority which directly motivate employees to commit and to behave safely. In addition, perceived behavior control was explained by employees' competency which states that employees have more confident and better control of their self-conduct when they have more knowledge, ability and skill to complete the tasks. Accordingly, the likelihood of a person to perform a behavior depends on the strength of his intention towards the behavior. This is justified by safety commitment and was explained that the likelihood for a person to perform safety behavior depends on the strength of his commitment to safety. Therefore, this study provided a new application and knowledge of how the theory of Planned Behavior should be applied to predict safety behavior.

5.4 IMPLICATIONS TO MANAGERS

The results of this study have several practical implications. In term of personality, the findings suggest that the employees who are low on conscientiousness may be trained to adopt certain skill to be alert and more confident. However, the training has to be associated with adequate motivation to improve themselves. Besides sending them for formal training, managers or immediate supervisors shall play their role to help their subordinates to achieve challenging goals and at the same time overcome obstacles.

Individual coaching and positive feedback rather than emphasizing punishment should help employees to enjoy their work more and hopefully improve their performance in safety.

The result of this study also suggests that safety motivation drives safe behavior at the workplaces. The primary motivator is to leave the workplace at the end of the day as healthy as when leaving the house for work in the morning. To live with this notion, a person needs adequate knowledge about the job and the risks associated with it. Not only that, a person needs to mitigate those risks to as low as possible. In any case of emergency, this person needs to know how to respond and protect himself against the danger. The widely used method for motivating the individuals is by using the reward and punishment method or carrot and stick technique. Rewarding someone for safe behavior encourages a person to continue the good deeds and sets the role model for colleagues to act in similar manner. On the contrary, punishment can be viewed as deterrence of safety violation while at the same time pushes the individuals to act according to the rules imposed by the master. This method of "obey me or you will be punished" works because of fear. Ideally, safety behavior and safety commitment work best when the true motivator is the individual awareness about the important to implement safety on the job.

Further finding suggests the requirement for petrochemical manufacturers to set a minimum competency level as part of employment criteria. The candidates must have a basic knowledge about the hazards, risks and how to protect themselves. They also need

to be exposed with hands-on experience while they were in college. This can be accomplished by internship programs, industrial training programs and site visits. In addition, universities and colleges have to open its door to invite safety practitioners to lecture and share experience with the students as part of program curriculum. Employers have to prepare the long term planning to establish a competent workforce. It has to start from hiring process and the development shall continue from day one until the employees decide to leave or retired from the company. The employers have to establish safety mandatory training where it is applicable for all staff. As an example, hazard identification and risk assessment training shall be part of mandatory safety trainings. On top of it, coaching and feedback from supervisors will enhance the competency level of their subordinates.

Finally, the finding suggests a new approach to promote safety behavior by focusing on employees' safety commitment. This is crucial as it represents the intention before the actual behavior is performed. Stronger commitment to safety means stronger likelihood the person will behave safely. The commitment, as outlined in this study, can be influenced by enhancing personality factor, social obligation and their competency. It will be the responsibility of the employers to support the employees in gaining commitment to safety by establishing programs requiring individual commitments such as team building program. The first step is to access the level of safety commitment of the employees in the organization because the results will provide a good indication of their safety behavior. Poor results means immediate corrective actions to close the gap

have to be established. Likewise, good results means high safety commitment and maintaining at this level would be a challenge for the organizations.

5.5 IMPLICATIONS TO POLICY MAKERS

The government had established regulations and has taken many actions to guard employees against the entirely preventable tragedies of occupational death, disease and disability (Occupational Safety and Health Act and Regulations, 2007). On the contrary, the existing safety regulations have had little effect to guard employees against occupational accidents at the workplace. In fact, as discussed in Chapter 1, the number of accidents was increasing in proportion with the expansion of the industry. This is the greatest challenge to policy makers in their quest to find a better approach to control the growing number of accident cases. The effectiveness of traditional method of managing occupational safety by merely focusing on the hardware of organizational safety system and the working environment is therefore needs to reviewed and reexamined.

The findings of this study suggest a new approach to enhance safety policy and safety performance at the workplace. This approach promotes heavier weightage on safety behavior that it shall be included during the entire process of the employment, beginning from the recruitment process until the employees retired from the company. Specifically, the policy on safety behavior should cover the hiring process, the induction process, on-the job process, enhancement process and maturity process. The hiring process involves selecting the right candidates for the jobs while the induction process relates to

explaining about the working condition and equipping the right tools and knowledge for the candidates. In addition, on the job involves supervising the new employees so that they have properly mentored in their journey in the new jobs. The enhancement process is the advance steps to further strengthen the knowledge of the new employees after they have served the company for several years and finally the maturity stage is establishing the refreshers courses to re-enlighten them with all the knowledge they have learned in the past. For all these process steps, the policy makers should regulate a requirement for the industry to establish a standard procedure for screening and assessing the candidates on their safety attitude prior to employment. Only those who have a positive attitude should be considered for interview. Similarly, the policy makers should establish a regulatory requirement that safety behavior syllabus shall be included in the procedures of the other process steps.

Policy makers should also establish a requirement for the industry to conduct behavioral based safety audits for its employees. This has to be conducted using an established safety behavior checklist with a detail procedure of the audit process including the frequency of the audit. The audit reports have to be submitted to the Department of Safety and Health as evidence and all corrective actions have to be closed according to the deadlines. The authorities can make a big impact on the audits by performing site verification to ensure the corrective action are closed while at the same time they can witnesses the safety behaviors of the employees. This is a check and balance process which is crucial to the successful implementation of safety behavior improvement at the workplace. In addition, policy makers shall make it a compulsory for all registered

Occupational Safety and Health Officers to be trained and certified in Behavior Based Safety audits and shall be part of the licensing and practicing criteria.

5.6 IMPLICATIONS TO FUTURE RESEARCHERS

The safety behavior model should be applicable to various work settings and industries because the variability of working conditions and the workers. The variation may be in the form of risks, safety climate and culture, organizational commitment and the background of the employees. The behavior may be better in proportional to the commitment of the employers, safety climate and culture and the risks associated with the job. However, the employees play a big role in occupational safety. As an example, it is a known fact that construction sectors employ many immigrant workers whose safety conscious might not be as good as locals. Therefore future research should examine the safety behavioral model in these areas and compare with the findings of this study.

To resolve the issue with response bias, future research should consider supporting the survey data by safety observation using behavioral checklist and safety records. However, the safety observation must be conducted with the intention to reinforce safe behavior and correct the unsafe act on the spot. It should not be used to reprimand employees for safety violations. The safety records would be the records of the individual violations of safety rules. When compare with the survey data, the quality observation method and individual safety records should provide a strong support for the actual individual safety behavior.

The scope of this study should be extended to include other Big Five personality factors such as extraversion, openness to experience, agreeableness and neuroticism. These four personality factors can be tested and analyze its relationship with safety behavior. As an example, neuroticism is about emotional stability including proneness to negative feelings such as anxiety. It would be interesting to discover the relationship of this personality characteristic with safety behavior. Likewise, motivation has to be discussed in the general context of driving individuals to fulfill their goals such as job satisfactions and job security. Similarly, employees' competency has to cover the breath and depth of the overall work scope including the safety aspect of the job. Finally, future study of safety behavior should assess the safety commitment of the employers and the commitment to the organization and relate those variables with safety behavior

5.7 LIMITATION OF THE STUDY

Several limitations of this study were noted. As an example the respondents in the survey consist of employees and contractors working in petrochemical industry and their safety behavior reflect the hazards and risks inherent in the petrochemical working environment. The behavior might be difference in other work setting because of the difference in the hazards and risks. For instance, the safety behavior of the construction workers might be different from safety behavior of plant operators. As the risk is measured by multiplying the probability and the severity of failure, the history have shown the frequency of construction workers getting injured and permanently disabled or died were higher than

plant operators (DOSH, 2007). Therefore generalisability of this finding to other industry in similar risk category may be limited.

This study used self-administered questionnaires as a primary tool to collect the data from the respondents. These measurement tools can be viewed as limitation because self-administered questionnaires may raise the tendency of single-source bias. It is understood, that majority of the respondents like to show their good safety behavior in the surveys. This might lead to a wrong conclusion assuming the responses represent the true picture of their safety behavior at the workplace.

The scope of this study is limited to the selected human factors and its relationship with safety behavior. Conscientiousness is one of the Big Five personality factors included in the model while the other four factors were not. Likewise, safety motivation was discussed in the context of fulfilling the obligation of the regulations imposed by the organizations and the government. The general term of motivating factor (e.g., job satisfaction and security) was not discussed. In addition, employees' competency was discussed in term of education background and the knowledge about the safety at work. This is a limitation because competency covers the breath and depth of the overall work scope in which safety is a part of it. Furthermore, this study focused on safety commitment of the individual employee. As highlighted by Abd Aziz (2008), safety commitment is multi-dimensional and should not be limited to the individuals only.

5.5 CONCLUSION

This research provided significant contributions to the academy and practitioners of safety behavior management. These findings may be used to enhance management's understanding of employees' safety behavior and how it can be influenced. This research also provides a foundation for future researchers to extend the study on safety behavior by covering wider range of human factors and different work setting.

Human capital is an important asset to the company, therefore it is imperative that the employers have clear understanding of the best strategy to win the employees to engage and commit to safety. This is vital for safety behavior improvement. The focus should be on improving employees' conscientiousness and developing competencies while at the same time motivating them to realize the important of safety. The strategy has to be to educate and then to enforce while regular performance review shall be conducted to assess and make prompt corrective actions when necessary.

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APPENDIX A: LETTER FROM THE TRANSLATOR

Azir Salleh
69, Jln 1
Balok Jaya Fl
26100, Kuantan

Tarikh : 19/5/09

Pendaftar Kanan / Pendaftar,
Mahkamah Sesyen/Majistret,
Kuantan,
PAHANG DARULMAKMUR

Tuan / Puan,

Permohonan Untuk Terjemahan Dokumen

Merujuk kepada perkara yang tersebut di atas, bersama-sama ini dikemukakan sesalinan fotostat dokumen-dokumen seperti berikut :-

i)	Sijil Kelahiran	
ii)	Sijil Perkahwinan	
iii)	Sijil-Sijil Persekolahan	
iv)	Kajian Soal Selidik ~~dll~~. Utk Pengesahan	/

untuk dibuat terjemahan dari bahasa Inggeris ke bahasa Melayu

Sekian, terima kasih.

Saya yang benar,

(Azir Salleh)

TERIMA
19 MAY 2009
Bhg Sivil / Jenayah
Mahkamah Sesyen
Majistret Kuantan

Cik Eva,
utk tindakan
19/5/09

012 981 1256
09 585 5401

18 May 2009

To Whom It May Concern

Dear Sir,

THE INFLUENCE OF EMPLOYEES' CONSCIENTIOUSNESS, EMPLOYEES' COMPETENCY, SAFETY MOTIVATION AND SAFETY COMMITMENT ON SAFETY BEHAVIOR IN THE PETRONCHEMICAL INDUSTRY: TRANSLATION TO MALAY LANGUAGE

I am EVA NUR AIN BINTI RAHMAT currently a translator at MAGISTRATE'S COURT had examined and assessed the questionnaire about "The Influence of Employees' Conscientiousness, Employees' Competency, Safety Motivation, and Safety Commitment on Safety Behavior in the Petrochemical Industry". This questionnaire was forwarded by Azir Salleh, Identification No. 660526-11-5077, student no. 90608, who is a DBA student of College of Business, Universiti Utara Malaysia.

I strongly believe that this questionnaire is appropriate to be applied in Malaysia, especially in the Petrochemical Industry.

Yours truly,

(.....)

EVA NUR AIN BINTI RAHMAT
Malay Interpreter
Majistrate's Court of Kuantan
Kuantan, Pahang

APPENDIX B

SURVEY QUESTIONNAIRE, ENGLISH VERSION

COLLEGE OF BUSINESS
UNIVERSITI UTARA MALAYSIA

Dear Sir/Madam

I am Azir Salleh, a Doctor of Business Administration (DBA) student from Universiti Utara Malaysia (Matric no: 90608), currently conducting a research entitled "The Influence of Employees' Conscientiousness, Employees' Competency, Safety Motivation and Safety Commitment on Safety Behavior in the Petrochemical Industry". In endeavoring to conduct this research data will be collected from Petrochemical organizations' employees.

Fortunately you have been nominated to take part in this research and may I ask that you kindly complete the questionnaire enclosed. I assure you that it would not take longer than 30 minutes as your cooperation will contribute to improving the standards of safety of your organization as well as Malaysia's Petrochemical industry.

All data provided will be treated as confidential and will only be used for this academic research.

Thank you for your cooperation

Yours sincerely,

Azir Salleh
College of Business,
Universiti Utara Malaysia
06010 Sintok,
Kedah
012 981 1256, AziR26@hotmail.com, azirs@basf-petronas.com.my

Section A: Safety behavior

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree
5-strongly agree

Item	Statement	1	2	3	4	5
1	I use all the necessary safety equipment to do my job.					
2	I use the correct safety procedures for carrying out my job.					
3	I ensure the highest levels of safety when I carry out my job.					
4	I am involved in improving safety policy and practices.					
5	If I think it will make work safer, I initiate steps to improve work procedures.					
6	If I see something unsafe, I go out of my way to address it.					
7	I voluntarily carry out tasks or activities that help to improve workplace safety.					
8	I often make suggestions to improve how safety is handled around here (e.g. plant areas).					
9	I often try new approaches to improving workplace safety.					
10	I often try to solve problems in ways that reduce safety risks.					
11	I keep abreast of changes to do with safety (i.e. to know the recent facts).					

Section B: Safety motivation

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree
5-strongly agree

Item	Statement	1	2	3	4	5
1	I feel that it is worthwhile to put in effort to maintain or improve my personal safety.					
2	I feel it is important to maintain safety at all times.					
3	I believe that it is important to reduce the risk of occupational accidents and incidents.					
4	I believe that workplace health and safety is an important issue.					

Section C: Employees' conscientiousness

Please tick (x) in the appropriate box to indicate your level of agreement for each item below.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree
5-strongly agree

Item	Statement	1	2	3	4	5
1.	I normally follow the rules and regulations.					
2.	I get others to do my duties.					
3.	I completed my duties on time.					
4.	I listen to my conscience.					
5.	I break the rules.					
6.	I go straight for the goal.					
7.	I break my promises.					
8.	I do more than what is expected of me.					
9.	I keep my promises.					
10.	I normally misrepresent the facts.					
11.	I demand for quality.					
12.	I work hard.					
13.	I put little time and effort into my work.					

	Statement	1	2	3	4	5
14.	I plunge into tasks with all my heart.					
15.	I do the opposite of what is asked.					
16.	I set high standards for myself and others.					
17.	I turn plans into actions.					
18.	I am not highly motivated to succeed.					
19.	I do just enough work to get by.					
20.	I tell the truth.					

Section D: Safety commitment

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree
5-strongly agree

Item	Statement	1	2	3	4	5
1.	I would not be worried about the hazard and risk at my workplace.					
2.	I really care about the safety procedures and regulations at my workplace.					
3.	Near-miss accidents are not important in safety records.					
4.	I am willing to put great effort beyond that normally expected in order to be a competent worker.					
5.	I would ensure the risks are assessed before starting my work.					
6.	It is very important to work in a safe environment.					
7.	I never give co-operation to my supervisor / manager about safety issues.					
8.	I am willing to put in great effort to achieve safety goals.					
9.	I would like to obey the safety regulations in order to keep workplace safe.					
10.	All employees should be actively involved in safety promotion activities.					

	Statement	1	2	3	4	5
11.	I think putting more effort into understanding all safety rules is a waste of time.					
12.	I am extremely glad if I am selected to be a member of a safety committee at my workplace.					
13.	Safety procedures and regulations reflect the safest techniques of doing a job.					
14.	It is an employee's duty and responsibility to support and encourage their colleagues to obey the safety rules / procedures / regulations.					
15.	I always ensure that the safety equipment is working properly before I start a job.					
16.	I am willing to do extra jobs in order to improve the safety performance at my workplace.					
17.	I would not feel guilty if I used a "shortcut" while completing my work.					
18.	I would like to be involved in safety discussions at my workplace.					
19.	I am ready to involve myself in the organizational safety activities.					
20.	I really would like to take part in occupational safety rule / procedure / regulation reviews.					
21.	I would like to be involved in the safety goal planning at workplace.					

Section E: Employees' competency

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.

1-strongly disagree 2-disagree 3-neither agree nor disagree 4-agree
5-strongly agree

Item	Statement	1	2	3	4	5
1.	I fully understand the safety procedures / instructions associated with my job (sk).					
2.	I understand the safety rules for my job (k).					
3.	Sometimes I am uncertain what to do to ensure safety in the work for which I am responsible*(a).					
4.	I am confident that I can identify the safety risks associated with the work for which I am responsible (a).					
5.	I am clear about what my responsibilities are for safety (k).					
6.	I understand the nature of all the hazards I am likely to encounter during my work (k).					
7.	Sometimes I am confused about what I am supposed to do*(a).					
8.	I have a poor understanding of the risks associated with my work (k).					
9.	I am good at detecting unsafe behavior during performing the job (sk).					
10.	I am not very effective at ensuring safety in the work for which I am responsible* (sk).					

Section F: Background Information

Please tick (x) in the appropriate box or fill the space provided.

No	Items	
1.	Gender	☐ Male ☐ Female
2.	Ethnicity	☐ Malay ☐ Chinese ☐ Indian ☐ Other (Please specify:.....)
3.	Marital status	☐ Single ☐ Married ☐ Widow ☐ Widower
4.	Age	☐ 18-25 ☐ 26-33 ☐ 34-41 ☐ 42 – 49 ☐ 50 and above
5.	Highest education level	☐ Primary school certificate ☐ SRP / SPM / STPM ☐ Diploma or equivalent ☐ Bachelor's degree or equivalent ☐ Master's degree or higher
6.	Job category	☐ Non-Executive (Operator / technician, etc) ☐ First Line Supervisor ☐ Middle management ☐ Top management ☐ Other (please specify : .....) Job title: .....

7.	Employment status	☐ Permanent ☐ Contract ☐ Temporary
8.	Working experience	☐ 0-5 years ☐ 6-10 years ☐ 11-15 years ☐ 16-20 years ☐ 20 years or more
9.	Number of years in the present company	☐ Less than 1 year ☐ 1-5 years ☐ 6-10 years ☐ 11-20 years ☐ More than 20 years
10.	Number of years in the present position	☐ Less than 1 year ☐ 1-5 years ☐ 6-10 years ☐ 11-20 years ☐ More than 20 years
11.	Estimate number of employees in the present company	☐ 1-50 ☐ 51-150 ☐ 151-300 ☐ 301 and above ☐ Not related

Thank you for your time and participation

APPENDIX C: SURVEY QUESTIONNAIRE, MALAY VERSION

KOLEJ PERNIAGAAN
UNIVERSITI UTARA MALAYSIA

Tuan/Puan yang saya hormati,

Adalah saya Azir Salleh (No Matrik 90608) seorang pelajar DBA (*Doctor of Business Administration*) dari Universiti Utara Malaysia sedang melakukan satu kajian bertajuk "*The Influence of Employees' Conscientiousness, Employees' Competency, Safety Motivation and Safety Commitment on Safety Behavior in the Petrochemical Industry*". Penyelidikan ini bertujuan mengkaji pengaruh kepekaan pekerja, kecekapan pekerja, motivasi keselamatan dan komitment keselamatan ke atas tingkahlaku keselamatan di tempat kerja. Sehubungan dengan itu, proses pengumpulan data bagi kajian ini akan melibatkan pekerja-pekerja dalam industri petrokimia.

Tuan/puan telah dipilih untuk dijadikan sampel kajian penyelidikan tersebut. Dengan itu saya amat berharap pihak tuan/puan dapatlah kiranya meluangkan masa untuk menjawab soalan-soalan yang diberikan. Ia hanya mengambil masa lebih kurang 30 minit. Sumbangan dan kerjasama tuan/puan di dalam menjawab soalan-soalan ini akan dapat meningkatkan lagi pretasi organisasi tuan/puan dan seterusnya kecemerlangan negara.

Untuk pengetahuan tuan/puan setiap maklumbalas yang saya terima akan dianggap sebagai maklumat **SULIT** yang akan hanya digunakan untuk kajian akademik semata-mata. Malahan dalam soalselidik yang saya sediakan tiada langsung soalan yang melibatkan pengenalan diri. Akhir sekali saya dahului dengan ucapan jutaan terima kasih di atas segala kerjasama dan jasabaik tuan/puan dalam usaha menjayakan kajian ini.

Yang benar,

Azir Salleh
Kolej Perniagaan,
Universiti Utara Malaysia, 06010 Sintok, Kedah
012 981 1256, AziR26@hotmail.com, azirs@basf-petronas.com.my

Bahagian A : Tingkahlaku keselamatan pekerjaan

Sila tandakan (x) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan di bawah ini.

1-sangat tidak setuju 2-tidak setuju 3-tidak pasti 4-setuju
5-sangat setuju

Bil.	Pernyataan	1	2	3	4	5
1	Saya menggunakan semua peralatan keselamatan yang diperlukan untuk melaksanakan tugas saya.					
2	Saya menggunakan peraturan keselamatan yang betul semasa bertugas.					
3	Saya mempastikan tahap keselamatan yang paling tinggi apabila melaksanakan tugas saya.					
4	Saya melibatkan diri dalam usaha menambahbaikkan polisi dan amalan keselamatan kerja.					
5	Saya akan mengambil langkah-langkah untuk memperbaiki peraturan kerja jika saya merasakan ia akan meningkatkan lagi keselamatan pekerjaan.					
6	Jika saya melihat tingkahlaku kerja yang tidak selamat, saya akan berusaha supaya ianya diberi perhatian segera.					
7	Saya dengan sukarela melaksanakan tugas atau aktiviti yang boleh membantu meningkatkan keselamatan di tempat kerja.					
8	Saya sentiasa memberi cadangan untuk menambahbaikan usaha menangani keselamatan pekerjaan di kawasan ini (contohnya dalam premis loji).					
9	Saya sentiasa mencuba pendekatan-pendekatan baru bagi menambahbaikan keselamatan di tempat kerja.					

	Pernyataan	1	2	3	4	5
10	Saya sentiasa berusaha untuk menyelesaikan masalah dengan cara yang boleh mengurangkan risiko keselamatan.					
11	Saya sentiasa mengikuti perkembangan dan peka terhadap perubahan yang berlaku berkaitan dengan keselamatan pekerjaan (contohnya, peka kepada fakta terkini).					

Bahagian B: Motivasi keselamatan

Sila tandakan (x) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan di bawah ini.

1-sangat tidak setuju 2-tidak setuju 3-tidak pasti 4-setuju
5-sangat setuju

Bil	Pernyataan	1	2	3	4	5
1	Saya merasakan adalah sesuatu yang penting untuk berusaha mengekalkan atau menambahbaikkan tahap keselamatan diri.					
2	Saya merasakan adalah sesuatu yang penting untuk mengekalkan tahap keselamatan pada setiap masa.					
3	Saya percaya bahawa adalah penting untuk berusaha mengurangkan risiko kemalangan di tempat kerja.					
4	Saya percaya bahawa keselamatan dan kesihatan di tempat kerja adalah suatu isu yang penting.					

Bahagian C: Kepekaan pekerja-pekerja

Sila tandakan (x) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan di bawah ini.

1-sangat tidak setuju 2-tidak setuju 3-tidak pasti 4-setuju
5-sangat setuju

Bil	Pernyataan	1	2	3	4	5
1.	Saya biasanya patuh kepada peraturan dan undang-undang.					
2.	Saya meminta orang lain untuk membuat kerja saya.					
3.	Saya menyiapkan kerja tepat pada masanya.					
4.	Saya mengambilkira bisikan hati.					
5.	Saya ingkar pada peraturan-peraturan.					
6.	Saya memberi sepenuh perhatian kepada matlamat.					
7.	Saya mengingkari janji-janji.					
8.	Saya bekerja melebihi dari apa yang diharapkan.					
9.	Saya menunaikan janji-janji.					
10.	Saya biasanya tersasar ketika mengemukakan fakta-fakta.					
11.	Saya menitikberatkan tentang kualiti.					

	Pernyataan	1	2	3	4	5
12.	Saya bekerja dengan bersungguh-sungguh.					
13.	Saya hanya meluangkan sedikit masa dan tenaga semasa bekerja.					
14.	Saya bekerja dengan sepenuh hati.					
15.	Saya membuat sesuatu yang bertentangan dari apa yang disuruh.					
16.	Saya menetapkan piawaian / kualiti kerja yang tinggi untuk diri sendiri dan orang lain.					
17.	Saya melaksanakan segala perancangan yang telah diatur.					
18.	Saya tidak mempunyai motivasi yang tinggi untuk berjaya.					
19.	Saya buat kerja secara sambil lewa sahaja.					
20.	Saya bercakap benar.					

Bahagian D: Komitmen pada keselamatan

Sila tandakan (x) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan di bawah ini.

1-sangat tidak setuju 2-tidak setuju 3-tidak pasti 4-setuju
5-sangat setuju

Bil.	Pernyataan	1	2	3	4	5
1.	Saya tidak bimbang terhadap kewujudan sesuatu yang membahayakan dan berisiko di tempat kerja saya.					
2.	Saya amat prihatin terhadap peraturan-peraturan keselamatan di tempat kerja saya.					
3.	Kemalangan yang hampir berlaku adalah tidak penting untuk direkodkan.					
4.	Saya bersedia untuk berusaha lebih dari apa yang diharapkan demi untuk menjadi pekerja yang cekap.					
5.	Saya akan pastikan segala risiko dipertimbangkan sebelum saya memulakan kerja.					
6.	Adalah penting untuk bekerja dalam suasana yang selamat.					
7.	Saya tidak pernah memberi kerjasama kepada penyelia / pengurus mengenai isu-isu berkaitan keselamatan di tempat kerja.					
8.	Saya bersedia untuk berusaha dengan bersungguh-sungguh bagi mencapai matlamat keselamatan pekerjaan.					
9.	Saya akan mematuhi peraturan-peraturan keselamatan untuk memastikan tempat kerja sentiasa berada dalam keadaan selamat.					
10.	Semua pekerja sepatutnya melibatkan diri secara aktif dalam aktiviti-aktiviti promosi keselamatan di tempat kerja.					

	Pernyataan	1	2	3	4	5
11.	Saya berpendapat bahawa usaha untuk memahami segala peraturan keselamatan di tempat kerja adalah membuang masa.					
12.	Saya merasa amat bertuah jika terpilih untuk menjadi ahli dalam jawatankuasa keselamatan di tempat kerja.					
13.	Prosedur keselamatan dan peraturan-peraturannya melambangkan teknik bekerja yang paling selamat.					
14.	Adalah menjadi tugas dan tanggungjawab setiap pekerja untuk membantu dan menggalakkan rakansekerja mematuhi segala peraturan keselamatan di tempat kerja.					
15.	Saya sentiasa pastikan bahawa alat-alat keselamatan berfungsi dengan baik sebelum saya memulakan tugas.					
16.	Saya bersedia untuk bekerja lebih bagi meningkatkan tahap pencapaian keselamatan di tempat kerja.					
17.	Saya tidak merasa bersalah apabila saya mengambil jalan pintas semasa menyiapkan kerja saya.					
18.	Saya berminat untuk terlibat dalam perbincangan mengenai keselamatan di tempat kerja saya.					
19.	Saya bersedia untuk melibatkan diri dalam aktiviti-aktiviti keselamatan organisasi.					
20.	Saya sangat berminat untuk melibatkan diri dalam sesi kaji-semula segala peraturan dan prosedur keselamatan dalam pekerjaan.					
21.	Saya berminat untuk melibatkan diri dalam perancangan berkaitan matlamat keselamatan di tempat kerja.					

Bahagian E: Kecekapan pekerja

Sila tandakan (x) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan di bawah ini.

1-sangat tidak setuju 2-tidak setuju 3-tidak pasti 4-setuju
5-sangat setuju

Bil.	Pernyataan	1	2	3	4	5
1.	Saya faham sepenuhnya segala peraturan / arahan keselamatan berhubung dengan pekerjaan saya.					
2.	Saya faham peraturan-peraturan keselamatan bagi pekerjaan saya.					
3.	Kadangkala saya kurang pasti tentang apa yang perlu dilakukan untuk memastikan keselamatan dalam pekerjaan yang dipertanggungjawabkan kepada saya.					
4.	Saya yakin bahawa saya berupaya mengenalpasti risiko-risiko keselamatan berhubung dengan pekerjaan yang dipertanggungjawabkan kepada saya.					
5.	Saya amat jelas berkenaan dengan tanggungjawab saya untuk keselamatan.					
6.	Saya faham akan segala perkara yang mungkin mendatangkan bahaya semasa saya bekerja.					
7.	Adakalanya saya keliru tentang apa yang harus saya lakukan.					
8.	Saya mempunyai pemahaman yang lemah tentang risiko-risiko berkaitan dengan perkerjaan saya.					

	Pernyataan	1	2	3	4	5
9.	Saya berkebolehan untuk mengesan tingkahlaku kerja tidak selamat dengan baik semasa bekerja.					
10.	Saya kurang berkesan dalam memastikan keselamatan pekerjaan yang dipertanggunjawabkan kepada saya.					

Bahagian F: Maklumat peribadi

Sila tandakan (x) pada petak yang sesuai atau mengisi ruang yang disediakan.

Bil.	Perkara	
1.	Jantina	☐ Lelaki ☐ Perempuan
2.	Bangsa	☐ Melayu ☐ Cina ☐ India ☐ Lain-lain (Sila nyatakan:.....)
3.	Taraf perkahwinan	☐ Bujang ☐ Berkahwin ☐ Janda ☐ Duda
4.	Umur	☐ 18-25 ☐ 26-33 ☐ 34-41 ☐ 42 – 49 ☐ 50 atau lebih
5.	Pencapaian akademik tertinggi	☐ Sijil sekolah rendah ☐ SRP / SPM / STPM ☐ Diploma atau yang setaraf dengannya ☐ Ijazah Sarjana Muda atau yang setaraf dengannya ☐ Ijazah Sarjana atau yang lebih tinggi
6.	Kategori pekerjaan	☐ Bukan Eksekutif (operator / juruteknik, dll) ☐ Penyelia peringkat bawahan ☐ Pengurusan peringkat pertengahan ☐ Pengurusan tertinggi ☐ Lain-lain (sila nyatakan:.....) Jawatan: .....

7.	Status pekerjaan	Tetap ☐ Kontrak ☐ Sementara ☐
8.	Pengalaman kerja	☐ 0-5 tahun ☐ 6-10 tahun ☐ 11-15 tahun ☐ 16-20 tahun ☐ 20 tahun atau lebih
9.	Tempoh bekerja dengan syarikat sekarang	☐ Kurang dari 1 tahun ☐ 1-5 tahun ☐ 6-10 tahun ☐ 11-20 tahun ☐ Lebih dari 20 tahun
10.	Tempoh bekerja dalam jawatan sekarang	☐ Kurang dari 1 tahun ☐ 1-5 tahun ☐ 6-10 tahun ☐ 11-20 tahun ☐ Lebih dari 20 tahun
11.	Anggaran jumlah pekerja dalam syarikat	☐ 1-50 ☐ 51-150 ☐ 151-300 ☐ 301 dan lebih ☐ Tidak berkaitan

Terimakasih di atas kerjasama anda.

APPENDIX D

DEMOGRAPHIC PROFILE

Parameter		Frequency	Percentage
Gender	Male	605	91.3
	Female	58	8.7
Ethnicity	Malay	615	92.8
	Chinese	25	3.8
	Indian	14	2.1
	Other race	4	0.6
Marital status	Single	180	27.1
	Married	477	71.9
	Widow	2	0.3
	Widower	4	0.6
Age	18-25 years old	120	18.1
	26-33	243	36.7
	34-41	190	28.7
	42-49	87	13.1
	50 and above	23	3.5
Highest education level	Primary school certificate	22	3.3
	SRP / SPM / STPM	315	47.5
	Diploma or equivalent	224	33.8
	Bachelor's degree or equivalent	95	14.3
	Master's degree or higher	7	1.1
Job category	Non-executive (e.g., operator)	375	56.6
	First line supervisor	95	14.3
	Middle management	107	16.1
	Top management	16	2.4
	Others	70	10.6
Employment status	Permanent	541	81.6
	Contract	104	15.7
	Temporary	18	2.7
Working experience	0-5 years	196	29.6
	6-10 years	223	33.6
	11-15 years	122	18.4
	16-20 years	71	10.7
	20 years or more	51	7.7

Parameter		Frequency	Percentage
Number of years in the present company	0-5 years	73	11.0
	6-10 years	221	33.3
	11-15 years	259	39.1
	16-20 years	103	15.5
	20 years or more	7	1.1
Number of years in the present position	Less than 1 year	81	12.2
	1-5 years	319	48.1
	6-10 years	200	30.2
	11-20 years	57	8.6
	More than 20 years	6	0.9
Estimate number of employees in the present company	1-50 employees	123	18.6
	51-150	148	22.3
	151-300	70	10.6
	301 and above	311	46.9
	Not related	11	1.7

APPENDIX E

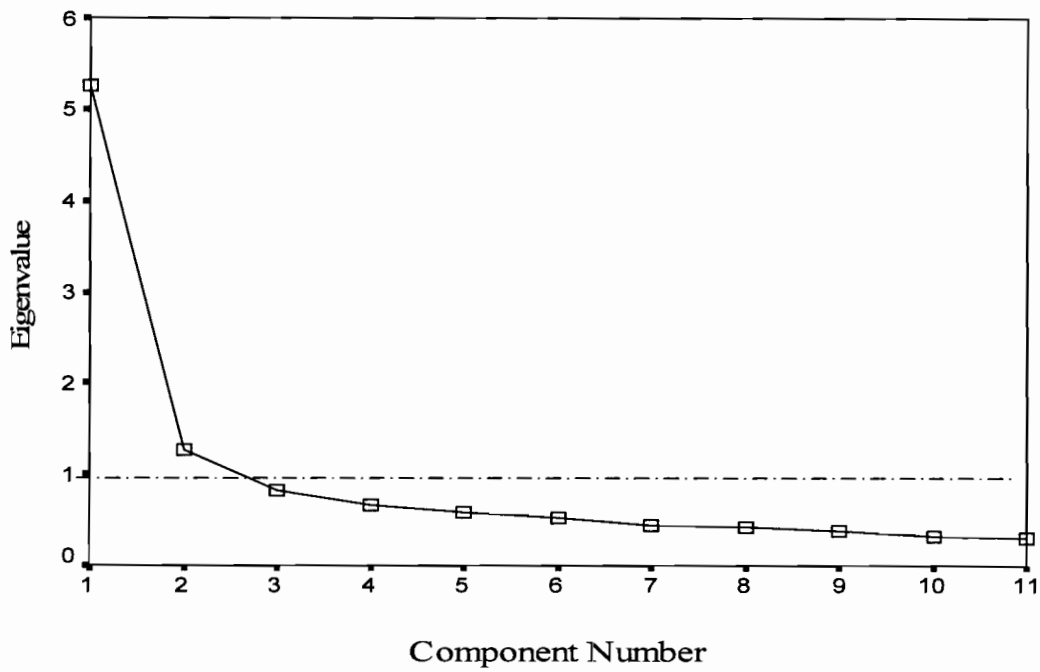
FACTOR ANALYSIS

SAFETY BEHAVIOR SURVEY DATA

Principal component analysis (PCA) of safety behavior survey data

Component	Initial Eigenvalue			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**5.261**	**47.824**	**47.824**	**5.261**	**47.824**	**47.824**
2	**1.274**	**11.579**	**59.403**	**1.274**	**11.579**	**59.403**
3	.813	7.393	66.796			
4	.667	6.068	72.864			
5	.582	5.290	78.154			
6	.527	4.792	82.946			
7	.449	4.078	87.024			
8	.426	3.871	90.895			
9	.389	3.536	94.431			
10	.321	2.920	97.351			
11	.291	2.649	100.000			

Extraction Method: Principal Component Analysis



Application of screeplot criterion for safety behavior survey data

The parallel analysis summary and comparison with principal component analysis Eigenvalue (safety behavior survey data)

Factor number	component Eigenvalue from principal analysis	Random eigenvalue output from parallel analysis with data matrix of 11 variables, 663 respondents and 100 replications	Decision
1	**5.261**	**1.2116**	**Accept**
2	**1.274**	**1.1521**	**Accept**
3	0.813	1.1063	Reject
4	0.667	1.0706	Reject

The component matrix coefficient (unrotated) for safety behavior items

Items	Component 1	Component 2
1	**0.626**	**0.587**
2	**0.695**	**0.549**
3	**0.667**	**0.488**
4	**0.688**	
5	**0.700**	
6	**0.728**	
7	**0.612**	
8	**0.767**	
9	**0.742**	**-0.336**
10	**0.647**	**-0.307**
11	**0.717**	

The factor rotation result with the percent total of variance (safety behavior survey data)

Factors	Initial Eigenvalue			Rotation sums of squared loadings
	Total	% of Variance	Cumulative %	Total
1	5.261	47.824	47.824	4.877
2	1.274	11.579	59.403	3.578

Pattern and structure matrix for PCA and Oblimin rotation of two factor solution of safety behavior items (safety behavior survey data)

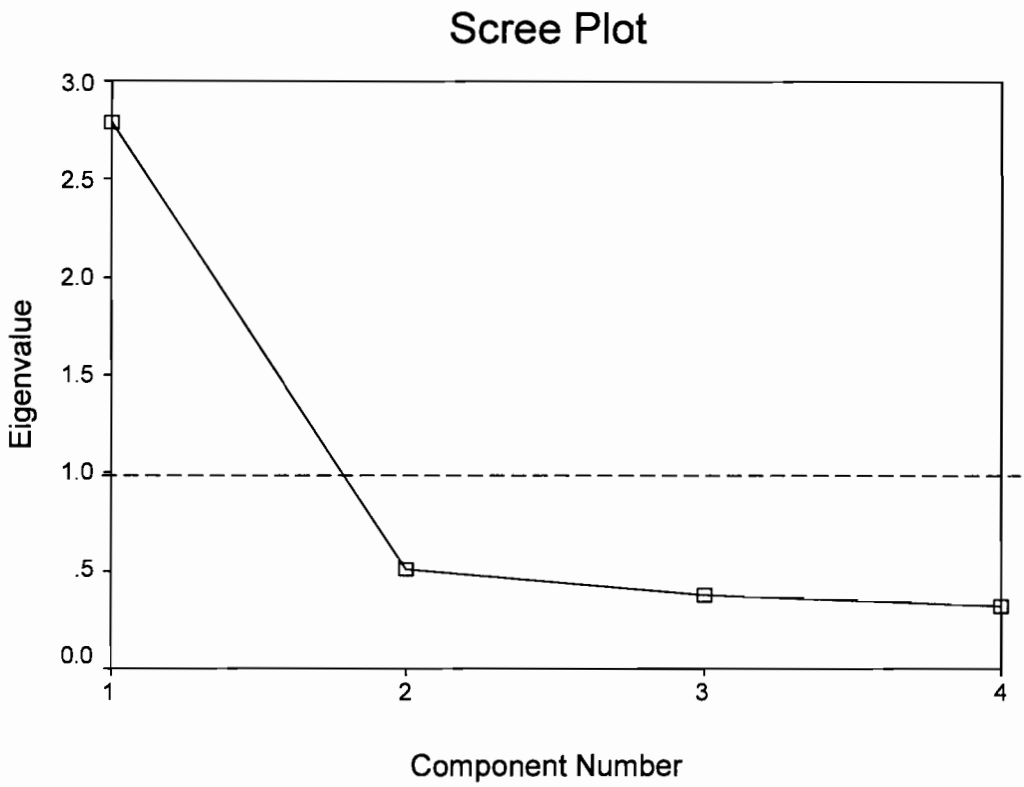
Item	Pattern coefficient		Structure coefficient		Communalities
	Component 1	Component 2	Component 1	Component 2	
9	**0.864**	-0.105	**0.810**	0.346	0.664
8	**0.819**	-0.016	**0.811**	0.411	0.658
11	**0.766**	-0.015	**0.758**	0.384	0.575
10	**0.766**	-0.107	**0.710**	0.293	0.513
6	**0.674**	0.115	**0.734**	0.466	0.549
7	**0.619**	0.032	**0.635**	0.354	0.404
5	**0.578**	0.197	**0.681**	0.499	0.492
4	**0.535**	0.236	**0.658**	0.515	0.474
1	-0.046	**0.882**	0.413	**0.857**	0.787
2	0.039	**0.865**	0.491	**0.885**	0.785
3	0.073	**0.787**	0.483	**0.824**	0.684

SAFETY MOTIVATION SURVEY DATA

Principal component analysis of safety motivation survey data

Component	Initial Eigenvalue			Extraction sums of squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**2.792**	**69.810**	**69.810**	**2.792**	**69.810**	**69.810**
2	0.505	12.630	82.440			
3	0.377	9.436	91.876			
4	0.325	8.124□	100.000□			

Extraction Method: Principal Component Analysis.



Application of screeplot criterion for safety motivation survey data

The Parallel Analysis summary and comparison with principal component analysis Eigenvalue (safety motivation survey data)

Factor	Eigenvalue from principal component analysis	Random Eigenvalue output from parallel analysis with data matrix of 4 variables, 663 respondents and 100 replications	Decision
1	**2.792**	**1.0843**	**Accept**
2	0.505	1.0280	Reject
3	0.377	1.9752	Reject
4	0.325	1.9175	Reject

The component matrix coefficient (unrotated) for safety motivation items

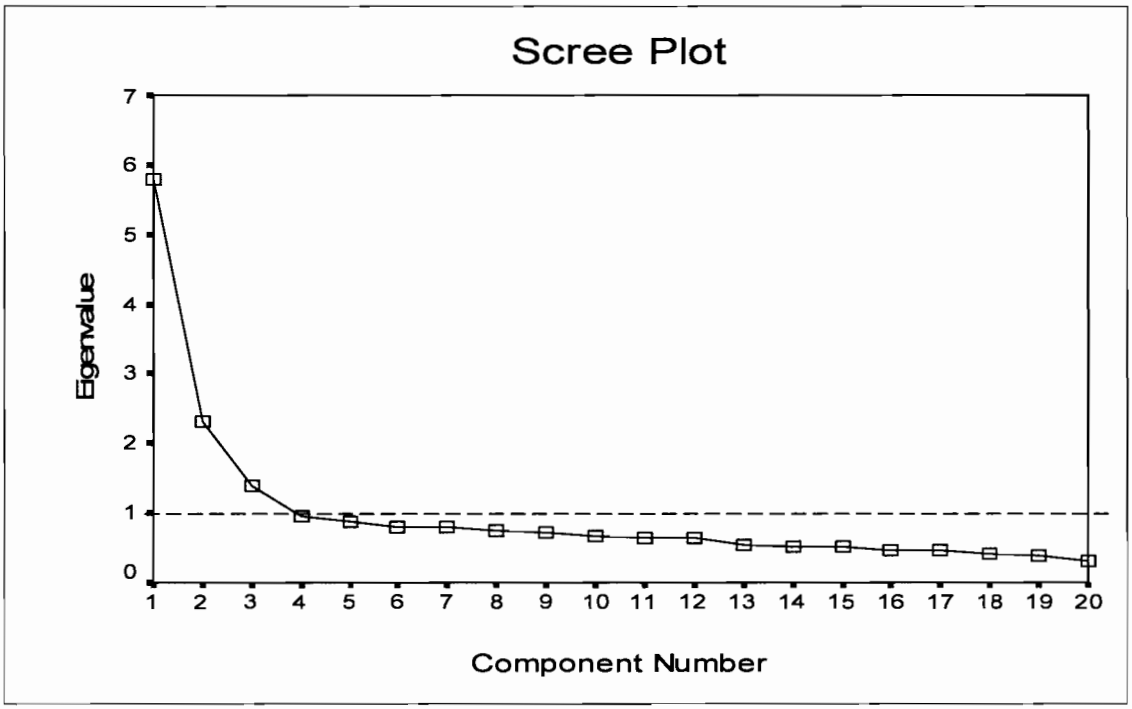
Item	Component 1
3	0.859
2	0.853
4	0.831
1	0.798

EMPLOYEES' CONSCIENTIOUSNESS SURVEY DATA

Principal component analysis of employees' conscientiousness survey data

Component	Initial eigenvalue			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**5.803**	**29.013**	**29.013**	**5.803**	**29.013**	**29.013**
2	**2.321**	**11.603**	**40.616**	**2.321**	**11.603**	**40.616**
3	**1.395**	**6.976**	**47.592**	**1.395**	**6.976**	**47.592**
4	.963	4.813	52.405			
5	.881	4.407	56.812			
6	.797	3.987	60.799			
7	.785	3.927	64.726			
8	.756	3.780	68.506			
9	.711	3.554	72.059			
10	.664	3.318	75.378			
11	.650	3.249	78.627			
12	.631	3.154	81.781			
13	.550	2.750	84.531			
14	.526	2.632	87.163			
15	.512	2.561	89.724			
16	.475	2.373	92.097			
17	.457	2.285	94.382			
18	.419	2.094	96.476			
19	.389	1.943	98.419			
20	.316	1.581	100.000			

Extraction Method: Principal Component Analysis



Application of screeplot criterion for employees' conscientiousness survey data

The parallel analysis summary and comparison with principal component analysis Eigenvalue (employees' conscientiousness)

Factor number	Eigenvalue from principal component analysis	Random Eigenvalue output from parallel analysis with data matrix of 11 variables, 663 respondents and 100 replications	Decision
1	**5.803**	**1.2116**	**Accept**
2	**2.321**	**1.1521**	**Accept**
3	**1.395**	**1.1073**	**Accept**
4	0.963	1.0706	Reject
5	0.881	1.0341	Reject

The factor rotation result with the percent total of variance (employees' conscientiousness)

Factors	Initial Eigenvalue			Rotation sums of squared loadings
	Total	% of Variance	Cumulative %	Total
1	**5.803**	**29.013**	**29.013**	**5.056**
2	**2.321**	**11.603**	**40.616**	**4.238**
3	**1.395**	**6.976**	**47.592**	**1.667**

The component matrix coefficient (unrotated) for employees' conscientiousness items

Item	Component 1	Component 2	Component 3
12	**0.669**		
14	**0.658**		**-0.318**
17	**0.626**		
7	**0.612**	**0.452**	
15	**0.604**	**0.437**	
11	**0.588**		
20	**0.587**		
6	**0.587**		
3	**0.582**		
19	**0.559**	**0.328**	
1	**0.553**		
9	**0.527**		**0.418**
16	**0.502**	**-0.353**	
18	**0.496**	**0.364**	
13	**0.493**	**0.466**	
10	**0.415**	**0.337**	**0.349**
5	**0.505**	**0.520**	
8	**0.416**	**-0.435**	
4	0.128	**-0.309**	**0.501**
2	**0.406**	**0.382**	**-0.457**□

Pattern and structure matrix for PCA and Oblimin rotation of three factor solution of employees' conscientiousness items

Item	Pattern coefficient			Structure coefficient			Communalities
	Comp 1	Comp 2	Comp 3	Comp 1	Comp 2	Comp 3	
14	**0.777**	-0.033	-0.178	**0.747**	0.268	-0.105	0.590
12	**0.751**	-0.000	-0.022	**0.749**	0.285	0.048	0.561
17	**0.730**	-0.024	-0.142	**0.708**	0.259	-0.073	0.521
16	**0.688**	-0.147	-0.022	**0.631**	0.115	0.047	0.416
11	**0.655**	0.007	-0.048	**0.653**	0.258	0.012	0.429
6	**0.611**	0.051	0.056	**0.635**	0.281	0.110	0.408
20	**0.536**	0.135	0.111	**0.598**	**0.334**	0.155	0.383
3	**0.517**	0.138	0.275	**0.595**	**0.324**	**0.318**	0.440
8	**0.492**	-0.059	**0.382**	**0.504**	0.112	**0.430**	**0.405**
1	**0.427**	0.208	0.261	**0.530**	**0.360**	0.292	0.377
5	-0.120	**0.809**	0.018	0.188	**0.763**	-0.024	0.595
7	0.005	**0.801**	0.043	**0.313**	**0.802**	0.013	0.645
15	0.096	**0.695**	-0.117	**0.349**	**0.736**	-0.135	0.561
10	-0.100	**0.654**	0.176	0.164	**0.610**	0.142	0.407
18	0.035	**0.617**	-0.020	0.267	**0.631**	-0.040	0.400
13	0.095	**0.564**	**-0.320**	0.279	**0.612**	**-0.333**	**0.479**
19	**0.300**	**0.414**	**-0.384**	**0.421**	**0.542**	**-0.373**	**0.494**
4	0.065	0.049	**0.591**	0.138	0.051	**0.595**	0.363
2	0.242	0.295	**-0.577**	**0.301**	**0.408**	**-0.566**	0.520
9	**0.357**	0.238	**0.501**	**0.493**	**0.354**	**0.525**	**0.523**

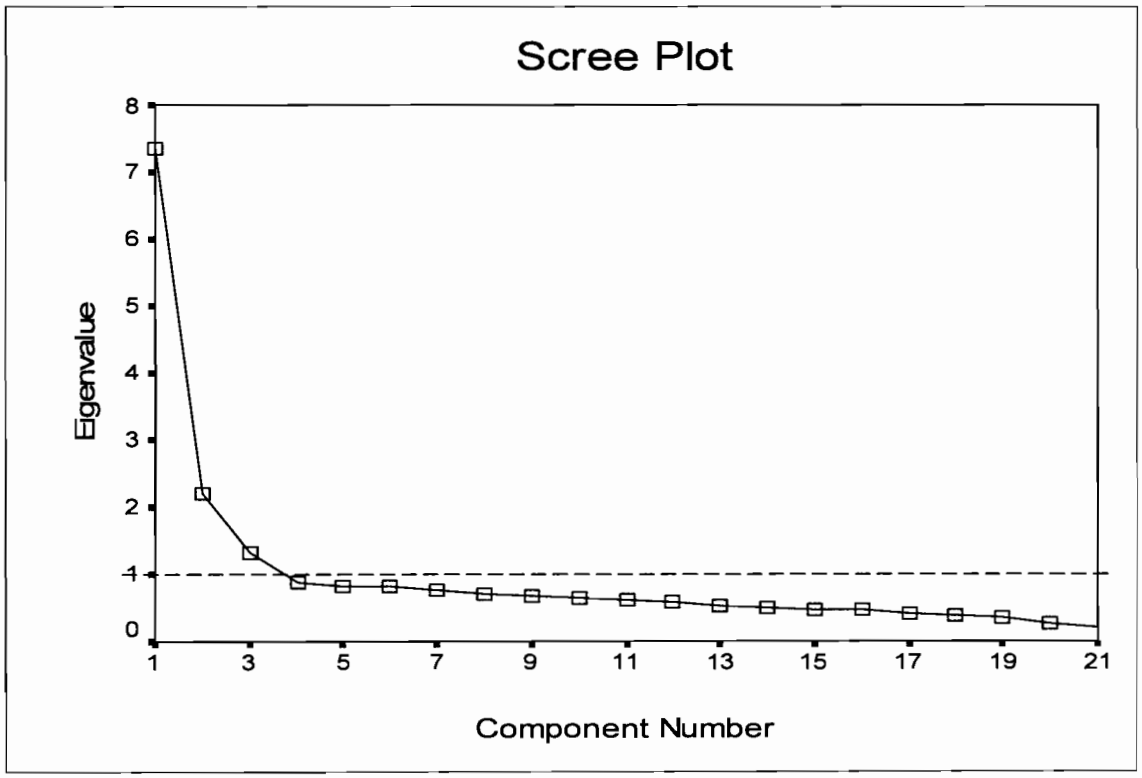
SAFETY COMMITMENT SURVEY DATA

Principal component analysis of safety commitment survey data

Component	Initial Eigenvalue			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**7.365**	**35.071**	**35.071**	**7.365**	**35.071**	**35.071**
2	**2.208**	**10.515**	**45.586**	**2.208**	**10.515**	**45.586**
3	**1.315**	**6.263**	**51.849**	**1.315**	**6.263**	**51.849**
4	.883	4.203	56.053			
5	.833	3.966	60.018			
6	.815	3.880	63.898			
7	.755	3.596	67.494			
8	.714	3.399	70.892			

9	.684	3.255	74.147			
10	.644	3.068	77.215			
11	.607	2.888	35.071			
12	.588	2.799	82.903			
13	.537	2.559	85.462			
14	.502	2.392	87.854			
15	.479	2.283	90.137			
16	.462	2.198	92.335			
17	.413	1.967	94.302			
18	.388	1.845	96.147			
19	.343	1.631	97.778			
20	.263	1.250	99.028			
21	.204□	.972□	100.000□			

Extraction Method: Principal Component Analysis.



Application of screeplot criterion safety commitment survey data

The parallel analysis summary and comparison with principal component analysis Eigenvalue (safety commitment)

Factor number	Eigenvalue from principal component analysis	Random Eigenvalue output from parallel analysis with data matrix of 11 variables, 663 respondents and 100 replications	Decision
1	**7.365**	**1.2116**	**Accept**
2	**2.208**	**1.1521**	**Accept**
3	**1.315**	**1.1073**	**Accept**
4	0.883	1.0706	Reject

The component matrix coefficient (unrotated) for safety commitment items

Item	Component 1	Component 2	Component 3
8	**0.713**		
5	**0.700**		
20	**0.696**	**-0.481**	
19	**0.685**	**-0.441**	
21	**0.683**	**-0.476**	
18	**0.670**	**-0.385**	
2	**0.660**		
4	**0.648**		
10	**0.648**		
16	**0.644**		
14	**0.640**		
12	**0.616**		
9	**0.614**		**-0.300**
15	**0.605**		
6	**0.560**	**0.318**	
13	**0.548**		
17	**0.477**		
11	**0.328**	**0.535**	
3	**0.332**	**0.526**	**0.395**
1		**0.488**	**0.339**
7	**0.421**	**0.484**	**0.350**

The factor rotation result with the percent total of variance (safety commitment)

Components	Initial eigenvalue			Rotation sums of squared loadings
	Total	% of Variance	Cumulative %	Total
1	**7.365**	**35.071**	**35.071**	**6.461**
2	**2.208**	**10.515**	**45.586**	**3.076**
3	**1.315**	**6.263**	**51.849**	**5.372**

Pattern and structure matrix for PCA and Oblimin rotation of three factor solution of safety commitment items

Item	**Pattern coefficient**			**Structure coefficient**			**Communalities**
	Comp 1	Comp 2	Comp 3	Comp 1	Comp 2	Comp 3	
9	**0.783**	0.043	-0.158	**0.715**	**0.318**	0.262	0.532
14	**0.727**	-0.016	-0.027	**0.706**	0.255	**0.356**	0.500
15	**0.707**	-0.098	-0.000	**0.670**	0.169	**0.362**	0.458
5	**0.704**	-0.048	0.094	**0.735**	0.230	**0.461**	0.550
6	**0.682**	0.146	-0.169	**0.648**	**0.382**	0.211	0.462
10	**0.645**	-0.022	0.081	**0.680**	0.232	**0.420**	0.468
8	**0.632**	0.092	0.112	**0.726**	**0.345**	**0.459**	0.542
13	**0.551**	0.006	0.049	**0.579**	0.220	**0.341**	0.337
16	**0.528**	-0.117	0.268	**0.682**	0.117	**0.533**	0.460
2	**0.518**	0.157	0.140	**0.651**	**0.371**	**0.435**	0.457
4	**0.501**	0.048	0.208	**0.629**	0.264	**0.480**	0.428
3	-0.035	**0.746**	0.026	**0.260**	**0.736**	0.104	0.543
7	0.054	**0.696**	0.064	**0.351**	**0.724**	0.183	0.535
11	0.078	**0.667**	-0.064	0.296	**0.688**	0.064	0.477
1	-0.071	**0.652**	-0.045	0.151	**0.619**	0.002	0.393
17	0.122	0.404	0.226	**0.394**	**0.479**	**0.343**	0.319
20	0.025	-0.035	**0.868**	**0.472**	0.087	**0.877**	0.770
21	0.011	-0.028	**0.865**	**0.459**	0.089	**0.867**	0.753
19	0.001	0.014	**0.853**	**0.459**	0.125	**0.856**	0.773
18	0.019	0.045	**0.797**	**0.458**	0.156	**0.813**	0.663
12	0.057	0.071	**0.669**	**0.438**	0.179	**0.708**	0.511

EMPLOYEES' COMPETENCY SURVEY DATA

Correlation matrix among variables

Correlation Matrix

		1	2	3	4	5	6	7	8	9	10
Correlation	1	1.000	**.724**	.283	**.458**	**.505**	**.371**	.255	.198	.242	.208
	2		1.000	.193	**.554**	**.591**	**.468**	**.338**	.246	.293	.207
	3			1.000	.267	.280	.193	**.549**	**.383**	.251	**.372**
	4				1.000	**.661**	**.504**	**.349**	.231	**.386**	.262
	5					1.000	**.558**	**.353**	.248	**.349**	.206
	6						1.000	.227	.189	**.440**	.230
	7							1.000	**.467**	.268	**.441**
	8								1.000	.244	**.584**
	9									1.000	**.301**
	10										1.000

Measure of sampling adequacy and partial correlations

Anti-image Matrices

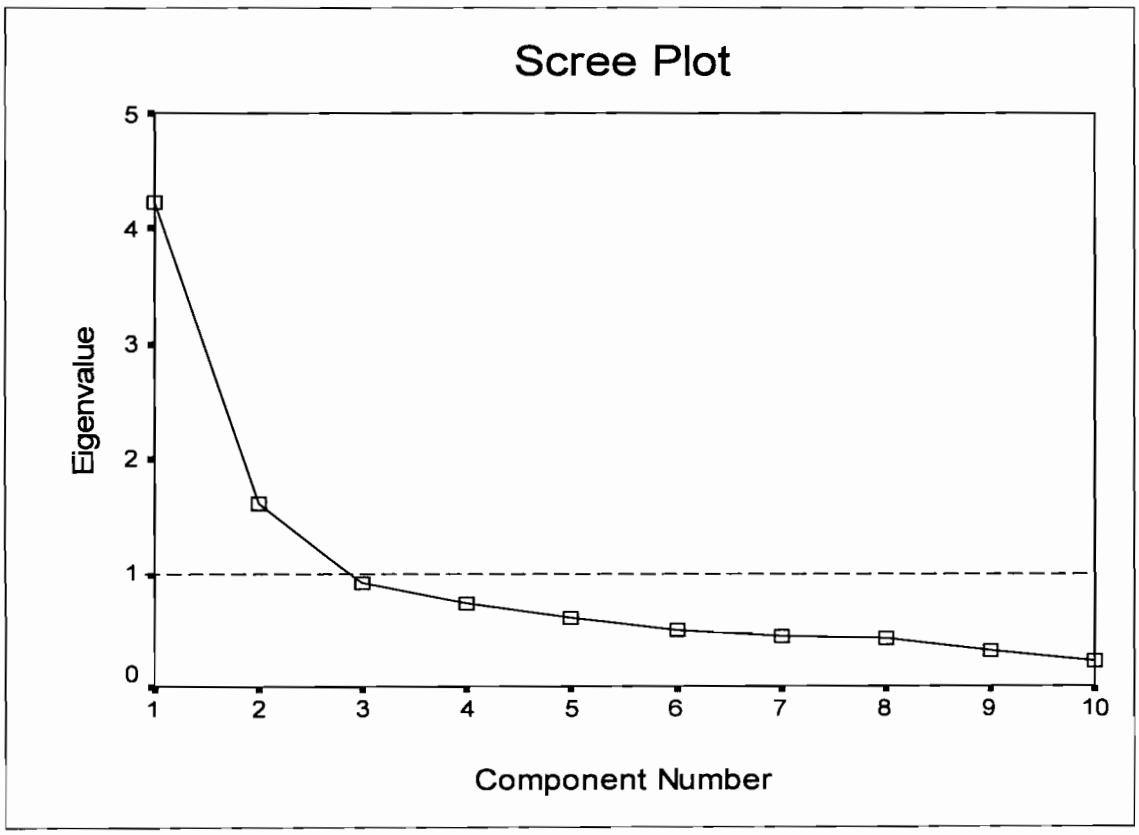
		1	2	3	4	5	6	7	8	9	10
Anti-image Covariance	1	.441	-.242	-.115	-.011	-.04	.009	.062	.024	.008	-.033
	2	-.242	.362	.093	-.066	-.06	-.061	-.080	-.038	-.005	.027
	3	-.115	.093	.625	-.012	-.03	-.003	-.242	-.065	-.047	-.044
	4	-.011	-.07	-.012	.485	-.180	-.063	-.035	.026	-.075	-.041
	5	-.041	-.06	-.028	-.180	.436	-.136	-.040	-.030	-.008	.048
	6	.009	-.06	-.003	-.063	-.136	.586	.037	.016	-.174	-.043
	7	.062	-.08	-.242	-.035	-.04	.037	.553	-.101	-.015	-.089
	8	.024	-.04	-.065	.026	-.03	.016	-.101	.590	-.018	-.267
	9	.008	.00	-.047	-.075	-.01	-.174	-.015	-.018	.731	-.078
		-.033	.027	-.044	-.041	.048	-.043	-.089	-.267	-.078	.590
Anti-image Correlation	1	.760[a]	-.605	-.218	-.024	-.09	.017	.125	.047	.015	-.065
	2	-.605	.772[a]	.196	-.158	-.162	-.133	-.179	-.082	-.009	.058
	3	-.218	.196	.773[a]	-.022	-.05	-.004	-.411	-.107	-.069	-.072
	4	-.024	-.158	-.022	.883[a]	-.392	-.119	-.067	.049	-.127	-.076
	5	-.094	-.162	-.053	-.392	.863[a]	-.270	-.081	-.059	-.014	.095
	6	.017	-.133	-.004	-.119	-.270	.875[a]	.065	.027	-.265	-.073
	7	.125	-.179	-.411	-.067	-.08	.065	.814[a]	-.177	-.023	-.156
	8	.047	-.08	-.107	.049	-.06	.027	-.177	.794[a]	-.027	-.453
	9	.015	-.01	-.069	-.127	-.01	-.265	-.023	-.027	.893[a]	-.119
		-.065	.058	-.072	-.076	.095	-.073	-.156	-.453	-.119	.786[a]

a. Measures of Sampling Adequacy(MSA)

Results for the extraction of component factors

Component	Initial eigenvalue			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**4.233**	**42.329**	**42.329**	**4.233**	**42.329**	**42.329**
2	**1.616**	**16.159**	**58.487**	**1.616**	**16.159**	**58.487**
3	.915	9.146	67.633			
4	.740	7.402	75.035			
5	.606	6.058	81.094			
6	.490	4.899	85.993			
7	.446	4.456	90.449			
8	.417	4.173	94.622			
9	.311	3.113	97.735			
10	.226	2.265	100.000			

Extraction Method: Principal Component Analysis



Scree Test for component analysis

The result of parallel analysis and the decision of the number of factors to be retained

Factor number	Eigenvalue from principal component analysis	Random Eigenvalue output from parallel analysis with data matrix of 10 variables, 663 respondents and 100 replications	Decision
1	**4.233**	**1.2116**	**Accept**
2	**1.616**	**1.1521**	**Accept**
3	0.915	1.1073	Reject
4	0.740	1.0706	Reject

Unrotated component analysis factor matrix

Items	Component 1	Component 2
5	**0.765**	**-0.327**
4	**0.749**	
2	**0.744**	**-0.379**
1	**0.678**	**-0.332**
6	**0.661**	**-0.313**
7	**0.637**	**0.452**
9	**0.569**	
3	**0.552**	**0.466**
8	**0.549**	**0.579**
10	**0.550**	**0.567**

Oblique rotation with the percentage of the total of variance explained

Factors	Initial Eigenvalue			Rotation sums of squared loadings
	Total	% of Variance	Cumulative %	Total
1	4.233	42.329	42.329	3.823
2	1.616	16.159	58.487	3.039

Oblique rotation of component analysis factor matrix

Item	Pattern coefficient		Structure coefficient		Communalities
	Comp 1	Comp 2	Comp 1	Comp 2	
2	**0.857**	-0.059	**0.833**	0.292	0.697
5	**0.831**	0.002	**0.832**	**0.343**	0.692
4	**0.781**	0.043	**0.799**	**0.363**	0.639
1	**0.770**	-0.040	**0.754**	0.276	0.570
6	**0.742**	-0.028	**0.730**	0.276	0.534
9	**0.423**	0.245	**0.523**	**0.418**	0.323
8	-0.062	**0.821**	0.275	**0.796**	0.636
10	-0.051	**0.810**	0.281	**0.789**	0.625
7	0.106	**0.732**	**0.406**	**0.775**	0.611
3	0.033	**0.708**	**0.323**	**0.722**	0.522

Table 29
Component correlation matrix

Component Correlation Matrix

Component	1	2
1	1.000	.410
2	.410	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.