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Safety Attitudes of Offshore Personnel

Safety Attitudes of Offshore Petroleum Personnel in the UK and Norway: A Statistical

Re-analysis

By

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A thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Masters

of Science in Applied Psychology

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Abstract

Safety Attitudes of Offshore Petroleum Personnel in the UK and Norway: A Statistical

Re-analysis

By Apostolos Paul Angelopoulos

This study re-evaluates the safety attitudes of an existing sample of offshore oil personnel. The data is comprised of the responses of 1138 Norwegians and 622 personnel from the UK to the Offshore Risk Perception Questionnaire (Rundmo, 1990). Six subscales were used in the present study including: 'attitudes to safety', 'perceptions of others commitment to safety', 'perceptions of job situation', 'perceptions of social support', 'risk perception' and 'satisfaction with safety systems'. Hierarchical cluster analysis displayed that 'attitudes to safety' and 'perceptions of job situation' displayed clear division between the UK and Norwegian installations. The remaining variables displayed several installations that consistently grouped away from their country. Hierarchical linear modeling (HLM) evaluated two separate multilevel models; 'risk perception' (Model I) and 'satisfaction with safety systems' (Model II) as outcome variables. For 'risk perception', results displayed no variance in slopes ($p > 0.500$) between groups. For Model II, there were significant slopes between 'others commitment to safety' ($t(137) = 2.520, p < 0.05$) and 'social support' ($t(137) = 2.673, p < 0.05$) with the outcome variable. Significant variability remained unaccounted after entering the organization level variables. Limitations of the study are discussed and the implications of cultural differences for international organizations.

October 22, 2004

Safety Attitudes of Offshore Petroleum Personnel in the UK and Norway:

A Statistical Re-Assessment

Occupational Health and Safety

Occupational health and safety is an area that has garnered considerable attention in empirical research (Takala, 1998), although there still remain disparities in the analysis and investigation of said events. The International Labour Office (ILO) has conducted research pertaining to fatal occupational accidents and discovered numerous systemic problems. For example, the frequency of accidents are not available from all countries, underreporting, a limited scope of coverage by this reporting, as well as non-standardized reporting strategies are all pervasive problems that exist within the field. These obstacles, do not reduce the importance of investigating and understanding occupational accidents. In this task the ILO has managed to collect and report figures from a sample of countries that display the magnitude of this problem. The “global” rate of fatal occupational accidents is 14.0/100,000 workers, with a total of 335,000 fatal accidents in 1994 (Takala, 1998). These figures display the urgency with which the global community must act to reduce organizational accidents as even one fatal occupational accident is unacceptable.

Organizational accidents can lead to a number of consequences, including rapidly increasing financial costs from lost time and production. Organizations have both a moral and financial imperative to keep the frequency of accidents low. Thus, ensuring the safety and well being of personnel is a fundamental goal shared by the majority of organizations. Their health and safety standards dictate the organizational *modus operandi*, which ensures the welfare of employees. Since the beginning of the late 20th century, there has

been an increase in the amount of attention devoted towards the affirmation of health and safety standards. This has been due largely to the catastrophic potential of modern industries (e.g. chemical, petroleum, and nuclear), and the immense pressure that can be exerted by trade unions (Phelps, 2001; Chen & Chan, 2004), as well as the media (Corcoran, 2002).

Traditionally, health and safety regulations have focused on preventing the reoccurrence of accidents (Flin, Mearns, Fleming, & Gordon, 1996a). Recently, with the emergence of quantitative risk assessment (QRA), there has been a focus on attempting to ascertain all the potential risks and hazards that occur within the organization. A hazard can be defined as a condition or practice with the propensity to cause harm or injury (Bird & Germain, 1996). A risk is the likelihood that the harm or injury will be realized. The goal of QRA is to quantify the amount of risk that is associated with a particular hazard within any given organization. In essence, the procedure aims to identify any potential hazards before they realize their “catastrophic potential” (Flin et al., 1996a, p.2). Although, the goal of QRA is justified, this procedure can underestimate the probability of the hazards on the job. Furthermore, it is nearly impossible to conceptualize all of the possible scenarios that could occur within an occupation of interest. Despite this fact, QRA is useful and it does not reduce the importance of understanding and attempting to keep organizational accidents at minimal levels. However, the goal of all of these initiatives is to uphold and maintain the health and welfare of employees. The present study examines the safety attitudes of personnel and the factors that influence their

perceptions. The personnel assessed were all members of 'high risk/reliabilities' industries.

High Risk/Reliability Industries

Although the rate of occupational accidents is high across all industries (Takala, 1998), there are a number of specific industries that have the potential for large-scale consequences from occupational accidents. Industries such as nuclear power plants, chemical processing plants, and oil platforms require the seamless operation and integration of numerous human and technological subsystems. Furthermore, these industries are labeled 'high risk' because a failure of the entire system can result in immediate peril for those directly involved within the organization. They are 'high reliability' as the surrounding general public dependent on their services and products (Weigmann, Zhang, Thaden, Sharma, & Mitchell, 2002). Failures in these high-risk systems are associated with all-encompassing, far-reaching negative outcomes. Thus, it justifies the evaluation and comprehension of the causes of such occurrences, and is essential for their future prevention (Weigmann et al., 2002). To exemplify this concept consider the following example. On April 26th 1986, the city of Chernobyl grabbed international headlines when the concrete ceiling of its nuclear reactor was sent hurtling through the atmosphere as two explosions shook the very core of the Ukraine. This unprecedented nuclear accident resulted in both short and long term catastrophes for the Ukrainian people who were working within the plant, as well as those who resided in the surrounding area (Cox & Flin, 1998). Within this region of the Ukraine the diagnoses of cancer still remain elevated. This illustrates the point that these high-risk industries pose a

potential threat not only to their employees, but also to the unsuspecting general public. Reason (1990) noted that the scale of potentially hazardous technologies could affect entire continents for generations to come.

Alternatively, we could also examine an organizational accident within a high-risk industry that occurred in relative geographic isolation, and yet still incurred far-reaching consequences for the general population. In 1988, in the volatile North Sea, another major organizational accident transpired. On the offshore oil platform Piper Alpha, an incorrectly executed work order caused ignition of the gas being extracted and resulted in a massive inferno that consumed the majority of the platform. The explosion and resulting fire continued to burn for hours (Cox & Flin, 1998), and claimed the lives of 167 offshore personnel. This led to the extensive investigation by Lord Cullen in 1990, which concluded this massive loss of human lives was largely the result of poor communication, inadequate safety protocols, and unclear maintenance procedures. For example, the manner in which the offshore pipelines were organized in this portion of the North Sea had Piper Alpha as a junction point for the oil being pumped from a number of other offshore installations. Once Piper Alpha was engulfed in flames, there was no mechanism to notify the adjoining platforms to cease pumping oil towards the troubled installation. This perpetuated the flames and contributed to the loss of human life (Cullen, 1990). However, there were positive actions that arose from this organizational disaster. With the large media attention devoted to this tragedy, health and safety protocols were brought to the forefront and legislation changes were enacted to protect the offshore personnel. There was also a renewed commitment to health and safety by the offshore oil

industry as a collective, and they still have remained committed to this endeavor. Due to these positive changes in the occupational health and safety procedures of this industry, it will serve as an environment with an *applied* setting to examine the impact of these initiatives. However, we must take care to note that regardless of the changes and organizational initiatives implemented, organizational accidents will continue to occur at great cost to both human and financial facets. Hence, health and safety will remain an ever-present aspect of operating a business, especially in high-risk industries such as offshore oil.

Offshore Petroleum Industry

The Health and Safety Commission (HSC) reviewed the accident statistics from 1991 and 1992 in several industries within the UK (HSC, 1992). These industries were chosen because they possessed the highest fatal injuries over a five-year period. These industries included: construction and railways, forestry, coal extraction, extraction of minerals and oil and natural gas extraction. The oil and gas industry had a fatal accident average that was eight times higher than the average of the remaining industries. However, this report (HSC, 1992), occurred after the Piper A disasters and as such it was no surprise that the oil and gas industry had the highest number of fatal accidents. When these 167 deaths from Piper A were removed from the oil and gas fatalities, this industry still ranked third (HSE, 1992). Thus, it is apparent that there is the potential for a great number of accidents and fatal accidents in the offshore industries. Moreover, there are a number of hazards that are specific to the oil and gas industry (i.e. helicopter accidents

and falling overboard). As a result of these high accident averages and the unique hazards in the offshore industry, safety is of paramount importance.

The offshore oil industry has undergone a number of positive changes in the wake of great misfortune. The nature of the industry is one that is extremely complex and fraught with the potential for large-scale catastrophes (Flin et al., 1996a). Within any given offshore installation, there are a number of prospective occupational accidents including falling overboard, or to a lower level, being injured operating large extracting and refining equipment, and extended helicopter transports to and from the platforms during poor weather conditions (Flin, Mearns, Fleming, & Gordon, 1996b), to name but a few. As it can be inferred, the offshore petroleum industry is considerably more risky and possesses the potential to result in more frequent and serious on the job injuries than most industries. Therefore, it serves as an excellent industry within which to study the prevailing safety attitudes of its personnel. Not only should we be concerned with the welfare of the offshore personnel, accidents and catastrophes within this industry have the potential to affect the general population.

The majority of the general population is dependent upon offshore oil production for most amenities; it is an industry that influences us all. From the fluctuating prices at the pumps for the unleaded fuel to propel your car, to the escalating cost of home heating fuel, all of us rely indirectly and interact with this industry on a daily basis. The offshore petroleum industry's far-reaching influence, motivated its choice as the focus of the present study.

Sutherland and Cooper (1996) examined the offshore petroleum exploration and production within UK installations. Their goal was to identify the sources of stress in the offshore work environment using a stress audit approach in 310 males in 97 installations. Using multiple regression and factor analyses, there were several factors that significantly related to the perception of stress in this industry. There were a number of external physical factors identified; however, one of the most influential factors that were of great concern to the employees was their safety while on the installations. This highlighted the importance of examining the safety and welfare of offshore employees, and their vested concern and interest in their own well being. Another important finding of Sutherland and Cooper (2002) was that the stress factors that were found to be the most influential varied, and were specific to certain occupational groups. This fact illustrated the magnitude of separately examining the safety and stress of the various subcultures within an offshore platform.

The North Sea

The North Sea is Europe's largest oil and gas producer and it is also one of the world's key non-OPEC producing regions (www.eia.doe.gov/emeu/cabs/northsea.html). Moreover, if the ownership and production rights of the North Sea are examined, Norway and the UK hold the majority of the reserves and production rights, and have the highest number of operating installations within the region. Denmark, the Netherlands, and Germany process smaller North Sea oil and gas resources and this further displays the dependence of a substantial portion of the world's population on the products extracted from this location. The North Sea has long been a part of the offshore petroleum industry.

Oil and natural gas were first discovered in the North Sea in the 1960s. However, it did not emerge as a key non-OPEC oil producing area until the 1980s and 1990s, which resulted from major discoveries of oil and gas reservoirs (www.eia.doe.gov/emeu/cabs/northsea.html).

Despite the invaluable and plentiful resources present within the ocean bed of the North Sea, there are still a number of concerns that must be addressed by the major players in this local. The climate of the North Sea is one that is fraught with peril, as the frigid temperature and gusts of wind lead to very trying working conditions. Moreover, the resources of the North Sea are located a great distance below sea level and require sophisticated offshore technology to extract the oil and gas. Consequently, the region is a relatively high cost producer, but its political stability and proximity to major European consumer markets have allowed it to play a major role in world oil and natural gas markets (www.eia.doe.gov/emeu/cabs/northsea.html). For example, North Sea offshore crude oil production reached new heights in 1999, averaging 5.94 million barrels per day (bbl/d). However, production declined in consecutively in 2001 and 2002, to approximately 5.72 million bbl/d and 5.66 million bbl/d, respectively. Total offshore oil production averaged 6.21 million bbl/d in 2002, about a 1% decrease over the previous year. In contrast, natural gas production, including onshore production, has steadily increased, reaching 9.5 trillion cubic feet (Tcf) in 2001. This statistics exemplify the importance of considering activity in the North Sea in the offshore petroleum industry.

As it was stated above, the UK and Norway hold the greatest proportion of land and drilling rights within the North Sea. Thus, they would serve as the largest and most

accurate sample within which to study the inter-workings of the offshore industry in this sector. The reasons for sampling UK and Norwegian offshore personnel in the present study are three-fold. Firstly, these country samples were selected from an applied sample and provided insight into industry trends and patterns. Secondly, the nature of the offshore oil and gas industry in these two countries is interrelated. With numerous production and refining installations from both countries operating in the North Sea (Rundmo, 1992), it provided a sample with the same environments, but distinct cultural influences. As the influence of the environment is relatively constant between the two sectors, it provided an excellent situation to examine the “controlled influence” of numerous organizational and national factors. Thus, this study simultaneously examined the relative influence of national and organizational culture on the prevailing safety attitudes of the personnel working within the North Sea. The research is an endeavor in cross-cultural research, examining both of its most prevalent cultural forms: national and organizational.

Risk and Safety Research in the Offshore Petroleum Industry

Within the offshore petroleum industry, Rundmo (1990; 1993; 1994) has conducted a substantial amount of research pertaining to accidents and safety. Rundmo (1990) assessed the relationship between occupational accidents and objective risk in eight Norwegian offshore installations, with a sample that was comprised of 915 personnel. These personnel were members of one of seven occupational groups. He assessed the subjective feeling of safety in relations to several hazards to the installation. There were no significant differences between the objective and subjective levels of

accidents, which displayed that the “front-line” staff was accurate in their assessment of risk. The also results showed that across all seven occupational groups, the feeling of safety was lowest for protection against large-scale disasters. Despite this universality across occupations for major accidents and disasters, the occupational groups reported feeling less safe with regard to the possibility of incurring different types of injuries and reported different safety levels (Rundmo, 1990). For example, drillers, maintenance, and construction personnel were exposed to the most strain, injury and experienced the highest frequency of accidents. Moreover, contractors felt less safe than operators and administration and production staff felt safer than all occupations. This displayed that there were clear differences between the occupational groups with regard to their experiences and accidents and safety on the installations. LISREL analysis confirmed that risk perception, work strain and occupational stressors all led to increases in the probability of an accident occurring. The three predictors of accident causation are physical and organizational factors. In essence, in order to change the risk perception of the personnel, changes had to be made in the physical and organizational conditions of the offshore installation.

Rundmo (1992) continued his work with the same sample and more closely examined the nature of risk perception and safety in the offshore population. He reported that employee perceptions of the risk, their physical working environment and safety measures, were accurate and in accordance with the objective measures. This replicated the findings of the previous study that also showed personnel were accurate in their risk perception. In particular, Rundmo (1992) stated that the risk perception was contingent on

the actual work environment. He further emphasized that organizational factors required improvement in order to increase the safety of personnel. Rundmo (1993) emphasized that management commitment to safety was extremely influential in improving an installation's safety culture. The most effective way to improve or alleviate dissatisfaction with safety measures would be to directly improve work and safety instruction. If the personnel are made aware of the benefits of safety and emotionally invested in the maintenance of these measures, they are more apt to adhere to improve safety protocols. He further suggested that this could include such initiatives as increased management commitment to safety as well as safety training and more safety devices afforded to the personnel on the installations. This finding was the culmination of several publications conducted by Rundmo (1990; 1992; 1993) on the Norwegian offshore population. Although Rundmo (1990; 1992; 1993) made prolific advancements in the safety and management procedures in Norwegian offshore industry, there was a glaring absence of research on the offshore populations of other countries operating in the North Sea. One noticeable absence of research pertained to one of the major holders of North Sea drilling rights, the UK. However, this state of research was not to remain for long. This next battery of studies pertaining to risk and safety in the offshore populations was conducted on the UK offshore personnel.

The results of the studies in Norwegian offshore population provided insight into the attitudes of the personnel within this high reliability industry. Researchers from other countries became interested in determining if similar patterns and attitudes prevailed in the personnel of their installations. For example, Fleming, Flin, Mearns, Gordon (1998)

evaluated the risk perception of UK offshore personnel. Their purpose was to determine how closely the subjective risk perception approximated the objective measures of risk (e.g. Quantitative Risk Assessment (QRA) and accidents frequencies). A translated version of Rundmo's (1990) original questionnaire was obtained for administration in English. Fleming et al. (1998) obtained a sample of 622 UK offshore personnel from six installations. Results showed there was a significant correlation between the objective and subjective measures of risk for all six installations. In order to enact changes into the safety attitudes of the personnel, Fleming et al. (1998) sought to determine the possible predictors of the risk perception. Therefore, they further examined the underlying factors they believed predict the risk perception of personnel. The rationale for the conducting the analysis was that if risk perception was a reflection of actual risk, then organizational factors should affect risk perception. The LISREL analysis revealed that there were several significant predictors: job situation; work environment; satisfaction with safety systems; and job satisfaction. Only work environment directly contributed to the risk perception of the personnel. Due to the fact that organizational factors predicted risk perception, this provided further evidence that front-line staffs' risk perception was a measure of 'real risk'.

Another theoretical safety model, with accidents as the outcome variable was conducted in order to determine the predictors of accident causation. It was proposed that the variables that were predictors of risk perception would also influence the respondents' accident involvement. There were several significant accident predictors of accident involvement: satisfaction with safety; safety attitudes, risk perception. However, these

variables only explained 3% of the variance. They concluded that there was accurate risk perception in offshore personnel, which was contrary to research conducted with other professions (e.g. construction) (Zimolong, 1985). Furthermore, as there was a relatively small percentage of the variance in accident involvement explained, this was an area that required further investigation. Rundmo (1992) stated that organizational factors influence the actual risk level, which was replicated by Fleming et al. (1998). Thus, in order to improve safety, one needs to change organizational factors that directly influence accident causation, or one could change organizational factors that affect risk perception, as it too influences accident causation. This study brought the offshore issues to the forefront of research in the UK as well. The next advancement was the comparison between countries within the same industry to determine if there were cross-cultural universals.

A further study utilizing the same sample was also a collaboration of two countries. Continuing on the research of Rundmo (1993), Mearns, Rundmo, Flin, Fleming and Gordon (1997) were evaluating the potential difference in safety attitudes between oil platforms operating in two distinct geographic regions: the U.K continental shelf and the Norwegian portion of the North Sea. The UK team of researchers formed a partnership with Rundmo, with Rundmo collecting another Norwegian sample and Mearns and her colleagues collecting the UK portion. They administered the translated and revised version of Rundmo's (1990) original self-report questionnaire for the 622 offshore personnel in the UK and 1138 Norwegian personnel responded to the Norwegian version of the questionnaire. Mearns et al., (1997) labeled the country variable as *sector* to denote if the installation was operating in either the UK or Norway. They hypothesized that the

cultural differences of these two countries would impact the operation of the platform and resulting perceptions/attitudes of its employees. There were several occupational variables assessed in the study, which included: risk perception, attitudes to safety, satisfaction with safety, others commitment to safety, job situation, physical working conditions and social support. The study sought to pinpoint the constructs that displayed differences between the cultures.

The results displayed a clear difference in the manner in which the UK and Norwegian personnel viewed the numerous social and organizational variables that influenced their safety while on the installations. All of these occupational variables were found to display significant sector differences (i.e. UK vs. Norway), however, when an η^2 was conducted to determine the strength of the influence, installation specific characteristics explained more variance than did sector. The only exception to these findings was found for the safety attitudes variable that had equal variance explained by both sector and installation. There were no variables that displayed a greater influence of sector. Nevertheless, there was an influence exerted on all the personnel's attitudes dictated by the culture of the countries from which they originated. This finding highlights the importance of evaluating the influence of national culture on the prevailing views of offshore petroleum personnel. Offshore employees working in the petroleum industry for the UK and Norway differ in their perceptions of the occupational variables, despite both countries operating in the same environment: the North Sea. These two countries are operating within the same geographic region; essentially, the influence of the

environment is constant across both of the sectors. Therefore, there remains variance that is explained by peripheral influences, such as nationality and organizational membership. The emergence of these significant differences warrants further investigation into the putative cultural differences of the U.K and Norway.

Despite its sound empirical design, the study conducted by Mearns et al., (1997) was limited in part by the statistical methods utilized on the data. The data was subjected to a battery of t tests and correlational analyses. The researchers also conducted structured equation modeling (SEM) to determine the relative influence of the variables assessed in the study. These techniques are well suited for traditional studies between relatively homogeneous groups. However, the previous study neglected the inherent *nested* structure within the data set. For example, there are occupational groups that exist within the installations and these installations exist within countries. When one is assessing differences between groups with a nested structure such as this, alternate statistical processes are typically implemented and this present study has conducted the appropriate analyses. The present study contributed to the analyses conducted by Mearns et al., (1997) through the execution of a simultaneous assessment of the influence of nationality and organizational membership on the prevailing safety attitudes of offshore personnel.

Cross-cultural Psychology

Cross-cultural research is dominated by North Americans whom have gravitated towards local and continental issues (Bond & Smith, 1996). Recently, there has been an increase in the number of cross-cultural research studies published in both textbooks and peer reviewed journals (Alder, 1991; Berry, Poortinga, Segall, & Dansen, 1996; Triandis,

1994). These articles are widening the focus from the North American tradition to global issues. Much of the pioneering cross-cultural research focused on measurement and assessment procedures, rather than constructs and theories (Bond & Smith, 1996), with the aim of developing a comprehensive instrument that would accurately assess the influence of culture. The research began with the impetus to understand national culture and its influence on aspects of human behaviour. However, as the understanding of culture grew, so too did the realization that institutions other than countries also possessed their own subcultures, nested within the broader national culture (Hofstede, 1991; Helmreich, & Merritt, 1998).

Outside of the national culture research, the institution that garnered much of the research focus was the organization. Hofstede (1994) proposed that although the culture of the organization can be competing with that of the nation, they could still coexist in relative harmony, as long as there is no direct competition for shared resources. Thus, the main research veins of cross-cultural psychology were formalized: national/ethnographic culture and organizational/corporate culture. These two avenues will be discussed in succession.

Internal vs. External Constraints.

Poortinga (1992) conceptualized a unique view of cross-cultural research. Essentially there were two competing forces that dictate cultural differences between individuals. These forces are internal-proximal versus external-distal constraints and they determine our behaviours. *Internal-proximal constraints* pertain to those factors that are enshrined within the individuals, and include *beliefs, attitudes, and values*. *External-*

distal constraints refer to factors external to the individual that may, or may not influence their behaviour(s) and, or thoughts. These constraints include *ancestry, national culture, organizational culture, the economy, and family*. Both facets are of particular importance when considering the present study, as it is an evaluation of the affect of national and organizational culture on the attitudes on employees.

Schwartz (1994) extended the work of Poortinga (1992), and pioneered much of the research on interplay between internal-proximal constraints and values. The breakthrough afforded by Schwartz (1994) was the culture level variables could be assessed at the *individual* level. Thus, individuals could now be assessed to gain insights into the broader cultural trends and national standards, which was not possible with the cultural dimensions proposed by Hofstede (1980). This is of particular relevance when examining the national level variables in the present study that were also assessed at the individual level.

Cross-cultural research on internal-proximal constraints has also been conducted on beliefs. As stated previously, internal-proximal constraints pertain to things believed to be *internal* to the individual, including: thoughts, ideas, and worldviews. Smith, Trompenaars, and Dugan (1995) assessed the beliefs of individuals from 43 countries. The results showed that beliefs could also vary significantly cross-culturally. It was a key finding because, it is known from the theory of reasoned action that beliefs eventually become the precursors of attitudes, values, and finally behaviour (Ajzen & Fishbein, 1977; Fishbein & Ajzen, 1975). Moreover, these beliefs are closely related to cultural differences in individuals' experiences of control, cohesion, and submission. This study

further emphasized the importance of the assessing the potential differences of culture between different countries.

Safety attitudes were measured in the present study; an evaluation of the internal-proximal constraints of the offshore employees. And measuring these attitudes is important because they dictate the behaviours of the employees. However, these internal-proximal constraints will in turn be influenced by the external-distal constraints (e.g. culture). It is believed that the attitudes will differ between the UK and Norway with regard to the importance the employees will devote to safety. This will be contingent upon the influence of their relative cultures. It is hypothesized that the Norwegians will place greater emphasis on the safety related attitudes on the installations. This would include the occupational variables of satisfaction with safety systems, others commitment to safety and attitudes to safety. This would result in these Norwegian personnel being strongly committed to these attitudes and reflect them in their behaviour. The rationale of this difference is dependent on the degree of *individualism-collectivism* within a culture. This construct will be discussed in greater detail in a future section.

If we shift our focus to the external-distal constraints, they refer to factors external to the individual that may, or may not influence their behaviours/thoughts. These constraints can include such things as ancestry, culture both national and organizational, the economy, and family. This area has included many factor analytic studies on ecological, economic, political, and social indicators (Bond & Smith, 1996), and is of particular importance when considering the current study's examination of both national and organizational culture. As external-distal constraints are not necessarily guaranteed to

have a substantive impact on the beliefs and attitudes of individuals, the present study seeks to answer the degree of influence of these two cultures.

Many believe that factors of interest in this body of literature are outside the scope of psychology (Bond & Smith, 1996). The majority of studies conducted in the 1970's are focused on the economic development of the countries in question, and in relation to this, the developments of their corporations and industries. However, Bond (1994) asserts that the assessment of the remaining areas will lead to the emergence of considerable variation between countries and could lead to clearer conceptualizations within organizational culture. The majority of cultural models are proximal rather than distal. However, an examination of concepts and issues that are not exclusively psychological in their nature could invariably lead to a clearer understanding of important psychological phenomena such as attitudes, satisfaction, commitment, and risk perception. Therefore, the present study examined variables that are both psychological and organizational in nature. Once again, it is believed that there will be cross-cultural differences in the level of influence the external-distal constraints have on the attitudes and behaviours of the offshore petroleum personnel. These differences will be manifested in relation to the amount of commitment the UK and Norwegian personnel will have to their national and organizational cultures. It is hypothesized that the Norwegian personnel will have a high degree of commitment to their national culture, which will be displayed as a high level of importance allocated to the safety issues on the installations and a high degree of commitment to safety. The UK personnel will also have a high degree of commitment to their national culture; however, it will result in a different expression of the safety issues

on the installations. The UK personnel will be more devoted to individual competition and sacrifice “peripheral” issues in order to accomplish this end. This could involve a lower commitment to safety and differing job situations than those in Norway.

National/Ethnographic Culture

Mjos (2000) defined culture as the collective learning of ideas, norms, values, and rules. This would encompass a large number of ideas and views that influence the manner in which we conduct our daily affairs. *Culture* defines the *status quo*, as well as in and out-group behaviour. Hofstede (1980; 1991) proposed that culture was not a unitary construct, but was comprised of several dimensions including: uncertainty avoidance; power distance; masculinity-femininity; individualism-collectivism; and future orientation (Hofstede, 1980; 1991). Power distance was defined as the degree of inequality among people which the population of a country considers as normal, while uncertainty avoidance pertains to the degree to which people in a country prefer structured over unstructured situations; ranging from relatively flexible to extremely rigid (Hofstede, 1994). The facet of masculinity-femininity was defined as the degree to which ‘masculine’ values assertiveness, performance, success, and competition prevail over ‘feminine’ values such as quality of life, maintaining warm personal relationships service, caring, and solidarity: ranging from tough to tender. Individualism-collectivism was defined as the degree to which people in a country have learned to act as individuals rather than as members of cohesive groups: ranging from collectivist to individualist (Hofstede, 1980). The last construct, long-term orientation, was added in future studies (Hofstede, 1984; 1991; 1994), and pertains to the adherence to thrift and perseverance.

However, Poortinga (1992) provided us with a working definition of culture, which was defined as, “a set of shared constraints that limit the behaviour repertoire available to members of a certain group” (Poortinga, 1992, p.10). This definition moved away from the ethnic-oriented tradition of cross-cultural studies, and provided a broader definition that could be applied to alternate settings, including organizations. The development of these cultural dimensions facilitated the categorization and understanding of different cultures; in essence we are searching for communal values, or a shared culture.

Merritt and Helmreich (1996) and Helmreich and Merritt (1998) have demonstrated that there are significant cultural differences between nations with regard to the remaining dimensions proposed by Hofstede (1980). They surveyed pilots from 26 countries and found that there were significant differences between nations for the following factors: attitudes towards authority; communication; attitudes towards adherence to rules/procedures; and interaction with computers. These 26 countries were significant differences in the attitudes towards authority and adherence to rules/procedures, as well as communication. This has direct implications to the present study, with regard to the variables of attitudes to safety. For example, if there were differences in country views towards attitudes towards authority and adherence to rules/procedures, it could be said that there are probable significant differences with regard to the occupational variable of attitudes to safety. This is because safety rules/procedures are measures enacted from the authoritative branch of industry, the management. If this decree from management is viewed as unjust, or unfounded, employees may be more apt not to comply with the initiative.

The present study sought to examine the influence of national and organizational culture on the safety attitudes of ten occupational groups within the offshore installations. The attitudes and perceptions that the employees have towards an organizations health and safety initiatives are important because it is the front-line staff that must implement and adhere to the various measures in place for their protection. If the safety attitudes of the employees are unfavorable, it likely that employees will not comply with the safety guidelines and a poor safety record will result. I believe that the national and organizational cultures of these offshore personnel dictate their safety attitudes and require investigation to delineate this relationship. The paper will discuss will first discuss national culture, followed by a brief review of organizational culture.

Individualism-Collectivism.

Hofstede (1991) proposed that, “individualism stands for a society in which the ties between individuals are loose; everyone is expected to look after himself/herself and his/her immediate family only...Collectivism stands for a society in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people’s lifetime continue to protect them in exchange for unquestioned loyalty” (p.260-261). One can clearly observe that these two tenets, would lead societies that subscribed to them to behave and value fundamentally different constructs. Therefore, researcher began to assess various countries to determine if they had variations in the cultures and views they held.

Smith, Dugan, and Trompenaars (1995) assessed cultural variation within 43 countries. This yielded two separate dimensions: conservative-egalitarian commitment

and loyal involvement-utilitarian involvement. This was a further division upon the collectivism dimension that was proposed by Hofstede (1980). Smith, Dugan and Trompenaars (1995) constructs were previously overlooked by Hofstede's (1980) original conceptualization of the collectivism. Smith, Dugan and Trompenaars (1995) restructuring of the collectivism construct was a significant change in the field because the new divisions exhibited temporal stability in differentiating the policies of countries worldwide, and led to more specific classifications.

Similar to the other cultural dimensions, the individualism-collectivism dimension has the potential to dictate the policies, legislation, and behaviour of an entire country (Poortinga, 1992). In particular, individualistic cultures place greater emphasis on the betterment of the individual, and foster individualistic competition (McAuliffe, Jetten, Hornsey, & Hogg, 2003). It could be inferred that individualistic cultures could overlook the good of the masses for the success of the individual. This could have direct implications when we consider the area occupational health and safety. Specifically, organizations operating within the borders of an individualistic nation could sacrifice the protection of the larger group in order to achieve success for the individual, in this case the organization. Conversely, collectivist cultures value the "greater good" (Jetten, Postmes, & McAuliffe, 2002), and seek to increase the benefits that are enjoyed by the masses. One could draw the conclusion that occupational health and safety would be of greater concern to organizations that operate within a collectivist nation. This is due to the fact that an optimal occupational health and safety department enacts safeguards that ensure the well being of all employees. This individualism –collectivism continuum is a

concept that was examined in the present study, in an effort to comprehend the interplay between national culture and occupational health and safety.

The construct of individualism-collectivism is one that has been the subject of numerous cross-cultural research studies (Hofstede, 1980; 1984; 1991; 1994). It is particular importance when examining the composition of the sample of the current research study. Specifically, the sample is comprised of offshore petroleum personnel operating in the North Sea from two countries: the UK and Norway. It is the contention of this researcher that these countries represent these two cultural dimensions. It will be argued that UK is a country that is more enshrined with individualistic ideals, while Norway is predominantly collectivist in its orientation to issues pertaining occupational health and safety.

Triandis (1990) believed that members of a collectivist society would have more social responses to the “Who are you?” test (Bochner, 1994). Triandis (1990) work allowed him to develop a scale that assesses the corresponding individual-level construct, allocentrism-idiocentrism, both within and across cultures. Gudykunst, Matsumoto, Ting-Toomey, Nishida and Karimi (1994) were also interested in collectivist cultures. They stated that persons from collectivist cultures feel more interdependence, which in turn favour such values as conformity, prosociality, and security. Conversely, individuals from an individualistic culture are more independent, and endorse self-direction (Gudykunst et al., 1994).

Educational curriculum is an area that many psychologists believe to be an integral part to the cross-cultural literature and an important political forum in which the

cultural undertones of a country may be illustrated (e.g. individualism vs. collectivism). Many believe that great lessons can be learned from the manner in which alternate cultures view their education systems and the methods they utilize in shaping the minds of their youth (Payne, 2002; Smithers, 1999; Brown, 1999). The recent shift from *goods*, to *service-based* economies has forced countries evolve their educational systems in order to pursue a high-skilled, knowledge driven work force (Payne, 2002). This alteration has resulted in the need for skilled employees that continuously learn and can adapt to a multitude of circumstances. The means of achieving this new breed of student is through the administration of an education regiment tailored to foster these traits in the new breed of students.

Payne (2002) assessed the differences in education platforms of two countries that were committed to the attainment of a high-skilled, knowledge-driven economy, or learning society: the UK and Norway. Both countries had to restructure their education systems to achieve this ultimate goal. Payne (2002) reported *three* fundamental differences between the educational curriculums of the UK and Norway. First, in the UK the educational system is viewed as a *servant* to the current economy of the time. Changes are made to the educational system in order to provide the population with employees to fill gaps in needed occupations, in other words, an employment-driven education system. Some have gone as far to say that the UK education system is preoccupied with measuring the quantifiable rather than refining the education system and protocol (Fielding, 1999; Broadfoot, 2000). Furthermore, the education system in the UK fosters individualistic competition through the attainment of limited employment

opportunities for its graduates. This trend exemplifies the UK's predominant individualistic tendencies. A similar trend may be apparent if we transfer this competition to the offshore industry. For example, as in every occupation, within any offshore installation, there are a limited number of workable hours and promotion opportunities. Thus, instead of ensuring that all employees have the opportunity to advance, they must fiercely compete with one another to 'make' their opportunities. This could come at the expense of team cohesion and communication.

A second major point of demarcation between the countries education systems pertains to the very conception of the "employee". In Norway, the educational curriculum entitles all learners to a broad, all-inclusive education (Payne, 2002). The curriculum includes both specific technical skills, as well as social skills to allow students to adapt and integrate new information. Furthermore, *all* students have the statutory right to three years post-secondary education. The Norwegian students are committed to life-long learning. Conversely, the UK focuses on a "lean" model of required skills for its students. Similar to the North American experience, education in the UK has also been reduced to a two-tiered system in which education is increasingly becoming available to only the financial elites (Payne, 2002). There is a focus on 'can-do' skills, and employer defined competencies, at the expense of theory and general education (Payne, 2002). This displays the UK commerce-driven education system with emphasis on occupational skills, while Norway's system is geared towards improving the attributes/skills of its students. It is probable that this divergence is due to the cultural differences between the

collectivist, welfare state of Norway (Payne, 2002), and the individualistic, capital state in the UK (Ashton & Green, 1996).

This divergence between the countries illustrates that Norway favours the betterment of its entire pool of life-long learners and offers them every advantage in order to provide them with the skills that will allow them to succeed in any number of settings. Norway is committed to allocating resources to ensure that each citizen has the opportunity for educational and career advancements. Conversely, the UK has its citizens competing for a limited number of resources and employment opportunities. The employees are taught a limited number of skills and must depend on superiors for direction. This would result in a work environment that lacks autonomy. This trend further displays the UK's individualistic tendencies and Norway's collectivist orientation. This could be manifested in various initiatives that structure the job situation of the offshore personnel. The Norwegian case is extremely liberal and teaches all its students the skills integral for success in today's perpetually changing world, which echoes a culture of collectivism and forward thinking. Alternatively, the UK favours a competitive education system that seeks to meet the needs of the economy. This exemplifies the UK's individualistic culture and commitment to government control of education, in order to serve the industry.

The final fundamental difference between the education systems of the UK and Norway concerns the construct of *trust*. Within the UK, there is very little trust bestowed on the teachers. They are viewed merely as technicians of the system (Payne, 2002). The voice of the teachers has been marginalized, and the curriculum has been enshrined on

performance based testing, rather than the judgment of the teacher. UK teachers find themselves imparting knowledge for the performance tests, rather than to a justified curriculum. Norwegian teachers have more discretion and *autonomy* for the education reform process. They have the authority to tailor their curriculum to the specific needs of their students and they retain control over the assessment procedures (Payne, 2002). The UK favours central control over the education system, while in Norway they favour trusting the teaching to accommodate the needs of their particular students. Thus, the needs of each and every student are taken into account in the educational system of Norway, while in the UK the students must compete in order to make the system work for them. One could interpret this as a direct divergence between individualism and collectivism.

From the review of the points of demarcation between the educational systems of the UK and Norway, it is clear that they are viewed as fundamentally different entities by the respective societies. Thus, it would be intuitive to assume that the nature of work would be viewed from a drastically different stance by these two countries. It is believed that the offshore employees are subjected to different job situations and working conditions. These differing job situations could also result in significantly different accidents rates and statistics; therefore the job situation of the employees must be evaluated.

From this brief review of educational systems, it is clear that Norway has been at the forefront of *progressive* educational reforms implemented by their liberal governments with their collectivist initiatives (Rust, 1990). The Norwegian education

policy has an emphasis on “social democratic progressivism” (Telhaug & Volckmar, 1999), which entails emphasis on personal development, equalization, and social solidarity, with a greater acceptance of choice, freedom and variation (Payne, 2002). Their society is extremely liberal and there is an emphasis placed upon the needs of all. They seek to foster equality and social cooperation, and to provide a broad education platform with adaptive capabilities, in both private and professional adult life (Payne, 2002). The education system is focused on cooperation rather than individual competition. There is a great degree of *communication* between the people and they share problems to a sympathetic listener. This displays the Norwegian predisposition to provide social support to those in need, for all seek to ensure the wellness of the masses. This is a policy that mirrors that cultural “collectivism” of the country. Norwegians have a vested interest in the success of the nation and strive to achieve this through their daily interactions with one another, especially in times of need and peril. Goodwin and Hernandez (2000) researched the amount of social support experienced in collectivist cultures. The sample was comprised of 72 respondents from the UK (e.g. individualist) and 68 from Spain (e.g. collectivist). The results showed that the Spaniards were more collectivist than the British; moreover, they experienced a higher level of social support. In the present study, it has been argued that Norway displays more collectivism than the UK.

Merritt and Helmreich (1996) and Helmreich and Merritt (1996) found significant cultural differences pertaining to the communication styles of pilots in 26 countries. Social support is contingent upon the communication between individuals and the

offshore petroleum industry is no exception to this fact. Therefore, if a country differs with regard to its prevalence to openly communicate, because social support is contingent upon communication, it could be inferred that the level of social support will also vary in relation to culture.

However, the generalizability of the results of Merritt and Helmreich (1996) and Helmreich and Merritt (1996) is questioned because the sample was restricted solely to one branch of an organization: pilots. To increase the strength of said findings, it was suggested that perhaps a more representative sample of the population would provide better insight into the cultural trends of these countries.

In another study of social support and culture, Oppedal and Roysamb (2004) assessed the experienced levels of social support of native Norwegian students and immigrant students to Oslo. They found that the immigrant students experienced higher levels of psychological distress and lower social support than the Norwegians. There were also significant gender differences displayed. Oppedal and Roysamb (2004) explained that the differences were the result of cultural differences in values and gender expectancies. This emphasized the importance of studying the each gender and culture separately. Thus, we would expect a similar pattern to emerge in the perceived levels of social support experienced between the offshore personnel of these two nations.

A quote from Coffield (1994) serves to illustrate the goal of the Norwegian education system. The students of Norway aspire in, “continuing their education” such that they are able to, “engage in critical dialogue/action to improve the quality of life for the whole community and ensure social integration as well as economic success.”

(Coffield, 1994, p.2). Moreover, the Norwegian government has devoted 6.8% of its Gross Domestic Product (GDP) annually to its education system. This is a clear social assistance program gauged at maintaining the welfare of *all* the Norwegian people. The Norwegian education system aspires to meet higher collectivist goals than simple employability of its graduates. The same cannot be said of the UK system, which seeks to provide assistance to industry rather than to the lives of its students (Payne, 2002).

The Norwegians are collectivists with regard to other aspects involving their populous. Norway is a prosperous 'welfare state'; they place great value in the social assistance programs (Payne, 2002). Their governments have been dominated by social democrats in this postwar era, which has fostered a consistent and effective partnership between the state, business, and trade unions. This has resulted in an extensive welfare system and an efficient, effective public infrastructure. The Norwegian oil economy employs state intervention, which has ensured its success. Newly implemented liberal workplace participation systems have resulted in cooperation with industrial restructuring and productivity enhancement (Payne, 2002). Furthermore, Norwegians utilize a centralized collective bargaining approach to alleviate wage disparity (Dolvik & Srokke, 1998). The UK remains largely individualistic in their major government initiatives, and parallels the capitalist system of the United States more so than the collectivist system of Norway. Although there is government intervention in the UK, it typically occurs once an industry is in the depths of economic hardships (Payne, 2002). The same collectivist rationale is not evidenced in the UK experience.

The UK and Norway implement divergent policies with regard to societal issues. The examples presented above were chosen to exemplify a selection of the issues that illustrate the individualism-collectivism of the countries in question. This issue is of particular importance in the present study because it is hypothesized that a collectivist culture will have a stronger commitment to occupational health and safety, as opposed to individualistic cultures. This is because the collectivist cultures value the safety initiatives, as they will ensure the safety of the masses. Conversely, an individualistic nation might place greater emphasis on competition to ensure individual success. This could result in favoring success and profit over the values of safety and well being of employees.

Production and protection can be viewed as opposing forces. If one were to invest all their time and efforts in the protection or safety of their organization, they would suffer and decreases in production and eventually incur bankruptcy. Conversely, if one were to focus all of their efforts on production, the protection or safety on the organization would decrease drastically and eventually result in catastrophe. Thus, one cannot devote all of their resources into one of these branches; there must be a balance. The individualistic tendencies of the UK will favour production, while Norway will favour the protection aspect. In particular, I hypothesized that the nationality of Norway will predispose the installations operating for this country to have a greater commitment to occupational health and safety. Within the present study, this will be displayed in the variables of attitudes to safety and others commitment to safety.

Cultural differences are present in the perceptions of one's environment and levels of acceptable risk. One such area involves risk perception, and the propensity to partake in 'risky' behaviours. For example, the level of risk an individual is willing to take is higher for Anglo students, rather than in non-Anglo groups (Cox, Lobel & McLeod, 1992). Although this study was conducted with a student sample it is possible that the same trends could be present within an organizational setting. These cultural differences could reflect concrete differences in the levels of acceptable risk on the installations and influence the resulting risk perception of the personnel. For example, perhaps the Anglo UK offshore employees have a significantly different perceived level of risk while on the job. This could in turn result in these employees participating in 'risky' acts. It is not for certain that the nature of risk perception is one that mirrors the situation with students. However, this study believed there are differences in the risk perception of the two countries evaluated.

Within cross-cultural research, there is another entity that also possesses its own culture. This entity is the organization and the following section will discuss the relationship between national and organizational culture

Organizational/Corporate Culture

Organizational culture can be defined as invisible, preconscious beliefs shared by members of an organization, which are largely shaped by shared practices (Schein, 1990). As it can be observed from the present definition, organizational culture more often arises from shared practices, while national culture largely arises from shared values (Mjos, 2002). Robbins and Langton (1999, p.615) alternative definition of organizational culture

states that “culture is a system of shared key characteristics and common perception held by members of an organization that distinguishes it from other organizations”.

Furthermore, organizational culture has several facets: innovation and risk-taking; attention to detail; outcome orientation; people orientation; team orientation; aggressiveness; and stability.

Although there is a division between the studies of national and organizational/corporate culture, there is a relationship between the two. Sousa-Poza (1999) examined the relationship between national and corporate culture in relation to total quality management (TQM) training. Three continents were analyzed: America (Missouri), Europe (Switzerland), and Africa (South Africa). National culture was assessed using the dimensions proposed by Hofstede (1980; 1991), and the corporate culture was assessed using a measure developed by the University of Missouri. Cluster analysis showed that there was a relationship between the national culture, corporate culture, and the TQM training. There were significant relationships between national and organizational culture, which displayed that they may vary in conjunction with one another. However, the relationships are complex and often contradictory. Perhaps the limited scope of the samples used in this study lead to biased results. But, Sousa-Poza (1999) provided evidence that the cultural views of a nation can have an affect on the organizational practices within these nations. It spurred further research in the organizational culture field.

The conceptualization of the relationship between these two cultural elements utilized in the present report proposes that the two elements are not mutually exclusive

entities. In essence, the cultures co-exist with one another (See Figure 1); the influence they exert is not separate from one another. This would result with organizational culture being subservient to the national culture. This relationship is further supported by Mjos (2002). He assessed the relationship between national and organizational cultures in a Norwegian airline company for a ten-year longitudinal study. The study investigated the cultural changes and the corresponding changes in team performance within the airline. The study assessed 137 pilots in 1986 and 50 of the same pilots in 1996. In order to assess the culture of the organization Mjos (2002) utilized Hofstede's (1980) four dimensions: power distance; individualism-collectivism; masculinity; uncertainty avoidance. Performance was assessed through the use of flight simulator task designed by the airline. The social climate of the organization was assessed using a four-factor measure, which included: encouragement, conflict tolerance, kindness, and reward. He proposed that if culture, social climate, and communication all can affect performance, it would be of interest to understand the nature and causality of said relationship.

From 1986 to 1996, results indicated that there was a significant change in the following dimensions: power distance, individualism, and uncertainty avoidance. All of the significant changes were reductions in the levels from 1986 to 1996. There were also significant increases in the climate areas of conflict tolerance and reward. With regard to the performance measure, there was a significant reduction in failures from 1986 to 1996. Mjos (2002) went one step further and compared the organizational dimensions of culture to the Norwegian national averages obtained by Hofstede (1980; 1991). The airline culture was significantly different from the national levels with respect to all four

dimensions. The airline culture was less dominant and individualistic, and more masculine and uncertainty avoidant than the national averages.

This further emphasized the need to assess organizational culture separately from national culture. This is evidence for the presence of an active *subculture* at work in the organization. Furthermore, this study illustrated the relationship between organizational culture and social climate on the outcome variable of performance. However, due to the ten-year duration of the study, it is difficult to determine the direction of causality in regard to the various aspects assessed. It is possible that the changes in the organization were spurred by national cultural changes. This provides a rationale for the investigation of the influences of national and organizational culture in the present study.

Bass (1997) reports there is cross-cultural universality with regard to the general leadership styles. This implies that the influence of the cultures overrides the differential impact of organizations. The concepts of transformational and transactional leadership transfer across cultures, however the specific behaviours involved in distinguishing the styles may be different. It would appear as though the constructs are universal, yet their expression is dictated by the national culture. Cross-cultural researchers find differences when the assessment specific and evaluates at the individual, level the values and behaviours displayed by leaders. Different cultures value different behaviours for their leaders, and as such, the effective leadership behaviours are distinct.

The leadership styles that are employed cross-culturally have a direct impact on safety measures. As the styles and types of leadership behaviours vary across national border, it is likely that the initiatives that these leaders will implement will also differ. For

example, the relative importance that is devoted towards production and protection will also vary. Thus, when examining the UK and Norway, there will be differences in these avenues that are dictated by their alternate national cultures. Perhaps, some of these expected differences are the result of the differing leadership styles implemented by the managers in the UK and Norway.

Brodbeck et al. (2000) conducted a large-scale cross-cultural study on leadership. They assessed cultural variation of leadership prototypes across 22 European countries and three different industry sectors (e.g. food, finance, and telecommunications), as such it was an exercise in both national and organizational culture analysis. They were testing Shaw's (1990) assumption that pre-existing concepts of leadership differ as a function of culture, albeit whether it was national or corporate remained unclear to Brodbeck et al. (2000). The method of evaluation was to use cluster analysis to compare European country clusters on the basis of similarities and differences in leadership styles, to those European country clusters for general cultural variables. The present study also implemented cluster analysis to answer a number of the research questions. The country clusters for the comparison of the general variables were obtained from Ronen and Shenkar (1985).

Brodbeck et al. (2000) hypothesized that culture and leadership would co-vary, although the exact relationship remained unclear. The major cultural regions included were: Anglo; Nordic; Germanic; Latin, and Near East European. Brodbeck et al.'s (2000) assessment of the 22 European Union members/applicants evaluated 6052 middle managers from three industrial sectors. Cluster analysis displayed two major clusters:

Anglo, Nordic, Germanic, and Czech countries clustered, versus the Latin and Near East European country cluster, while France formed a distinct third cluster. These clusters replicated the work of The Ronen and Shenkar (1985). Yet, Brodbeck et al. (2000) caution there might be considerable variation between and within countries within the same cluster that were not displayed in their results. An explanation for this is that there was not enough detail in the collected data to pinpoint differences. However, they concluded that leadership prototypes correspond significantly with the national cultural values held by the general population. Perhaps if they had implemented a more specified level of analysis, an even greater level of difference would have been found both within and between the clusters.

A limitation of the study was the Nordic sample did not include sampling from Norway, which could limit the generalizability of the results. Furthermore, the clustering of the Anglo and Nordic countries together on the basis of broad constructs could bias the results to display trends that are not truly evident in both cultures. The sample was also only representative of three industries, of which the present sample of offshore petroleum was not included. These limitations provide an empirical rationale to assess the influence of the national and organizational cultures separately. Furthermore, there is cause to explicitly evaluate the characteristics of two entities (i.e. Norway and offshore petroleum) simultaneously, which were not assessed by Brodbeck et al. (2000). I believe that organizational culture of the oil and gas industry could be significantly different from the three industries assessed by Brodbeck et al. (2000), as the offshore petroleum industry is extremely distinct with regards to working environment and characteristics. Moreover,

the organizational culture of the offshore petroleum industry is significantly different from national culture, yet it will be subservient to the national views to matters of high importance (i.e. health and safety).

Another point that displays the divergence between the UK and Norway involves the prevalence of a collectivist entity: trade unions. Labour unions are an organization of workers formed for the purpose of advancing its members' interests in respect to wages, benefits, and working conditions (Merriam-Webster Dictionary, 2004). There are significant differences in the membership enrollment in labour unions in the UK and Norway, particularly in the offshore population. For example, in 1994, Norwegian Oil Workers Union (Oljearbeideres Forening – OFS) had a total membership of 6000 workers. In the same year, the UK equivalent to this offshore union, the UK Offshore Union (OILC), had only 1800 members. This further displays the Norwegian national commitment to collectivism and the protection of the rights of all its citizens.

If we were to take a specific organizational example, from the Norwegian sector, although not safety oriented, we could briefly review the performance of Norwegian Airlines in adherence to the collectivist tendencies. This organization was spawned from three private, separate but interrelated Scandinavian companies: Transwede Airways, Sterling Airways, and Norway Airlines. These three competing organizations have merged to form TransNordic Group (Shifrin, 1992). The resulting merger not only facilitated greater operational effectiveness and revenue, the savings were also relayed to the consumer through reduced rates and cost-saving initiatives. This revealed that this organization has placed greater emphasis on the status of their employees rather than

sacrifice their well being for attaining a greater margin of profit (Shifrin, 1992). This exemplifies the Norwegian cultural commitment to the well being of all their working class, as well as the general public. Organizations are committed to their employees and society, and in turn the employees are committed to their organizations.

A further study of organizational culture, examined the perceptions of leadership styles across different national cultures. Popper and Druryan (2001) were interested in the influence that cultural background could have on leadership perceptions. The demographic composition of organizations affects the behavioural perceptions within these organizations. The subjects for the study were native Israelis and recent Russian immigrants to Israel. The subjects used the multifactor leadership questionnaire (MLQ) to rate the leadership style of the managers. There were cultural differences in the ratings of the managers, with the Russians rating their managers significantly higher than the Israelis on all facets except laissez-faire. We have an example in which the organizational culture is different from the national culture, strengthening the position that both cultures warrant independent assessment. This is important for the present study because these differential leadership styles and behaviours could adversely affect the safety initiatives implemented within an offshore platform. Thus, it is important to determine if there are significant cultural differences in the safety and risk perceptions of offshore installations, and secondly it is important to understand why these differences occur such that they can be predicted and rectified if the situation warrants.

Continuing within the area of organizational culture differences and their related outcomes, Ogbonna and Harris (2002) assessed organizational culture in the food-

retailing sector of the UK. They were interested in the relationship between organizational culture and performance. Ogbonna and Harris (2002) were concerned that much of the research in the field had focused on national culture and its putative influences on organizational performance. They assessed two separate change initiatives implemented in the UK food-retailing sector over a ten-year period. Their most profound conclusion was that researchers in the field should focus more closely at the *subcultures* within business sectors and specific organizations. They argued for the assessment of sector or industry cultures on the performance and management of any sector of interest (Ogbonna & Harris, 2002). This was an effort to account for the specific differences that arise within a given industry. This suggestion was implemented in the current study as 18 offshore installations were assessed to determine if there were significant culture differences both within and between geographic sectors. I believed that it is of paramount importance to evaluate the relative influence of both organizational and national culture separate as they both undoubtedly influence the perceptions and behaviours of employees simultaneously. It remains unclear what the strength of the influence of these two cultures is, or if it remains constant across industry. Thus, it must be assessed in all countries and industries.

It has been found that there also exist cross-cultural differences within organizational behaviours. For example, Misra, Ghosh, and Kanungo (1990) assessed the construct of work motivation in both India and Canada. Misra et al. (1990) labeled India as a “collectivist” culture, while Canada served as the representative for “individualistic” culture. They found that there was a greater linkage between work motivation and

familial concerns in India than there was in Canada. This study illustrates the collectivist cultures motivation for the greatest good, rather than the need for individual achievement. These results that illustrate the alternate work motivations of collectivist and individualistic cultures could also be applied to the present sample. As there are collectivist (i.e. Norway) and individualistic (i.e. UK) countries, these cross-cultural differences in work motivations could also be transposed to other work place variables. For example, perhaps the cultural differences that lead to differences in motivation could also lead to differences in the satisfaction and work attitudes of employees. I believe that there will also be significant cultural differences with regards to the attitudes and satisfaction in the collectivist and individualistic installations.

An alternate body of cross-cultural research was investigating resource allocation. Bond, Leung, and Wan (1982) assessed the potential contrast in resource allocation between individualistic cultures and collectivist cultures. They postulated that collectivist cultures would allocate resources by means of egalitarian divisions, or need based divisions. Conversely, individualistic cultures favoured a performance based resource allocation. Leung (1995) later revised the theory to incorporate the type of relationship that existed between the allocator of the resources and the receiver. Leung (1995) contends that collectivist cultures should favour an egalitarian allocation method when the receiver of the resource is an in-group member, as well as a coworker. Thus, collectivist cultures favour egalitarian distribution of resources for individuals that are in-group members and have a close relationship to the allocator. This concept of resource allocation could also be applied to the resource allocation to organizational initiatives.

The funding of safety initiatives in offshore oil could also display differences across the cultures. Perhaps the installations that are operated by individualistic cultures will not devote as much time and financial resources to the safety procedures because their quantifiable performance outputs are the absence of accidents, rather than an increase in performance. This could lead to the reallocation of funds to other organizational areas that have more concrete measures of increases in performance and success. Conversely, the installations operated by collectivist cultures, could devote a higher proportion of resources to the safety initiatives because they ensure the well being of employees. Moreover, these individuals are less focused on individual achievement and financial success, which could also provide another reason why they devote more time and resources to their safety programs. These potential differences result in fundamentally different importance placed on the safety on installations between these two cultures.

As it has been discussed, there have been numerous studies that have exemplified the significant influence of both nationality and organizational membership. Moreover, the implications of these studies are vast as issues such as leadership, legislation and safety all are dictated by these two cultural facets. Branzei (2002) investigated the influence of cultural expectations on individual preferences in an organization. The results showed that cultural values affect the organizational goals that are pursued by the individual and which tactics are implemented. The present study sought to clarify the relative influence of nationality and organizational membership on the prevailing safety attitudes of offshore oil personnel.

Overview of the Present Study

Culture has been shown to be an important indicator of group attitudes and behaviour. Hofstede (1980) reported that culture distinguishes between the members of one category from another, such as members of a nation, region, ethnic group, men or women, young or old, social class, and profession or occupation (Hofstede, 1994). Merritt and Helmreich (1996) and Helmreich and Merritt (1998) demonstrated that there are significant cultural differences between nations for the dimensions proposed by Hofstede (1980; 1991). However, national culture is not the only entity we interact with that possesses a distinct culture. Employees must also function within organizations, which often instill cultural elements that diverge from the national culture within which they reside. Organizational culture can be defined as invisible, preconscious beliefs shared by members of an organization, which are largely shaped by shared practices (Schein, 1990). Organizational culture is shared key characteristics and common perceptions held by members of an organization that make their practices unique. Potentially one could have competing cultural forces that seek to dictate the manner in which one conducts themselves.

There is no question that these two cultural facets jostle for control to dictate how one will behave. For example, Sousa-Poza (1999) examined the relationship between national and corporate culture in relation to total quality management (TQM) training. There were found to be significant relationships between national and organizational culture, which displayed that they may vary collectively. Within the empirical research, there have been few attempts to examine the influence of the national and organizational

culture simultaneously. Hence, the relationship between the two cultures remains unclear. The present study sought to further examine the relationship between national and organizational culture with a simultaneous analysis of these constructs through two statistical procedures: cluster analysis and hierarchical linear modeling (HLM). Essentially, the present study sought to examine the national and organizational differences as outcomes and proposed that nationality had the stronger influence on the employee safety attitudes. This would result in a relationship in which organizational membership was overshadowed by nationality, and thus would be nested within it (See Figure 1). It is important to note that although there have been several publications pertaining to the present sample; the current study was the first time that the theoretical models were evaluated on the entire data set. Moreover, it attempted to explain group level differences through the inclusion of higher order variables, which had not been attempted previously.

A working sample of offshore oil personnel from the UK (e.g. 622) and Norway (e.g. 1138) served as the participants in this study. This sample was the same sample that was assessed by Mearns et al., (1997) and was obtained with their cooperation through the Robert Gordon University. A number of organizational constructs were measured at the individual level. These variables were utilized to execute the cluster analysis portion of the study. These variables also served as the level 1 variables for the hierarchical linear modeling (HLM) portion of the analysis. They included:

- **Job Situation:** (or job characteristics): individual's perceived work demands, decision latitude and communication.
- **Others Commitment to Safety:** the degree that an individual perceives another

employee as committed to maintaining and participating in organizational safety measures.

- **Social Support:** the individual's perceived amount of instrumental and emotional support afforded to employees following a traumatic workplace event.
- **Attitudes to Safety Systems:** individual's perceptions of the safety measures, risks and accidents on the installations.
- **Risk Perception:** A subjective assessment of the individual's exposure to risk.
- **Satisfaction with Safety Systems:** the level of satisfaction an employee has with the safety systems within the organization.

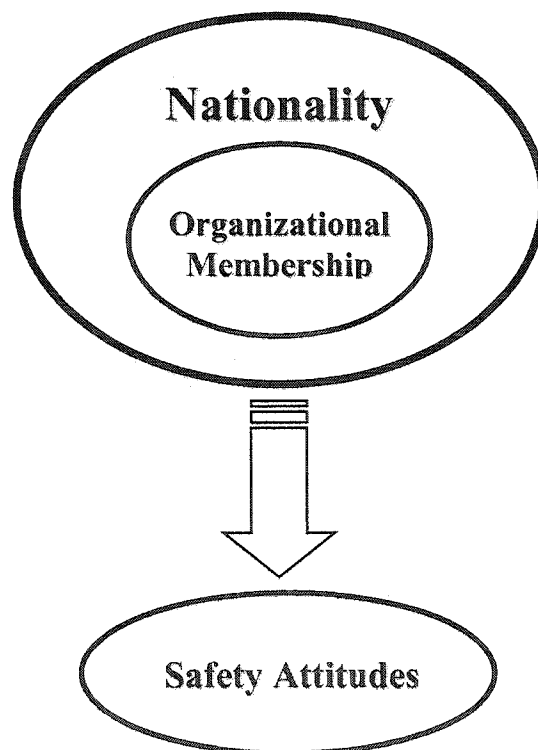


Figure 1. Nested relationship of nationality and organizational membership in influencing employee safety attitudes.

- *Hypothesis 1:* There will be significant similarities (for the variables assessed), between the installations operating in the same sectors of the North Sea.

This will result in the installations clustering into groups (i.e. UK vs. Norway), which are contingent on the national culture of these nations. This issue is addressed through the

implementation of cluster analysis. This involved a two-step process in which the first analysis was conducted with installation as the clustering variable, while the second analysis utilized the occupational group as the clustering variable. For the installation cluster analysis, if there were two separate clusters, one that contained the UK installations while the other contained the Norwegian installations, this would display that there were more similarities between installations of the same nation. In essence, it provides support for the notion that nationality is influencing the personnel's attitudes. If we consider the occupational groups analysis, if occupations with similar characteristics (i.e. personnel that work on the deck of the installation), this could be viewed as support for the notion that the organizational characteristics, specifically the occupational elements, were dictating the employee's attitudes. This process was repeated for each of the occupational variables described above.

Marek, Tangenes, and Hellesoy (1985) assessed the risk perception of offshore oil personnel operating in the Norwegian platform Statfjord A of the North Sea. Four occupational groups with very different job requirements were evaluated: operators, drillers, flotel crew, and caterers. The results displayed that the occupational groups lived and worked in separate 'worlds of risk'. They proposed that this was most likely the result of differing work environments and conditions. This leads these distinct groups to consider safety and perceive risk from within their own occupational frameworks.

If we make a logical extrapolation from this finding, we could assume that the differing surroundings and requirements these jobs entail would also lead to significant differences for other important perceptions as well. For example, this finding could also

apply to job situation, safety attitudes, satisfaction with safety, social support and others commitment to safety. We need to establish that there are workplace attitudes in this industry that potentially differ from one occupational subculture to another. Moreover, the ‘worlds of risk’ concept could also be extrapolated to include the influence of installation. In the present study there are occupational groups, each with their own perceptions and group climate (Zohar & Luria, 2004). Mearns et al. (2004) reported that following their η^2 analysis to determine the relative influence of installation and sector, the results displayed that installation explained more variance for all but one variable. Perhaps, the installations are also operating within their own distinct ‘worlds of risk’, which has caused the influence of installation to override that of sector. In order to accurately answer this question, we need to assess the influence of occupation, installation and sector simultaneously. This goal was achieved through the use of HLM, which reviewed the influence of these facets in conjunction with several occupational variables.

There were also several variables that measured nationality and organizational membership, which were included for the purpose of conducting the HLM analyses. These variables were measured at the individual level; their inclusion in the study was to serve as proxy measures of organizational and national level variables. These variables were utilized as the higher order or level 2 variables within the HLM analysis. These higher-level variables included:

- **Sector:** UK vs. Norway: A proxy measure of national culture
- **Operating Company:** One of 15 companies: A proxy measure of organizational culture

- **Location:** On deck vs. below deck (i.e. in the installations accommodations) work locations

There were two primary regression models that served as the basis of the HLM analyses. These models were based on the work of Mearns et al., (1997) but have been modified to answer the questions relevant to the present study (Refer to Figure 2 and 3). These models assess two essential areas required for effective safety measures within an offshore installation.

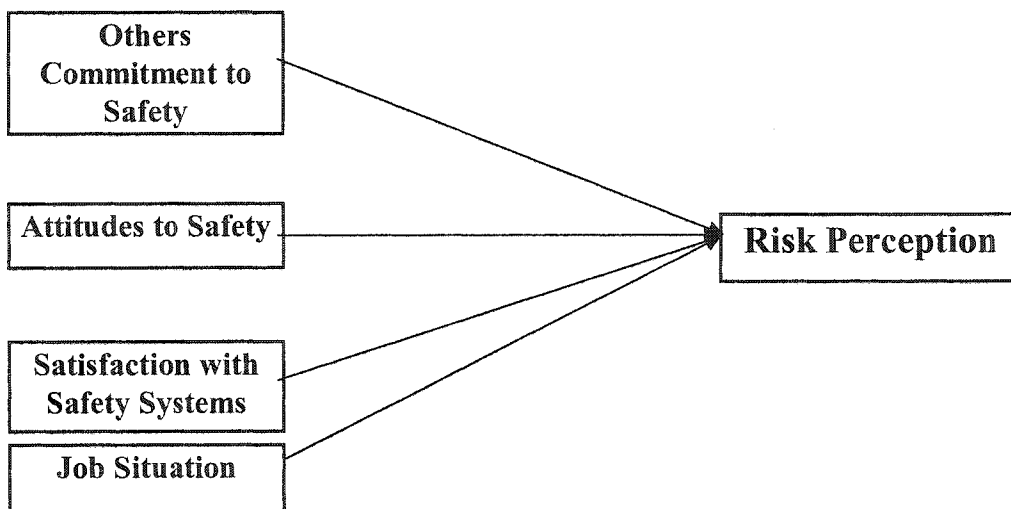


Figure 2. Model I: Organizational and social factors affect on perceived risk.

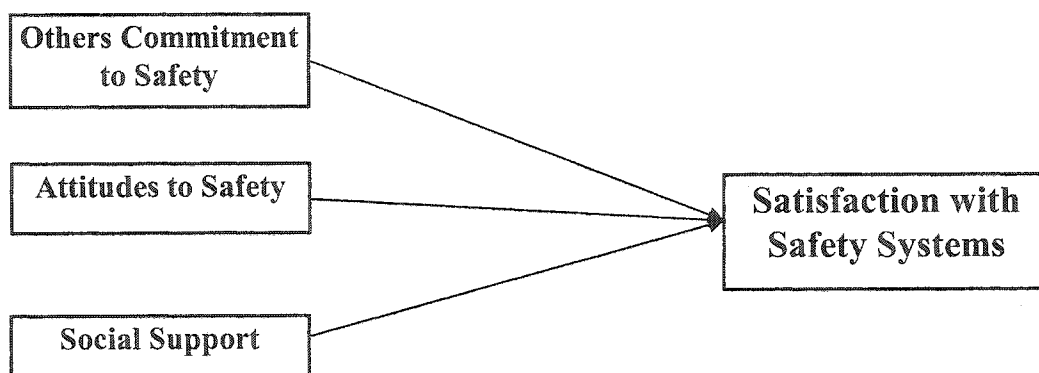


Figure 3. Model II: Organizational and social factors affect on satisfaction with safety system.

It is important to note that each of the variables presented below were subjected to hundreds of permutations within the HLM analyses. In order to clarify this point, consider the number of groups assessed in this analysis. There are 147 groups (Refer to the Methods sections for the construction of these aforementioned groups), and each of the two models was assessed for each of these 147 groups. To display the characteristics of the groups, let us consider Group 1. There are several characteristics that make it distinct from the remaining 143 groups. Specifically, this particular group is part of the Administration/Management occupational group and is employed on Installation 1. Furthermore, this installation is operated by one of 15 separate organizations within the sample in the UK sector (Refer to Figure 4). It is apparent that this group of employees has several external groups acting on them, with each influence possessing and acting to secure their own set of perceptions and interests. As the HLM analyses are conducted, one must take into account the gamut of each of the influences acting on the personnel of the various groups.

This results in two stages of hypotheses for the HLM analyses. The first group pertains to the level 1 analyses. I hypothesize that there are significant differences between each of the groups for Model I and II. The predictor variables of the models will ultimately lead to a differential experience of risk perception and satisfaction with safety systems in the two sectors. Thus, significant differences are expected in the levels of risk perception and satisfaction with safety systems in the offshore sample, which is the result of the differing 'worlds of risk' of the various occupations.

Model I

- *Hypothesis 2:* There are significant differences between the 147 groups for the influence of the predictor variables on risk perception.

Model II

- *Hypothesis 3:* There are significant differences between the 147 groups for the influence of the predictor variables on the satisfaction with safety systems.

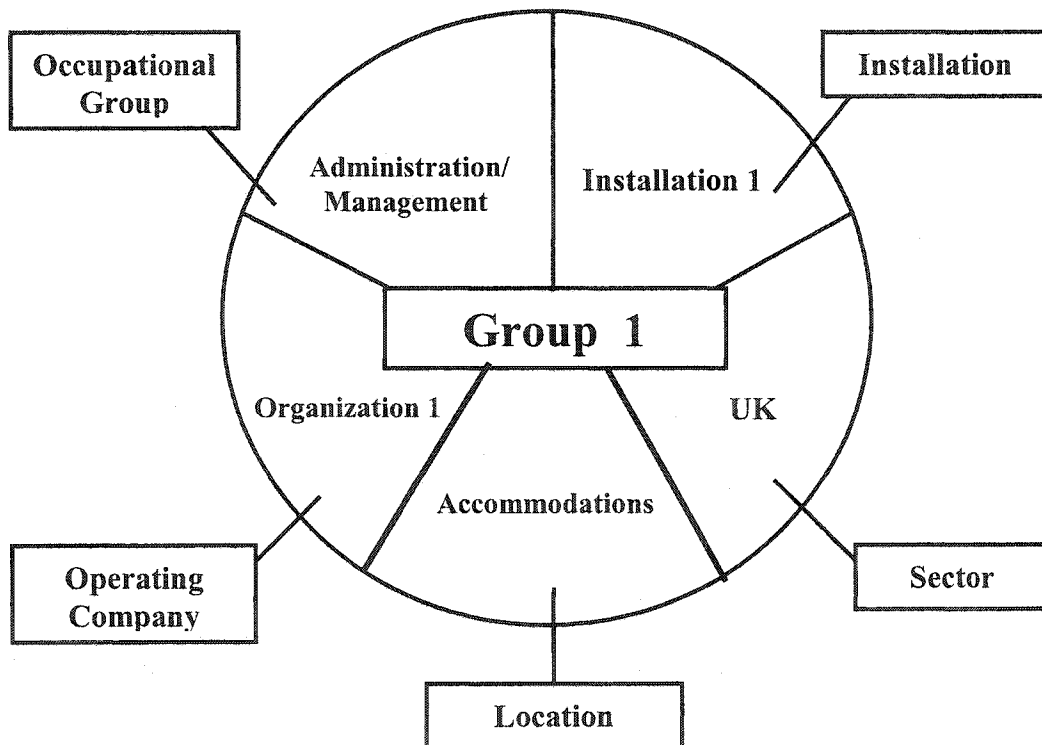


Figure 4. Group 1 characteristics

HLM: Models I and I II

There are significant differences expected between the groups for the several level 1 occupational variables. Therefore, the following step in the HLM procedure is to attempt to explain the significant differences between the groups with the level 2 variables. As stated above there are several ordinal type, level 2 variables (i.e. sector, operating company, location, duration of employment). It is my belief that these variables explain the variance between the groups. Through these analyses, I examined the relative

importance of the predictive variable and their relationships with the outcome variable, moreover, I assessed the changes in these relationships through the addition of the higher order variables.

Geographic Sector. The geographic sector variable serves as a proxy measure of nationality. As there was no concrete measure of national culture values included in the original data collection, I have used the sector variable to denote the national culture of the personnel. The national culture facet of particular importance for this variable is individualism-collectivism (Hofstede, 1980). Within the National Culture: Individualism-Collectivism section of the thesis, I have argued that Norway favours more collectivist values, while the UK leans towards individualistic values. I hypothesized that the sector variable would have an influence on all of the occupational variables included in the models and impact their relationships with the outcome variables.

The others commitment to safety variable in Model I and Model II is influenced by sector (i.e. proxy measure of national culture). Those individuals with a propensity to favour the collective are committed to initiatives that protect this group (Hofstede, 1980), there is a vested interest in protecting the well being of the entire group. Any initiative that ensures this goal (i.e. safety) would be highly valued to these individuals. In turn, they would be strongly committed to safety on the offshore installations in order to ensure their “collective safety”. Furthermore, the majority of personnel within the installation would share these collectivist attitudes valuing everyone’s safety, resulting in a perceived high commitment to safety. If there is a perceived high commitment to safety, personnel feel as though the safety systems are effective and they are protected against hazards to

the installation. In essence, the perceived high commitment to safety will result in a significant positive relationship with risk perception: the higher the perceived safety commitment, the lower the perceived hazard exposure. These relationships are contingent on the attitudes that differentiate between the sectors; therefore, these relationships will differ between the sectors. As I believe the collectivist nations are more strongly committed to safety, they will also have a greater influence of safety attitudes on the outcome variable. Essentially, more collectivist cultures value the commitment, safety attitudes, job situation and satisfaction with safety systems to a greater extent than individualistic cultures. Therefore, with regard to sector, the collectivist culture will have a greater impact on the outcomes variables.

If we consider the individualistic tendencies of the UK, this would result in a different relationship between others commitment to safety and the outcome variables. As a result of the UK's individualistic tendencies, we would expect the offshore personnel to be committed to individual competition (i.e. performance/production) (Hofstede, 1994) and primarily concerned with their personal goals rather than those of the entire platform (i.e. safety). All personnel could believe that the offshore population was dedicated to individual competition and the attainment of personal quantifiable results. This could result in assigning lower importance to commitment to safety, and more importance devoted to quantifiable performance criteria. One could elaborate on this stating that individualistic cultures in their quest for individual achievement would be focused on individual performance outcomes and quantifiable results (i.e. production levels), rather than the reduction of accidents, which could be viewed as the absence of quantifiable

results. This might result in personnel sacrificing safety to achieve this performance. Thus, because there are differences between the national cultures of the offshore personnel, it is hypothesized that this variable will have a significant impact of the relationships between others commitment to safety and attitudes towards safety, which differs across the sectors. The Norwegians collectivist tendencies will have stronger positive relationships between the predictor and outcome variables.

Collectivist nations utilize a group approach when solving problems and this has relevance when discussing social support. If we consider the social support variable in Model II, because the Norwegians lean more towards collectivist tendencies, we would expect them to offer more social support than the individualistic UK personnel (Goodwin & Hernandez, 2000). For a collectivist nation, providing social support is a vehicle that facilitates the well being of the masses (Hofstede, 1980). The collective mentality will result in a higher level of communication between the personnel, as they are concerned with the thoughts and concerns with the group. As a result of this high communication, there are higher levels of social support in the face of tragedy. The more social support that one receives following trauma, the more beneficial the affects (Goodwin & Hernandez, 2000) and this could be translated into the attitudes towards the surrounding. This relationship will differ between the sectors as a result of the underlying national culture, with Norwegians having a stronger positive relationship between social support and satisfaction with safety systems, than the UK personnel. As collectivist cultures utilize social support frequently, it is assigned a higher level of importance. Therefore, the

lack of it will have a greater influence on the relationships between the variables, than in an individualistic culture.

The national culture also influences the job situation to which a nation's personnel are subjected (Brown, 1999). The Norwegians favour collectivist views and implement legislation that protects the masses both in everyday life and in the workplace. Their legislation produces a work environment that ensures the protection of collective rights, resulting in initiatives that facilitate positive work environments conducive to work. The legislation encompasses job characteristics such as hours of work, safety regulations, etc. Consider a study of several European nations, which included Austria, Czech Republic, Germany, Italy, Norway, Slovakia and Sweden (Nextra, 2001). The participants were middle to senior managers within the technology, finance and public sectors. The results showed that in Norway the average workweek is comprised of 30 hours per week. Moreover, when asked how many individuals worked from home, 39 % of the UK respondents never had the option to do so, while in Norway 40 % of respondents worked from home at least once per week (Nextra, 2001). This showed the Norwegian commitment to ensuring the physical and mental well being of their citizens on the job. The Norwegians place more emphasis on job situation than in the UK. Therefore, job situation will have a greater impact on the outcome variable for these individuals. Another important point is that the collectivist Norwegians are more committed to safety as it ensures the protection of the group. This would be reflected in the job situation on the installations, with emphasis placed on safety procedures and the overall level of safety

experienced by the offshore personnel. This would result in a positive relationship between the job situation and risk perception in Model I for the collectivist Norwegians.

- *Hypothesis 4.* Differences in the relationships between the predictor and outcome variables within the models will be attributed to geographic sector.

Operating Company. The operating company of the installations also plays a vital role in determining the workplace perceptions and attitudes of offshore personnel. As with the previous variable, there were no measures administered to the participants to ascertain the exact characteristics of the organization and its managerial approach. Thus, the operating company variable serves as a proxy measure of organizational culture.

Organizational characteristics differ significantly between and within nations (Hofstede, 1994). Hofstede (1994) assessed a private sector company and two police forces within the same nation to determine whether their organizational culture differed. Different organizations in the same country could maintain significantly different workplace practices, despite having similar employee values (instilled by national culture). From this result, it could be said that organizational values display variance both between *and* within countries, and there is merit in assessing the influence of the organization culture. This is important because organizational conditions act as the framework that dictates the implementation and importance of safety measures (Marek, Iversen & Hellesoy, 1987). Thus, we must consider the influence of both organizational and national culture in the expression and adherence to occupational safety. Although, national culture may dictate the values possessed by employees, it is the organizational culture that ultimately dictates the specific safety procedures.

Organizations also have varying strengths in their culture (Robbins & Langton, 1999). Those organizations that have a *strong* culture result in organizational values and goals that are widely held by all personnel. Therefore, an organization with a strong culture will have great influence on its employees' workplace attitudes. Conversely, those organizations that have *weak* culture will not have a high degree of influence on the attitudes and behaviors of their personnel (Robbins & Langton, 1999). This is of particular importance when we consider subcultures within the organizational culture. This includes such subcultures as safety culture. Safety culture is the value assigned to employees and public safety, by all personnel in an organization (Wiegmann, Zhang, von Thaden, Sharma & Mitchell, 2002). Stronger organizational culture results in higher correlations.

An organization with a strong culture can also influence the job situation (Hofstede, 1994). For instance, if an organization places great importance on the protection of its employees, they are likely to reform the job situation such that it ensures the well being of their employees. This could involve such initiatives as flextime, reduced hours per week, staff lounges, or work from home (Robbins and Langton, 1999). All of these approaches are more common in Norway, than in the UK (Nextra, 2001). These are initiatives seek to increase employee well being rather than directly influencing an increase in production. There are differing goals of the operating companies, especially for in terms of their commitment to the well being of their employees through positive job situations. This will result in a strong positive relationship between job situation and the outcome variables for those organizations a strong culture.

Organizational culture is critical to this study because it dictates the goals of the entire organization, which affects the individual employee's attitudes (Spector, 2002). Organizational characteristics such as the work environment, job conditions and safety training influence the satisfaction and production levels of employees (Belcourt, Wright & Saks, 2000). The goals of the operating company must be evaluated when determining the relationship between employee attitudes, risk perception and satisfaction. Thus, organizational culture can impact the safety attitudes of personnel on an installation. Those organizations with a strong safety culture will have strong positive relationships between the predictor and outcome variables of Models I and II. Those organizations with weak safety culture will have weak relationships between the predictor and outcome variables.

- *Hypothesis 5.* Differences in the relationships between the predictor and outcome variables of the models will be attributed to operating company.

Location. The location variable denotes the working environment of personnel on the installation. For simplicity sake, all of the personnel have been categorized as working either on the deck or below deck, in the accommodations. This variable was included because the work environment on the installation dictates the personnel's exposure to hazards. For example, Fleming (2000) assessed the workplace perceptions' of managers that operated on the deck of the installation. The results of the study displayed a clear difference between the hazard exposures of different work locations on the installation. Fleming (2000) has reported that those personnel that work on the deck of the installations are exposed to more hazards (i.e. the elements, falling overboard, being

crushed by equipment, etc.). This would play a significant role in determining the workplace safety attitudes of employees, as those individuals that work in different locations are likely to perceive different levels of safety. Essentially, those employees that work on the deck on the installation will have higher hazard exposure. The different work locations will result in significant variance in the safety attitudes and ultimately the risk perception of the work groups. Those individuals that work on the deck of the installations will likely have significantly different relationships between the predictor and outcome variables. Those that work within the accommodation of the installation would believe their jobs are safer than those employees that operate on the deck. This would in turn increase their satisfaction with the safety systems, resulting in a significant different relationship for the two work locations of the installation. Because the front-line staffs' perceptions are a measure of 'real risk' (Fleming et al. 1998), these results could be used to gauge the 'true' level of safety in these work locations. Thus, those that work within the accommodations of the installation will have strong positive relationships between the predictor and outcome variables of Models I and II. Conversely, those that work on the deck of the installation will display weak relationships between the predictor and outcome variables.

Another interesting point pertains to the influence of work location on the level of social support. The occupations that operate on the deck and inside the accommodations are fundamentally different (Rundmo, 1990). They execute different task and often are differentiated by their level of manual labour. Those occupations that operate on the deck are often viewed as possessing a 'macho' subculture (Rundmo, 1994), which could lead

them to keep their traumatic experiences to themselves in an effort to maintain this image. This would decrease the level of social support given in the deck occupations, resulting in a significant difference in the levels of the two work locations. Those individuals that work in the accommodations will have higher social support and display a positive relationship with satisfaction with safety systems.

If we consider the job situation of the work locations, they also are likely to reflect significant differences. As stated above, those on the deck of the installation are exposed to more hazards and more physical labour, and are likely less satisfied with their work environment. While those personnel inside the platform are exposed to a significantly fewer hazards and do not have to physical work requirements. These characteristics are likely to result in fundamentally different job conditions and characteristics. Those in the accommodations will have a positive relationship between job situation and risk perception. Those that work on the deck of the installation will have a weak relationship.

- *Hypothesis 6.* Differences in the relationship between the predictor and outcome variables of the model will be attributed to location

The hypotheses are reiterated in their entirety below:

Hypothesis 1: There will be significant similarities (for the occupational variables assessed), between the installations operating in the same sectors of the North Sea in the study. This will result in the installations clustering into sectors (i.e. UK vs. Norway), which is contingent on the national culture of these nations.

Model I

Hypothesis 2: There are significant differences between the 147 groups in terms of the influence of the predictor variables on risk perception.

Model II

Hypothesis 3: There are significant differences between the 147 groups for the influence of the predictor variables on the satisfaction with safety systems.

Hypothesis 4: Differences in the relationships between the predictor and outcome variables within the models will be attributed to geographic sector.

Hypothesis 5: Differences in the relationships between the predictor and outcome variables of the models will be attributed to operating company.

Hypothesis 6: Differences in the relationship between the predictor and outcome variables of the model will be attributed to location.

Within the following section, the methods implemented to complete the study are discussed. As the main methods utilized are statistical in nature, there is a brief section to describe the process used in order to execute both the cluster analysis and hierarchical linear modeling. These analyses were used in order to answer the research questions presented above. Cluster analysis was used to illustrate that there is greater similarity between installations within the same sector than there is between installations with different sectors. Furthermore, HLM was used in order to pinpoint the specific individual and installations level variables that will explain for the differences in the formulated groups.

Methods

Participants

The Robert Gordon University collected the data set reanalyzed for this study. All 1760 of the participants in the present study were employees of an offshore oil installation for at least six months. Of this sample, 1138 were Norwegians and the remaining 622 were from the UK. The sample is described in greater detail elsewhere (Flin et al, 1996a; Mearns et al, 1997). Within the offshore oil sample, there was a further classification of occupational group.

The frequencies for each of the ten occupational groups were as follows:

1. 167 Administration/Management
2. 166 Catering Personnel

- | | |
|------------------------------|-----------------------------|
| 3. 37 Deck Crew | 7. 82 Medics |
| 4. 228 Drilling Personnel | 8. 264 Production Personnel |
| 5. 38 Logistic Personnel | 9. 165 Technician/Mechanics |
| 6. 303 Maintenance Personnel | 10. 169 Service Personnel |

These personnel were employed on one of 18 offshore installations. The first six installations (i.e. Installation 1 through Installation 6) were operated in the UK portion of the North Sea, while the remaining installations (i.e. Installation 7 through Installation 18) were operated in the Norwegian sector.

Questionnaire

All of the participants of the study completed the Offshore Risk Perception Questionnaire (1996). The development of this questionnaire was accomplished by means of a multinational effort. The scale was developed through three main approaches: literature review, review of accident statistics, and semi-structured interviews. These efforts resulted in the formulation of a final version of the questionnaire, which contains thirteen subsections an open-ended section for general comments, which resulted in the questionnaire totaling 16 pages in length. The subsections accompanied with a brief description of their content include:

Demographic information (Section I). General information including sex, age, marital status, number of children, rotation (e.g., 2 weeks on-2 off), installation name, number of years employed offshore, occupational position, number of installations employed on.

Current Job Situation (Section II). 18 items with a five-point Likert scale (Not at all = 5; Yes, to a high extent = 1). Inquires about the current perceived work demands, decision-making authority, and amount of communication.

Physical Working Environment (Section III). 11 items with a five-point Likert scale (Low point: Not at all; High point: Yes, to a high extent). Inquires the degree to which participants are exposed to five physical stressors (e.g. with three of the stressors expanded into two items).

Experience of Risk (Risk Perception) : Hazards (Section IV). 18 items with a five point Likert scale (Very Safe = 1; Very Unsafe = 5). These items inquired about the participants overall feeling of safety while on the installation from being injured from hazards specific to the offshore environment. These hazards include such things as explosion, toxic gas leak, falling overboard, helicopter crashing into platform, etc. In addition to these 18 items, respondents were also asked how safe they felt while in several other potentially hazardous environments to establish a comparative baseline. For example, deep-sea fishing, nuclear plant, and coal mining.

Probability of Injury (Section V). Eight items with a five-point Likert scale (Very high probability = 1; Not at all probable = 5). This group of items requested that participants rated the probability of injury in the occurrence of a major hazard. These hazards were the same as listed in section IV. The purpose of this scale was to determine if the probability of injury was in accordance with the probability of the hazard occurring.

Experience of Risk (Risk Perception): Work Tasks (Section VI). 26 items with a five-point Likert scale (e.g. Very safe = 1; Very unsafe = 5), as well as a Not Applicable

option as all hazards are not applicable to all occupations. This section was included as a measure of the perceived risks that each of the participants are exposed to and how safe they feel while completing their work tasks. An item that assessed the participants overall feeling of safety was also included.

Job Satisfaction (Section VII). 16 items with a seven-point Likert scale (Extremely satisfied = 1; Extremely unsatisfied = 7). This was a standard British measure of job satisfaction that has been used several times within the offshore population.

Assessment of Safety (Satisfaction with Safety Systems) (Section VIII). 19 items five-point Likert scale (Very satisfied = 1; Very unsatisfied = 5). These items assessed how satisfied the participants were with the safety systems and procedures that their installation had in place. For example, control and inspection routines, escape routes on platform, evacuation devices, deluge system, and safety officer, etc. An additional eight items with a four point Likert scale (Very interested = 1, Not interested = 4, also a Not Applicable option) were added to the scale in order to assess the degree to which employees believed that other individuals on the installation were concerned with their safety.

Safety and Accident Prevention (Section IX). 16 items with a five-point Likert scale (Fully agree = 1; Fully disagree = 5). These items measured employee attitudes towards safety, risk and accidents. These items were scenarios that the participants had to rate their probability of occurrence on their installation. These included such items as: sometimes it is necessary to ignore safety regulations to keep production going; and there is sometimes pressure to put production before personal safety.

Occupational Health (Section X). Three items inquired about the overall health of the participant. They included:

Have you seen a doctor in the last 6 months?

Have you been on sick leave in the last 6 months?

How many days have you been absent from work
due to illness during the last six months?

These items were included to determine if the health of the participant was related to their attitudes and satisfaction levels.

Questions regarding Safety on this Platform (Section XI). Nine open-ended questions to assess respondents' views about the safety on the platform. These questions have not been previously asked to offshore personnel.

Accidents and Near Misses (Section XII). Six items to assess the participants involvement in accidents, their involvement in near misses and whether they had seen someone have an accident. This subscale also inquired as to the frequency of each of these issues.

Personal Support and Help from Others (Social Support) (Section XIII). Three sections.

Section 1: How much support do these supporters give - seven items

Section 2: Approachability of supporters for work issues– four items

Section 3: Approachability of supporters for personal issues – eight items

All of the items were six point Likert type (High point: Very much; Low point: None; also a Lack such People option).

Comments (Section XIV). This was the final section of the questionnaire and requested respondents to make any further comments or suggestions they saw as relevant.

For more information on the development of the questionnaire please refer to Flin et al., (1996a).

Categorical and Ordinal Level Variables. There were several variables created for the purpose of conducting the HLM analyses. These variables were utilized as the higher order or level 2 variables within the HLM analysis. Two of these variables were categorical in nature (i.e. sector and location). The final level 2 variable (i.e. operating company) was ordinal in nature. These higher-level variables included:

- Sector (e.g., UK vs. Norway: A proxy measure of national culture)
- Operating Company (e.g., One of 15 organizations: A proxy measure of organizational culture)
- Location (On deck vs. below deck work locations)

Statistical Analyses

The study is focused on the use of statistical analyses rather than the manipulation of variables. The procedure is exclusively focused on the application of statistical procedures to reanalyze the pre-existing data set. Thus, the following section will contain explanations of the procedures and applied examples of the statistical procedures.

The subscales were each assessed to determine their reliability levels and their correlations with the remaining subscales. The subscales were also subjected to a principle components exploratory factor analysis. The factor scores were saved as variables and used in the subsequent analyses.

As stated above, these variables were assessed with hierarchical cluster analysis, and HLM in order to determine the relative influence of group and organizational level variables simultaneously. Cluster analysis was chosen for use because the data set

included pre-existing meaningful groups (i.e. occupational group and installation). The cluster analyses were run twice for each occupational variable. The first pass of the analyses utilized installation as the clustering variable; the analysis was then repeated with occupational group as the clustering variable.

Cluster Analysis. Cluster analysis is similar to factor analysis to some degree. For example, we use factor analysis to group variables according to their shared variance, while we use cluster analysis instead of grouping variables, we are grouping, or clustering individuals. It could be said that cluster analysis is the opposite of factor analysis. Instead forming groups of variables based on the responses of several individuals, we are interested in forming groups of individuals based on their responses to several variables. Thus, cluster analysis is a collection of multivariate procedures used in order to detect/facilitate the formulation of homogeneous clusters in a data set (Field, 2000). The homogeneous cluster members are more similar to those individuals within their cluster than those in another cluster. However, it is important to note that the formulation of cluster is not a clear-cut process. Much like the factors in factor analysis, the formulation of clusters has been characterized more as an art rather than a science (Everitt, 1980). There is a great degree of interpretation that is up to the discretion of the researcher. It is up to the researcher which variables will be used in order to determine the boundaries in between the clusters. Thus, this is an extremely effective procedure for determining the similarities and differences in a sample.

There are two main procedures implemented for cluster analysis: hierarchical cluster analysis and k means cluster analysis. Both the hierarchical cluster analysis and k

means cluster analysis is conducted through the use of statistical software packages or programs. For psychological research, the more commonly used program in Statistics Package for the Social Sciences (SPSS). There have been several versions of this program produced to date, with the most recent version being SPSS version 11. The computer program executes all of the steps involved in cluster analysis and provides an interpretable print out. The analyses from the present study utilized hierarchical cluster analysis. For additional information pertaining to cluster analysis, please refer to Appendix A.

Procedure

The aim was to assess whether the installations from the UK and Norway will have more similarities with other installations from the same country, or with other installations operated by the same organization. In the first step of the cluster analysis (i.e. installation as clustering variable), if the groups displayed a cluster solution with a demarcation between the UK and Norway installations, this was taken as evidence that national culture exerted a stronger influence on this variable. If the first step of the cluster analysis revealed no that there was no clear division between the UK and Norwegian installations, the second step was conducted.

Within the second analysis (i.e. occupation as clustering variable), if the data clustered along occupational groups, this was taken as an indication that for that particular variable, the data displayed that organizational culture was dictating the manner in which employees perceived the variables. For example, if all of the maintenance, drilling and production personnel clustered together, this was understood as an indicator

that the culture of this occupational group was exerting a stronger influence on the variable, rather than national culture. As the occupational culture within an organization is set by the organizational protocol, this result (e.g. occupational groups clustering together) was interpreted as an indication that organizational culture was dominating the perceptions of that variable. Thus, these pairs of analyses were run in order to determine if the groups would form *clusters* along national or organizational culture lines. This would provide an indication of the relative influence of national and organizational culture. However, the exact nature of these relationships was to be evaluated through the use of HLM.

It is hypothesized that the installations that share nationality will have more similar perceptions for the variables, than installations with different nationalities. This was accomplished by conducting the cluster analysis procedure in two steps. Cluster analysis was facilitated by the data set because it included pre-existing meaningful groups (e.g. occupational group and installation). The cluster analyses were executed twice; the first pass utilized installation as the clustering variable while the second analysis was executed with occupational group as the clustering variable.

In the first step of the cluster analysis (e.g. installation as clustering variable), if the groups displayed a cluster solution with a demarcation between the UK and Norway installations, this was taken as evidence that national membership exerted a stronger influence on this variable. If the first step of the cluster analysis revealed no that there was no clear division between the UK and Norwegian installations, the second analysis was conducted. If the results of this cluster analysis produced clusters in which the

installations from the same nation were not together, this would be the rationale to proceed to the second step.

The second step of the cluster analyses sought to further tease apart the influence of organizational culture by assessing the various occupations within the installations. Within the second analysis (i.e. occupation as clustering variable), if the data clustered more along occupational groups, this was taken as an indication that for that particular variable, the data displayed organizational membership was dictating the manner in which employees perceived the variables. For example, if all of the maintenance, drilling and production personnel clustered together, this was understood as an indicator that the culture of this occupational group was exerting a stronger influence on the variable, rather than nationality. As the occupational culture within an organization is set by the organizational protocol, this result (i.e. occupational groups clustering together) was interpreted as a sign that organizational culture was dominating the perceptions of that variable. Thus, these pairs of analyses were run in order to determine if the groups would form *clusters* along national or organizational culture lines. This would provide an indication as to the relative influence of national and organizational culture. However, the exact nature of these relationships was to be evaluated through the use of HLM.

There were several variables assessed in the present study, which included: risk perception, attitudes to safety, others commitment to safety, social support and job situation. It was believed that the installations would not form similar cluster groupings for all of the variables, as previously stated in the introduction. Although there was no

statement of the direction of the differences between the sectors, it remains that I believe there are significant differences between them.

For the second group of analyses, it was hypothesized that the influence of nationality would account for variance unattributed to organizational membership. In order to properly answer this hypothesis, an analysis that controls for organizational membership and simultaneously assess the contribution of nationality was required. One such statistical tool that is able to accomplish this task is hierarchical linear modeling. Therefore, in order to accurately answer the second research question, hierarchical linear modeling was implemented.

Hierarchical Linear Modeling (HLM). Hierarchical linear modeling is a statistical tool that has recently come to the forefront of psychological research (Raudenbush & Bryk, 2002). The current study provided an analysis of the two major facets of culture: organizational and national, simultaneously. HLM has been found to be quite useful in organizational research. For example, if one desired to assess a number of organizational variables, it could be said that these variables are nested within communities, which are in turn nested within provinces, which are in turn nested within countries (Raudenbush & Bryk, 2002). The own submodel represents each of these levels. HLM allows you to assess the various levels individually and then describes the potential interactions between the levels of analysis.

The HLM analyses, allow a more direct comparison of the influence of national and organizational culture. The data set utilized for the study was one that was nested in its natural state (i.e. installations nested within geographic sectors). Specifically, this data

set is structured in such a way that the individual level variables served as the level 1 of the HLM model, while the higher-level variables served as level 2 within the model. This is a structure that is well suited for analysis with HLM, and provided estimates of the relative influence of the amount of variance that can be attributed to each level of variables.

Often with data collected for empirical research, a natural *nested* structure exists. Essentially, this nested structure denotes that there are groups of participants that exist within other meaningful groups (e.g., occupational groups within organizations or psychological outpatients within the general population). The special feature of HLM is that this analysis can properly assess and account for the influences of both existing groups simultaneously. Furthermore, as it is often the case with an applied data set, there are missing data or incomplete questionnaires. However, HLM can easily manage data sets that contain such anomalies. In order to complete an HLM analysis involves linear models that satisfy the assumptions of linearity and normality (Raudenbush & Byrke, 2002).

As stated above, HLM is a method of modeling nested or grouped data that allows the researcher to attribute variability to both the within and between groups components of the theoretical model (Raudenbush & Byrke, 2002). The analysis facilitates the examination of interaction affects that occur across the levels as well. Moreover, HLM is not limited to the evaluation of group means; it also incorporates the relationships between the predictor and outcome variables. The most typical form of HLM involves a two-level analysis. The first level of the analysis, level 1, pertains to the group that is

nested within the larger entity. This includes employees in organizations, such as teachers nested within a school. Alternatively, a two-level HLM analysis could involve the same individuals reassessed over time. Thus, the units of time are nested within the individual. An example of this form of analysis could involve a teacher that is evaluated several times throughout the course of the academic year. HLM analyses are not limited to two-level models, although three-, and four-level models are less frequently conducted. A three-level model could involve a teacher that is nested within a school, and a school that is nested within a district. So we could evaluate multiple teachers within multiple schools, and compare the results between school districts.

The process HLM utilizes in order to achieve its final solution contains three distinct steps: within and between analysis, random coefficients model and the intercepts-and slopes-as outcomes model. The first step has been labeled by convention as the within and between subjects analysis, or “WABA”. This can be viewed as the unconditional model and serves to estimate the grand mean as a starting point. This involves running the analysis with only the outcome variable entered into the model. This provides one with an estimate of the degree of variability in the intercepts and slopes, as they exist at the outset of the study. Essentially, this stage can be conceptualized as taking a baseline measure of the grand mean across the groups as the intercepts. At this stage the fixed effects convey the grand mean across the groups on the outcome variable and the variance component determines whether there variance and means and slopes. If there is a significant variance component, then we proceed to the following step in an attempt to account for the variance with level 1 predictor variables (Raudenbush & Byrke, 2002).

Assuming that there was a significant proportion of variance that remains to be unaccounted for from the WABA analysis, we proceed to the random coefficients model. At this stage of the HLM analysis, the level 1 predictor variables are entered into the model (Raudenbush & Byrke, 2002). Within this level of analysis, the researcher seeks to answer the following questions:

1. Does the relationship between predictor and outcome variables vary as a function of groups?
2. If it does vary, how much does this relationship vary between the groups?
3. If significant differences exist between the slopes, can these differences be attributed to the predictor variables?

The output of this stage is in the same format as the WABA stage. The fixed effects of this stage explain the overall slope between the individual level 1 predictors and the outcome variable across the groups (Raudenbush & Byrke, 2002). The variance components of this stage are compared to those of the WABA model to determine if there is any additional significant proportion of the variance that is accounted for by the level 1 predictors. If there remains a significant proportion of the variance in the outcome variable that remains unexplained, we proceed to the final step of the analysis.

The intercepts and slopes as outcome measures is the final step in the HLM analysis. This is comprised of running the model from the previous step with the addition of any level 2 predictor variables that could account for the variance in the outcome variable. The fixed effects of the final stage determine whether the slope between the predictor variable and the outcome variable differed as a function of the level 2 variables (Raudenbush & Byrke, 2002). The level 2 variance components are compared to the variance components of the previous step for further evidence of the explanatory power

of the variables added in the final level of the analysis. If there remains a significant proportion of the variance that is unexplained, this could be an indication that the variables that were evaluated were not accurately assessing the relationships of interest.

The results of HLM are grounded in the assessment a traditional regression structure, in which the researcher attempts to utilize variables in order to *predict* values on a subsequent variable (Raudenbush & Bryk, 2002). One has the advantage of evaluating potential models are multiple levels individually, with the option of combining them in a future joint analysis. The strength of HLM is it can assess variables that are nested within larger, more encompassing variables. Hierarchy is a fundamental characteristic of many psychological and social phenomena (Littell, Milliken, Stroup, & Wolfinger, 1996). For example, in educational research, we might be interested in the test performance of schools within neighborhoods, within districts, within provinces, and within the country. Each level of the analysis is subordinate to the further encompassing levels. The multilevel data structure stated above can easily be fit into a mixed-effects model including both fixed and random effects (Littell et al., 1996), which can be assessed with the use of HLM. The HLM procedure dictates that the regression coefficients that are present at the Level 1 analysis become random outcome variables at Level 2. This allows for a complete and accurate assessment in a stepwise holistic manner. HLM is required if there are random effects of interest at both levels of the analysis.

Mearns et al. (1997) provide an assessment of the proportion of variance that was accounted for by installation and sector characteristics to determine if the relationships would differ. However, these analyses were conducted separately and do not provide an

insight as to the putative effect that could result from the cultures interacting with one another. It is feasible that the proportion of variance that is accounted for by either organizational culture or national culture could be altered once they are assessed simultaneously. The present study implemented HLM in order to provide an answer to this question. It was hypothesized that there would be differences in the proportion of variance that was accounted for by national culture once the culture of the installation was controlled. I believe that the effect of national culture was not given an adequate amount of attention by Mearns et al. (1997), due to the lack of proper statistical procedures. However, the use of HLM will facilitate more accurate interpretations of the influence of the two cultural elements. For additional information concerning HLM, please refer to Appendix B.

Procedure

The first step in the HLM was the construction and formulation of theoretical models. The process began with the level 1 variables. It was hypothesized that the effect of national culture will contribute for a higher proportion of variance than proposed by Mearns et al. (1997). Furthermore, the predictive power of each occupational element will differ across national borders. It was hypothesized that Norway leans more towards collectivist values, due to this fact that the Norwegians place greater emphasis of the values and well being of all (Jetten, Postmes and McAuliffe, 2002), there influence of the others commitment to safety will have a greater influence than in the UK. With regard to the attitudes to safety variable, it is proposed that univariate regression be conducted to determine the predictors with strong individual prediction of each outcome variable

(Raudenbush & Bryk, 2002). The following step involved the entering of the level 1 predictors into a random coefficients level 2 model variance component for to ascertain the predictive power of the variables.

Mearns et al. (1997) assessed the proportion of variance accounted for by organizational and national culture using LISREL MIMIC (e.g. multiple indicators and multiple causes) models and path analyses. For the purpose of this study, the focus was on the variable interactions obtained from Mearns et al. (1997) path models. There were two separate analyses conducted, one for the UK and another for Norway. Thus, the analyses were conducted separately and do not provide insight of potential influence of national culture, or the putative effect that could result from the two cultures interacting. It is feasible that the proportion of variance that is accounted for by either culture could be altered once they are assessed in conjunction. In the present study, two models of variable relationships obtained through the path models evaluated by Mearns et al. (1997) were reassessed with HLM, to determine if there was an interaction between the two cultural facets. The models reassessed with HLM are presented in Figure 2 and 3. It is hypothesized that the effect of national culture will contribute for a higher proportion of variance than found by Mearns et al. (1997) study. This was accomplished by entering all of variables measured at the individual level, as level 1 variables within the HLM.

The level 1 variables of the Model 1 HLM analysis included:

Predictor Variable(s) (Level 1: Individuals)	Outcome Variable(s):
<ul style="list-style-type: none"> - Others Commitment to Safety - Attitudes to Safety - Satisfaction with Safety Systems 	<ul style="list-style-type: none"> - Risk Perception

- Job Situation

The organizational level variables were entered at level 2 of the HLM analysis.

Although these variables were assessed at the individual level, they are a measure of organizational level information. These level 2 predictor variables included:

Predictor Variable(s) (Level 2: Installations)

Outcome Variable(s):

- Geographic Sector (Nationality)
- Operating Company (Organizational Membership)
- Work Term (Long term vs. Contract)
- Work Location (On vs. Off-deck)

HLM Model 2 involved an assessment of the satisfaction with the safety systems

as the outcome variable. Once again, the individual level variables were entered at level 1 of the HLM model, and the organizational level variables were entered in at level 2.

The level 1 variables of the Model 2 HLM analysis included:

Predictor Variable(s) (Level 1):

Outcome Variable(s):

- Job Situation
- Others Commitment to Safety
- Attitudes to Safety

These level 2 predictor variables included:

Predictor Variable(s) (Level 2):

Outcome Variable(s):

- Geographic Sector (Nationality)
- Operating Company (Organizational Membership)
- Work Term (In House vs. Contract)
- Work Location (On vs. Off-deck)

For a review of the proposed models, please refer to Figure 2 and 3.

The second step in the HLM procedure was the formulation of the groups that were analyzed. In HLM it is convention to run the analysis with no more than 30 groups. With the current data set we were limited because there were only 18 installations and 10 occupational groups. Neither of the group totals was sufficient to properly conduct the

analysis. Thus, there had to be a combination between the nested variables to conduct the analysis. This led to combining the installation variable with the occupational group variable.

Results

Reliability Analysis

The reliability of the Offshore Risk Perception Questionnaire was reported as high in previous studies (Flin et al. 1996a; Mearns et al. 1997), although the coefficients ranged from 0.40 to 0.90. Therefore, a reliability analysis was conducted to determine the reliability of the subscales. As the subscale factors resulted in poor coefficient alphas (Mearns et al. 1997), the overall coefficient for each of the subscale was computed.

The reliability of the entire subscales was assessed and the correlations with the remaining subscales were also computed. The coefficient alphas for each scale in its entirety were above $\alpha = .62$ (Refer to Table 1 for the coefficient alphas and scale correlations), which indicates that the subscales display moderate to high reliabilities. The major issue occurs when the individual factors of the subscales are reviewed as presented previously. This is indicative of fair reliability for the scales in their entirety.

Table 1
Reliability Coefficients and Intercorrelations of the Six Subscales

Scales	RP	SAT	JS	ATT	OTH	SOC
Subscale Name						
1. Risk Perception	.944 [^]					
2. Satisfaction with Safety Systems	.427**	.908				
3. Job Situation	.242**	.269**	.720			
4. Attitudes to Safety	-.096**	-.075**	.269	.635		
5. Others Commitment to Safety	.249**	.435**	.219**	-.088**	.843	
6. Social Support	.126**	.262**	.208**	-.067*	.238**	.752 [^]

Legend

RP – Risk Perception

SAT – Satisfaction with Safety systems

JS – Job Situation

ATT – Attitudes to Safety

OTH – Others Commitment to Safety

SOC – Social Support

** - Correlation significant at the 0.01 level (2-tailed)

* - Correlations significant at the 0.05 level (2-tailed)

[^] - Standardized alpha

Factor Analysis

Prior reports of the UK and Norwegian data set were not clear about the factor analysis procedure that was implemented on the subscales of the questionnaire.

Specifically, it was not clear if the two sector samples were analyzed individually and then averaged together to formulate to final factor loadings. Hence, in the present report

the principle components exploratory (PCE) factor analysis with Varimax rotation were conducted on the *entire* data in order to determine if the results obtained by Mearns et al. (1997) could be replicated and clarified.

Risk Perception. The PCE factor analysis was conducted on the items devoted to this subscale of the Offshore Risk Perception Questionnaire. After examination of the Eigen values and the scree plot it was concluded that there were in fact three factors within this subscale. They included: hazards to the installation, hazards to the individual and major incidents. An average of the three factors was used in the remaining analyses. This was done in an attempt to assess the broad hazards on the installation that apply to all personnel, rather than examining the affects of occupation specific hazards. If the level of specificity was too fine, between groups variation could be lost and the true nature of the potential differences might be missed. Refer to Table 2 for the component matrix.

Satisfaction with Safety Systems. The PCE factor analysis was conducted on this satisfaction subscale. The results of the Eigen values and the scree plot confirmed the initial factor loadings. A three-factor structure was decided upon. The first dimension was measures directed at personnel, which included items assessing safety training. The second dimension was labeled protection measures and housekeeping and evaluated the various systems and machines in place for the protection of the personnel, as well as the housekeeping on the platform. The final factor was labeled detection systems and evaluated the satisfaction the personnel had towards the various barriers to ensure their well being. Refer to Table 3 for the component matrix.

Job Situation. The PCE factor analysis was used to assess the group of items. The analysis resulted in a four-factor structure. These factors assessed the characteristics of the jobs on the platform. The four factors included the following: independence at work, communication and influence, job ambiguity and job demands. Refer to Table 4 for the component matrix.

Attitudes to Safety. PCE factor analysis was conducted on the items of this subscale. The analysis of the scree plot and Eigen values led to identification of four factors. The factors include: operational vs. safety goals, accident causation, fatalism, and personal control over safety. These facets were an assessment of the production pressure of the installation in question. Refer to Table 5 for the component matrix.

Others Commitment to Safety. The PCE factor analysis was not successful at reducing the factor structure of this subscale. All of the items could be viewed as a single factor assessment of the safety commitment of the various individuals presented in the individual items. The items were designed to give an indication of whether significant individuals in the respondent's life were concerned with their safety. The scale included individuals such as the safety officer, their supervisor and their co-worker to name but a few. Refer to Table 6 for the component matrix.

Social Support. The final scale that was assessed with PCE factor analysis was the social support subscale. Similar to the results of the others commitment to safety subscale, the factor analysis procedure failed to reduce to the items into distinct facets. The questions were meant as a measure of the amount to support that personnel receive from a number of work and non-worker related individuals. For example, some of the

items requested if social support was obtained from the safety officer, co-workers, or a spouse. Refer to Table 7 for the component matrix of this subscale.

Cluster Analysis

The initial stages of the analysis included the use of both hierarchical and K means cluster analysis. Although the two procedures differ in their primary procedures for the formulation of data clusters, the results did not differ significantly. Therefore, only the results of the hierarchical cluster analysis are reported. The hierarchical cluster analysis procedure was used to cluster the offshore oil personnel on the basis of the occupational variables discussed in the methods section. The factor loadings of the PCE factor analysis were implemented in the cluster analysis procedure such that a weighted cluster solution would be the end result. The cluster analysis solutions were deduced using Ward's method. Ward's method was utilized because it more accurately reveals the true underlying cluster structure, more so than the alternative methods (Griffin, Hom, DeNisi, & Kircher, 1985). These results were compared to the other cluster analysis procedures (e.g. Between groups linkage, Nearest neighbor, Furthest neighbor, etc.). However Ward's method was maintained because it resulted in the clearest formation of the clusters. Thus, it was utilized as the primary means of forming all clusters for all variables.

Risk Perception

Clustering Variable: Installation

The subscale of risk perception was found to have three factors: hazards to the installation, occupational hazards and major hazards, of which an average of the three

factors was utilized for the remaining analyses. It was expected that the exposure to major incidents would be relatively constant across all installations, as they both are operating within the North Sea. Therefore, it was hypothesized that the nationality of the personnel would dictate their perception of all variables, including risk perception. The results of the cluster analysis displayed a large cluster of Norwegian installations comprised of two smaller distinct clusters. Specifically, one cluster contained the installations: Installation 7, Installation 9, Installation 10, Installation 12, Installation 13, Installation 14, Installation 15 and Installation 17. However, the UK installations Installation 4 and Installation 6 clustered in the midst of this group. The smaller cluster of Norwegian installations contained: Installation 8, Installation 11, Installation 16 and Installation 18. There was a four-member cluster of the remaining UK installations (e.g. Installation 1, Installation 2, Installation 3 and Installation 5).

This did not provide support for expected clusters solution as only two UK installations were inter-dispersed between clusters of Norwegian offshore platforms. Moreover, those two UK installations were clustered together within the Norwegian installations, displaying that they were still more similar to each other, rather than the Norwegian installations.

It was proposed that the offshore platforms would cluster into sectors for installations according to national culture. It would appear as though there are more similar characteristics shared between the Norwegian installations, and more similarity shared between the UK installations. The exception to these findings pertains to the installations of Installation 4 and Installation 6. Furthermore, the employees of the UK

and Norwegian installations were measuring the actual risk of the installations, which should not be dependent on national culture. Yet, there were more similarities between the installations from the same nationality than from installations from different nationalities. This would suggest that nationality is influencing this allegedly objective task. It would appear as though nationality has a significant influence on the risk perception of offshore personnel. Refer to Figure 5 for the complete dendrogram of risk perception.

Clustering Variable: Occupation

The risk perception subscale was also assessed using occupation as the clustering variable. Essentially, if risk perception were a “truly” objective process, there would be a distinction between the occupations that operate within similar locations and are exposed to the same hazards and risks. This would result in two general clusters, one that contains Administration/Management, Medic, Logistics, Catering, and Services, and the other cluster would contain Production, Drilling, Technician/Mechanic, Deck Crew, and Maintenance. The results of the cluster analysis showed that there was a cluster containing Catering, Services, and Medic. However, this cluster also contained the Maintenance and Drilling occupational groups. The occupational groups of Administration/ Management and Logistics also clustered together, but this was in the cluster that contained Production, Technician/Mechanic, and Deck Crew. These results did not support the notion that similar occupations would cluster together, as occupations with drastically different hazards and job characteristics are found clustering together. Refer to Figure 6 for the dendrogram for risk perception. As there were no meaningful

clusters that emerged for the occupational groups, it strengthens the argument that nationality plays a significant role in determining the risk perception of personnel.

Attitudes to Safety

Clustering Variable: Installation

The primary goal of assessing the safety attitudes of employees was to determine whether the installations would cluster along the nationality. Installations would cluster along national culture lines because it is believed that the predominant cultural norms will dictate important attitudes with regard to organizational operations and protocols (Sousa-Poza, 1999). An average of the four factors for safety attitudes subscale were included in this analysis. The dendrogram from the hierarchical cluster analysis displayed two major clusters. There was a cluster that contained all of the Norwegian installations and another that contained the remaining six UK installations. The Norwegian Installation 11 was an outlier from the installations in the Norwegian installation group. However, it too was more similar to the Norwegian country cluster than the UK cluster. The cluster solution that emerged supported the initial hypothesis that stated the installations would cluster along national cultural lines. Refer to Figure 7 for the dendrogram. It would appear that the attitudes to safety on the installation mirror that of the masses and nationality dictates the safety attitudes of offshore personnel.

Clustering Variable: Occupation

The attitudes to safety subscale were again assessed using occupation as the clustering variable. It was hypothesized that the nationality of the personnel would dictate all of the occupational variables. Therefore, there would not be any meaningful

occupational clusters, as nationality would exert a stronger influence than the occupational membership. The dendrogram revealed that no meaningful clusters emerged. Although, Drilling and Maintenance staff grouped together, this cluster also contained Services, Medic, Logistics and Catering personnel, which is counter to the occupational requirements and environments of these drastically different occupations. Moreover, the Administration/Management group was only associated with this cluster to a small degree.

For the remaining occupational groups, the Deck Crew, Production, and Technician/Mechanic occupational groups clustered together. Their association was extremely divergent from the occupations of Drilling and Maintenance, which is perplexing as they share similar occupational elements and environments. These results were in accordance with the initial hypothesis. Essentially, the support staff (i.e. working within the accommodations) was clustered among the oil and gas personnel, resulting in meaningless clusters. This displays that the occupational group subcultures did not outweigh the influence of the national culture. As the Figure 1 suggests, these two sets of attitudes (e.g. national and organizational culture), can co-exist along a continuum of relative importance, however, the national culture exerts the stronger influence. Figure 8 presents the complete dendrogram.

Social Support

Clustering Variable: Installation

The social support subscale was found to have a one-factor structure, thus all of the items were included in the cluster analysis. It was hypothesized that the installations

would cluster along national culture lines because the collectivist tendencies (e.g. communication and ensuring the good of the masses) would result in the Norwegian installations distinguishing themselves from the UK installations. This would result in the Norwegian installations being more similar to one another than with the UK installations that favour individualistic tendencies. However, this was not conclusively displayed in the resulting dendrogram. For the most part, the Norwegian installations clustered together with the exceptions of Installation 9, Installation 11, and Installation 13. These installations were positioned among the cluster of UK installations (e.g. Installation 2, Installation 4, Installation 5 and Installation 6). The two remaining UK installations (e.g. Installation 1 and Installation 3) were associated with the larger Norwegian cluster. Thus, there was a four-member cluster of UK installations and the majority of the Norwegian installations clustered together. This does not provide support for the initial hypothesis. However, this does not nullify the importance of the three-member contingent of Norwegian installations that clustered with the UK group. Moreover, two UK installations clustered within the Norwegian cluster (Refer to Figure 9 for the dendrogram), and Installation 11 was once again an outlier from the remaining Norwegian installations. These results were not clearly interpretable, it is likely that there is a pattern in the resulting grouping that requires further investigation.

Clustering Variable: Occupation

The social support subscale was reanalyzed using the occupational group as the clustering variable. As nationality is hypothesized to be the dominant force directing the expression of occupational attitudes, no meaningful occupational clusters would emerge

from this analysis. The results did not conclusively support this hypothesis. For example, Services, Catering, Logistics, and Medics formed a group; however, the Maintenance occupational group was also a member of this cluster. Also, the Administration/Management personnel, who share similar characteristics with the above occupations, clustered with the Drilling, Technician/Mechanic, Production, and Deck Crew personnel. This is in opposition to the intuitive pairing of occupations with similar work environments and hazards. The Administration/Management group is also an unlikely addition to the “outside staff” cluster, as the majority of the cluster members work on the deck of the installation and are exposed to a similar hazardous work environment and job characteristics. Although there were several o similar occupational groups that clustered together, there still remains the issue as to why the Administration/Management group and the Maintenance group are once again found grouped with dissimilar occupations.

These occupational groupings are not the result of similar work environments or exposure to similar occupational hazards. The results could be interpreted as support for the belief that a similar level of social support will be displayed across all offshore personnel despite their occupation. It is likely that national culture has overshadowed the occupational subcultures in terms of the levels of social support. Although there was some grouping of occupational groups with similar job characteristics, these groupings were tainted with the addition of occupations that share little in terms of job characteristics. It is likely that national culture is the major force behind the clustering of these groups (Refer to 10 for the dendrogram).

Job Situation

Clustering Variable: Installation

The four factors of the job situation subscale were average and assessed with hierarchical cluster analysis. As nationality was hypothesized to dictate the expression of all the variables, the emerging clusters would again differentiate between the two sectors. The rationale for the hypothesis is the cultural values of the nation will dictate the job characteristics and situation to which its citizens are subjected. Furthermore, the legislation of these countries specify how, when, and where employees will work. The cluster analysis displayed two main clusters, which differentiated between the UK and Norway sectors. This was in agreement with the initial hypothesis that stated that the national culture of these two countries would dictate the working conditions and the resulting job situation. However, there was one platform (e.g. Installation 11), which was an outlier from both groups. However, Installation 11 clustered more closely with the Norwegian than the UK cluster. This result is not problematic and will be discussed in the final section of the report (Refer to Figure 11 for the complete dendrogram).

Clustering Variable: Occupation

The job situation items were reassessed with occupational group as the clustering variable. It was believed that nationality dictates the expression of this variable; the occupational group attitudes would be overshadowed by the national attitudes. This would result in a cluster solution with no meaningful occupational groupings. The dendrogram showed occupations subjected to drastically different hazards were inter-dispersed among one another. For example, the Catering, Administration/Management, Logistics, and Medic occupational groups formed a cluster amongst those occupations

that function on the installation's deck (e.g. Drilling and Production). Furthermore, occupations subjected to similar workplace hazards did cluster together (e.g. Technician/Mechanic and Maintenance), however the Production occupational group, which also operates in similar working conditions, was clustered closer to the occupational groups that operate within the safety of the installation's confines. Once again the results of the occupational analysis led to clusters that can be explained through the expression of national cultural attitudes (Refer to Figure 12 for the dendrogram). It is believed that the national culture views transcend all of the occupational groups despite their work environment and location.

Others Commitment to Safety.

Clustering Variable: Installation.

The unitary factor of others commitment to safety measure was first assessed with installation as the grouping variable. Similar to attitudes to safety and job situation, the others commitment to safety construct was also hypothesized to display clusters that distinguish between national cultures. In essence, the nationality of the UK and Norway would dictate the clustering of the installations. If the collectivism culture of Norway were considered, we would expect the personnel of the Norwegian installations would value the safety of *all* the individuals of the platform. Conversely, the individualistic UK tendencies would lead them to manifest differing levels of safety commitment and result in different perceptions of other employee's commitment to safety. Thus, there will be sector differences in the safety commitment levels between the installations of these two nations.

The results did not provide support for this hypothesis. A cluster was formed that contained UK Installation 1, Installation 2, Installation 3, and Installation 5; however, this cluster also contained the Norwegian installations Installation 9 and Installation 11. Another cluster was formed that contained a majority of Norwegian installation (e.g. Installation 7, Installation 8, Installation 10, Installation 12, Installation 13, Installation 14, Installation 15, Installation 16, Installation 17 and Installation 18). Yet this cluster also contained the UK installations Installation 4 and Installation 6.

It is clear that several UK installations share some degree of similarity with regard to others commitment to safety variable. Furthermore, there are shared views between the Norwegian installations as the greater majority has grouped together. What is ever more intriguing is the fact that the two Norwegian installations that are operated by the same company (e.g. Installation 9 and Installation 10), did not cluster together closely in the Norwegian installations cluster. Moreover, Installation 9 clustered within the UK installations group. The two UK installations Installation 4 and Installation 6 were once again grouping within the midst of the Norwegian installations, which is puzzling because neither shares national or organizational culture (e.g. operated by different companies), with the Norwegians. Also, the Norwegian Installation 11 has repeatedly clustered as an outlier as it has not cluster strongly with either the UK or Norwegian groups (Refer to Figure 13). The results were difficult to interpret; yet there could still be a pattern in the resulting clusters.

Clustering Variable: Occupation.

The analysis was rerun with occupation as the clustering variable. It was believed

that there would be no meaningful occupational groups formed with this analysis, as nationality was determining others commitment to safety. The results did not support this hypothesis, as outside staff occupations (e.g. Maintenance, Production, Technician/Mechanic and Deck Crew), clustered with support staff, or inside the accommodations occupations (Services, Medic and Logistics). Moreover, the Administration/Management and Catering groups clustered with Drilling personnel. This grouping was not anticipated at the outset of the study, although this “irregular” clustering of the Drilling and Administration/Management staff was becoming more common. It appears these occupations that involve different job characteristics and requirements are sharing a common bond that is leading them to cluster together (Refer to Figure 14 for the complete dendrogram).

Satisfaction with Safety Systems

Clustering Variable: Installation.

This variable was also hypothesized to cluster into two groups: the UK and Norway. The results of this analysis did not support to the initial hypothesis, as the UK and Norwegian installations were to a large part inter-dispersed with one another. For example, Installation 2, Installation 3 and Installation 6 clustered in the midst of the majority of nine Norwegian installations. The remaining three UK installations were intermingled with the three remaining Norwegian installations. From these results it is quite apparent that there was no clear division between the Norwegian and UK installations. Although this variable was also proposed to cluster along national lines, this result is neither surprising nor problematic, as this variable is contingent on all of the

previous variables. And as such, it has reproduced the patterns displayed by a number of the other variables. Once again the results were difficult to interpret, yet there still is a need to examine this construct more closely.

Clustering Variable: Occupation.

As stated above, it was hypothesized that satisfaction with safety systems would result in two clusters, one containing the Norwegian installations and the other cluster the UK installations. The results of the previous analysis did not support the initial hypothesis; I examined the results of the cluster analysis with the occupation as the clustering variable. The results displayed no meaningful occupational clusters. Although the Administration/Management, Catering, and Medic staff clustered together, this group also contained the Maintenance and Deck Crew. Furthermore, the cluster that contained the Drilling, Production and Technician/Mechanics, also contained the Services and Logistics staff. It would appear as though the level of satisfaction with the safety systems is not dependent on the type of occupational group. Different occupations are subjected to significantly different levels of hazards and risk (Marek et al. 1985). Therefore one could believe that this would differentiate between those occupations that operate on the deck on the installation, versus those that work within the accommodations of the installation, yet, the results did not support this notion (Refer to Figure 16 for the dendrogram).

Hierarchical Linear Modeling (HLM)

There were two separate HLM models evaluated for the present study. Model 1 with risk perception as the outcome variable, will be presented first followed by a review of Model 2 with satisfaction with safety systems as the outcome variable.

HLM Model I

A preliminary analysis was conducted on the risk perception variable to determine if it differed significantly across the constructed groups (Refer to Figure 4). The outcome variable was run through the HLM program without the addition of level 1 or level 2 predictor variables. This is often called the unconditional within and between analyses (e.g. WABA). This step of the analysis established an estimate of the total amount of variance in the intercepts that can be accounted for through the addition of higher order predictors. There was no significant difference between the OLS and robust solutions. Yet when the variance components were reviewed, there was a significant result ($X^2(1, n = 147) = 263.554, p < 0.05$) (Refer to Table 7 for the variance components). These results displayed there was no significant difference from zero in the intercepts of the groups; however, the variance component indicated that there was variance in the intercepts to explain.

The following step (i.e. random coefficients model) sequentially added the level 1 predictor variables into the model. The final estimation of the robust fixed effects showed that there were significant slopes for the variables of others commitment to safety ($t(143) = 3.515, p < 0.05$) satisfaction with safety systems ($t(143) = 15.575, p < 0.05$), job situation ($t(143) = 6.391, p < 0.05$) and attitudes to safety ($t(143) = -2.473, p < 0.05$), in their individual relationships with risk perception across all groups. These results displayed that there were significant differences in the slopes between these three level 1 predictors and the outcome variable, moreover, all of the relationships were positive, except for attitudes to safety (Refer to Figure 16 for Model I). There were differences

between the OLS and robust solutions; therefore, the robust solutions are presented.

When the final estimates of the variance components are reviewed (Refer to Table 9 for variance components), it is clear that there is no variance in the slopes between the groups to explain. This negative finding is further compounded when the random coefficients level 1 reliability estimates are reviewed. All of the reliability estimates for each of the level 1 predictors, both significant and non-significant are extremely low, ranging from 0.006 to 0.191. This information provides you with an estimate in the level of “trust” one can have in the variance components for the intercepts and slopes, which is based on the sample size. These values range from 0 to 1, as a convention you desire values of at least 0.70. The obtained values insinuate that there is not enough power, or the sample size was too small. However, there was no significant variance in the slopes of the groups to explain. Thus, there was no need to proceed with the execution of the slopes as intercepts HLM analysis.

HLM Model II

As with the previous model, the analysis was accomplished using the “step-wise” procedure. A review of the WABA analysis there were no significant differences between the OLS and robust solutions. Upon reviewing the variance components, it was found that there were significant differences in the means of the groups ($X^2(1, n = 147) = 310.35, p = 0.000$) (Refer to Table 10 for the variance components). Thus, there was empirical rationale to proceed to the random coefficients model and add the level 1 variables to attempt to account for the variance.

The results of the random coefficients model final estimation of fixed effects

showed there were two level 1 predictors, others commitment to safety ($t(143) = 9.761, p < 0.05$) and social support ($t(143) = 6.990, p < 0.05$), which displayed significant slopes with satisfaction with safety systems across the groups. Both of the relationships were positive in their direction. There were not significant differences between the results of the OLS and robust solutions (Refer to Figure 18 for Model II).

An examination of the variance components showed that for the two significant level 1 predictor variables, there was also significant variability between the slopes for the groups (others commitment to safety, $X^2(3, n = 147) = 147.40, p < 0.05$ and social support $X^2(3, n = 147) = 149.06, p < 0.05$). Furthermore, attitudes to safety systems also approached significance ($X^2(3, n = 147) = 131.57, p > 0.05$). This provided the rationale to conduct the final step of the HLM analysis with the addition of level 2 variables to explain the differences at the group level with organization level characteristics (Refer to Table 11 for the variance components). After reviewing the reliability estimates, they were once again very low. The obtained values insinuate that there is not enough power, or the sample size was too small in Model II as well.

The intercepts and slopes-as-outcomes portion of the analysis was then conducted. This final stage of analysis was accomplished through entering all of the level 2 predictor variables into the HLM model. The robust final estimation of fixed estimates displayed significant differences for the intercepts (i.e. mean levels) of two level 2 predictors at the group level. This occurred for the variables of operating company ($t(137) = 2.257, p < 0.05$) and work location ($t(137) = -2.487, p < 0.05$). As it can be observed the relationship between operating company and satisfaction with safety systems was

positive, while the relationship between location and the outcome variable was negative. However, this does not reduce the importance of including more extensive measures of these entities in future studies of offshore petroleum safety.

Examination of the slopes displayed that the significant level 2 variables did not have a significant influence on the relationships between the level 1 predictors and satisfaction with safety systems. For others commitment to safety, both the affects of operating company ($t(137) = 0.096, p > 0.05$) and location ($t(137) = -0.785, p > 0.05$) were non-significant in accounting for differences in the relationships with satisfaction with safety systems. For social support, operating company ($t(137) = -1.023, p > 0.05$) and location ($t(137) = -1.204, p > 0.05$) were non-significant differences in the relationships as well. It is interesting to note that the level 2 location variable had a negative relationship with both others commitment to safety and social support (although weak in both occurrences). The location was coded as “1” for outside, or deck personnel, while a “2” was assigned to those employees that worked within the accommodations of the installation. The negative relationship suggests that as the higher the value of the location variable, the lower the level of others commitment to safety. This would be displayed as “inside employees” having a lower commitment to safety than “outside employees”. If we consider social support and its negative relationship with location, it could be displayed as “inside employee” giving lower levels of social support than the “outside employees”. This could insinuate that there are characteristics of the location of work that influence the safety attitudes of personnel.

The nature of the relationship of operating company is more complex as there

were fifteen different companies involved. Moreover, the influence of operating company displayed a non-significant positive relationship with others commitment to safety, and a non-significant negative relationship with social support. Without more information pertaining to the characteristics of these organizations safety measures, it is extremely difficult to determine the deciding factors that influenced these variables. However, it must be remember that they were non-significant relationships and could remain this way despite future attempts to clarify the nature of these relationships.

A final examination of the variance components showed significant findings. This result suggests that significant variability remains in the slopes between the level 1 predictors and the outcome variable after the addition of the level 2 predictors. Ideally, all of the variance would be accounted for by the level 2 variables, yet this is rarely the case in applied research. Although there were significant results for each slopes of the level 1 predictors, there still remains a large proportion of the variance that is unexplained (Refer to Table 12 for the variance components). This can be observed in the relative lack of reduction in the magnitude of the values of the variance component attributed to level 1. At this point the main concern focuses on the type and nature of level 2 predictor variables. It would appear that the level 2 predictors as they currently exist are ineffective in accounting for variance. In order to properly evaluate the influence of these constructs, valid measures of the level 2 predictors that reveal more useful information must be administered in a future study.

Discussion

The present study was successful in finding support for a number of the initial hypotheses. The results are discussed in some detail accompanied with an explanation. The same format used in the results section will once again be employed in the present section. The interpretation of the factor analysis will be presented first, followed by the cluster analysis results, and lastly, the HLM results will be interpreted.

Reliability Analyses

Previous studies reported the reliability of the Offshore Risk Perception Questionnaire subscales as high (Rundmo, 1990; Flin et al. 1996a; Mearns et al. 1996). However, reviewing the present reliability analyses results in contradictory findings. Two of the scales resulted in poor to moderate reliability estimates (i.e. attitudes to safety and job situation). The difference in reliabilities could have been the result of differences in the data set. Perhaps there were different procedures used to “clean up” the data that produced to different respondent data sets. There also could be a small degree of variation between the coefficient alphas that was the result of rounding error. Moreover, previous studies may have reported standardized alphas causing differences present and previous coefficient alphas. Yet, these two explanations would only account for small differences between the reported values. The poor reliabilities are likely the result of the nature of the scale itself. There are an unequal number of items representing each of the subscale and the wording of the items varies significantly. This could be improved upon by revising the existing items in such away that there is more standardization in their format. Yet, these poor reliability coefficients call into question the integrity of the scale itself. The

poor reliabilities most likely compromised the results obtained in the present study. The Offshore Risk Perception Questionnaire will require further investigation and most likely revisions to the existing scale prior to its use in future studies.

Factor Analyses

All of the subscales of the Offshore Risk Perception Questionnaire were evaluated with PCE factor analysis with Varimax rotation. The results of the present study were congruent with those attained by Mearns et al. (1997). Thus, it would appear that Mearns et al. (1997) utilized the entire data set to arrive at their obtained results. Furthermore, the same factor analysis procedure does appear to have been implemented in the former and present study.

Cluster Analysis

There were thirteen subscales present in the Offshore Risk Perception Questionnaire, the present study was concerned with six of these subscales. The rationale for including a subscale into the cluster analysis portion of the study was that the construct displayed significant differences between groups in the work of Mearns et al. (1997). Furthermore, the constructs were also essential in the assessment of Model I and II in the subsequent HLM portion of the study. For all of the variables assessed by cluster analysis, it was hypothesized that installations from the same country would cluster together. The hypothesis presented below pertains to all of six of the occupational variables assessed with cluster analysis.

Hypothesis 1: There will be significant similarities (for the occupational variables assessed), between the installations operating in the same sectors of the North Sea in the study. This will result in the installations clustering into sectors (i.e. UK vs.

Norway), which is contingent on the national culture of these nations.

Risk Perception. The installations were hypothesized to cluster into sectors; however, the resulting clusters did not exclusively group together along national lines. There was no conclusive support for the expected clusters for the risk perception, despite the fact that a pair of UK installations (i.e. Installation 6 and Installation 4) was inter-dispersed within the Norwegian installation cluster. All of the Norwegian installations were found within the same large cluster.

Risk perception is vital to the survival of the installations as the information that is acquired from employees can aid in ensuring worker safety and health. Work environments that are free of accidents are in high demand in today's workplace (Corcoran, 2002; Wennen, 2002; Wong, 2003), and employers seek to keep the amount of risk in their organizations to a minimum. This typically involves striking a balance between production and protection (Hale, 2003; Probst, 2002). Proper "protection", or safety systems can lead to reductions in the costs incurred by loss production and lost-time injuries (LTI). There have been studies from a number of disciplines that have contributed to our current understanding of risk perception (Royal Society, 1992). For example, front-line staff is exposed to the *actual* hazards within all occupations (Mearns et al., 1997), and are more accurate at assessing the "real" levels of risk, rather than upper management. Therefore, the results of the present study are likely to adhere to this finding. An explanation of the results could be that the perceived levels of risk are a measure of actual risk of the physical working conditions, rather than an indicator of national cultural values. Thus, the risk perception variable reflects installation specific

characteristics rather than trends in national culture. As risk perception is a measure of the real risk, therefore it is contingent on the surrounding environment and not the national culture. This could explain why there were two UK installations that fell within the Norwegian cluster. These installations could share more characteristics with their Norwegian counterparts, rather than with the UK installations.

A further explanation for this unexpected grouping could be that these two UK installations inter-dispersed within the Norwegian cluster, are operated in the UK portion of the North Sea that is adjacent to the Norwegian portion. This portion of the North Sea is subjected to extreme weather conditions. It appears as though the installations clustered according to similar levels of hazards exposure on the installations and is reflective of the similar working environments. If national culture were the major driving force behind risk perception, then we would have expected a cluster solution in which the UK and Norwegian installations formed distinct groups and this was not the case. Although there were two distinct clusters, one that contained the majority of the UK and the other, the Norwegian installations, there were still two UK platforms intermingled of the in the midst of the Norwegian group. It would appear as though organizational characteristics played a dominant role in the emerging clusters.

A further step in the analysis for risk perception involved the potential groupings of the occupational groups. Although it was hypothesized that there would be no meaningful clusters, as sector groups were proposed to emerge, it could be the case that occupations operating in similar conditions and exposed to similar hazards would group together. Marek et al. (1985) proposed that different occupational groups operate in

separate 'worlds of risk' because of their exposure to different hazards. It is feasible that individuals employed within the same occupations could be subjected to similar levels of risk, despite which sector they are operating within. Similar occupations could cluster together across the sectors. A likely divergence occurs between those occupations that operate on the deck of the installations (i.e. exposed to the elements as well as physical hazards), versus those occupations that operate within the confines of the installation and are sheltered from major physical hazards. In particular, this would result in the Administration/Management, Medic, Logistics, Catering, and Services occupational groups clustering together. While the Drilling, Production, Technician/Mechanic, and Deck crew occupational groups would cluster together. Moreover, these clusters would occur across the sectors.

However, the results of the occupational groups were not easily discernable. Although, the Catering, Services and Logistics personnel grouped together, this cluster also contained the Maintenance personnel. Another point that disputes the notion that similar occupational would cluster together, was the group containing the Administration/Management and Medic staff also contained the Production, Drilling, Technician/Mechanic, and Deck Crew. It is unclear why these occupations that are quite dissimilar in working condition and requirements are clustered together. It is possible that the conceptualization the occupations proposed by myself is quite different than the reality on the offshore installations. Perhaps the limited space of the installation and close proximity of all the occupational groups has resulted in a culture that is more similar than not, across all occupational groups. It could be possible the environment within an

offshore installation is quite unique and this environment does not foster the existence of separate occupational cultures. Perhaps there are no subcultures exerting an influence on the installations.

There is a need to further examine the occupational groups within the offshore installations to determine the putative presence and strength of occupational subcultures. As there was the emergence of sector groups, it is clear that risk perception is a variable that is influenced by the national culture of individuals'. Yet, we still cannot rule out the influence of the immediate surroundings and occupational characteristics as having a role in determining personnel risk perception. This is an important finding because it once again exemplifies the wealth and importance of information that is possessed by the front-line staff. It is to these employees that an organization must seek guidance from when they are attempting to instill organizational change initiatives in areas such as organizational health and safety.

Attitudes to Safety. It was hypothesized employee attitudes to safety would be dictated by the nationality of the participants. This would result in the installations from the same countries grouping together. The results of the cluster analysis displayed that there were two distinct clusters; one that contained all of the Norwegian installations, while the other was comprised exclusively of the UK offshore platforms. This was strong support for the initial hypothesis. It could be inferred that nationality dictated the attitudes of the employees in this occupational area. There is no question that safety on the platforms is a necessity of the employees and is important to their well being. This could be the reason why they adhere to the rationale and motives of the

nation. Specifically, the more value that is assigned to a construct, the more enshrined it is within the individual's value system (Fishbein and Ajzen, 1975). Perhaps for issues that are extremely important, one seeks guidance from other tenets that share equal importance in their hierarchy of values. Typically, one's nationality is deeply enshrined in one's self-identity. This could involve the referencing of nationality and national culture in order to determine how one would view the matter at hand. In this sample, I have argued that the prevailing cultural norms are collectivism and individualism. The fact that safety on an installation ensures the safety of *all* on board could be viewed as a collectivist goal. This reasoning would appeal to the values of Norwegians; thus they would aspire to hold safety in high regard and be committed to ensuring its maintenance. This could be the rationale at work that has led to the clustering of Norwegian installations. This is not to say that offshore oil personnel in the UK do not value their safety on the installation, but perhaps the reason for the grouping of the UK installations is different. Perhaps, the UK installations view the adherence to safety as a vehicle that would ensure the maintenance of production and profits. With installations operating consistently without shutdowns from organizational accidents, increases their chances at succeeding at competition with the other installations.

If we review the results of the occupational group as the clustering variable, it can be seen that no meaningful clusters emerged. It is possible that national culture has overridden the subculture of organization groups for this organizational variable. It is plausible safety is not something that is specific to a certain occupational group; its importance transcends all occupational groups. This would result in all groups having the

same level of devotion to this ideal, and thus, groupings for this variable would be largely meaningless in terms of occupational subcultures. As it was stated above, as a belief becomes more enshrined within the individual, it would become associated with other areas and aspects of life that are highly valued, such as national culture.

Others Commitment to Safety. It was hypothesized that others commitment to safety was dictated by the nationality of the participants. The results of the analysis did not provided definite support for this hypothesis. Of the six UK installations, four clustered within a single group, which also contained two Norwegian installations (e.g. Installation 11 and Installation 9). The remaining UK installations (e.g. Installation 6 and Installation 4), once again clustered amongst the Norwegian installations. The reasoning for why these two installations have grouped more closely with the Norwegians is perplexing. Perhaps the employees *perceptions* of others commitment to safety are contingent upon the immediate surroundings. If personnel view coworkers as not adhering to safety measures by 'cutting corners' in order to save time. This would have a direct influence on the perceptions of others safety commitment. Although the attitudes to safety resulted in groups that clustered along national lines, it is unusual that others commitment to safety also did not display this grouping.

Another possible explanation could reflect the difference between attitudes and behaviour. Despite the fact that personnel believe and report that they are committed to safety, perhaps their behaviours portray a different picture. It is likely that there is a significant discrepancy between the attitudes and behaviours of the offshore personnel. There is little doubt that all personnel believe in the merits of safety and report that they

are committed in this endeavor. However, their behaviour that is observable by their coworkers is what determines the results of this subscale. Thus, it is probable that the others commitment to safety variable is dependent on the immediate surroundings of employees (i.e. the observable behaviours of coworkers) and not the result of nationality.

The influence of the operating company could also play a role in determining others commitment to safety. If we examine the Norwegian installations, it is clear that there is an installation operated by BP (e.g. Installation 7). This is a situation in which UK initiatives could have been applied to the installation within the Norwegian portion of the North Sea. However, when the results of the cluster analysis are reviewed, for the most part, Installation 7 clustered more strongly with the Norwegian, rather than the UK installations. Therefore, it is hard to make the case that operating companies conducting business across borders have disseminated culturally specific initiatives. However, a more probable explanation could revert to the location of these two UK platforms. As said within the risk perception section, the UK installations Installation 6 and Installation 4 are both operating in the UK portion of the North Sea near to the Norwegian installations. This could result in similar work environments, but it is difficult to explain the like-minded attitudes of others commitment to safety on these installations. This area requires further investigation to understand how these geographically distinct installations share similar attitudes towards others commitment to safety.

With the analysis conducted with occupation as the clustering variable, it was believed that the nationality would override the occupational subcultures. Moreover, these national cultural values would be echoed within the attitudes displayed across the

occupational groups. This would result in a cluster solution with no meaningful groups. The results showed that there were drastically different occupations grouped together in the cluster solution (e.g. Drilling, Catering and Administration/Management). The on-deck and off-deck occupations were inter-dispersed with one another. This could be a sign that nationality was playing a stronger role in dictating the perceptions of others commitment to safety, rather than the occupational subcultures. However, it must be noted that this effect is small if at all present.

For the variables of attitudes to safety and others commitment to safety, one must consider the nationality and cultural values instilled by these two countries. If we consider the Norwegian case, I have argued they possess more collectivist tendencies and emphasize a utilitarian philosophy: the greatest good for the largest amount of people (Olaussen and Braten, 1999). For example, they are devoted to ensuring all individuals are treated with the utmost concern. The case is somewhat different within the UK, where there is a greater emphasis placed on individual competition and they favour a capitalist rationale of the ends justifying the means (McAuliffe, Jetten, Hornsey, and Hogg, 2003). One avenue in which these mentalities may be tested is the implementation of safety measures and protocols and the associated commitment to these policies.

Perhaps in Norway, the employees assign different importance of safety protocols, as they value and follow the measures designed as the groups' safeguard. Conversely, it has been suggested the culture of the UK places greater emphasis on individual competition and places more emphasis on quantifiable results (i.e. production) over the absence of accidents (i.e. protection) (Peterson, Smith, Bond, and Misumi, 1990). Thus,

the UK experience may favour the dereliction of safety procedures in order to compete and increase profit. This could result in lower commitment to safety and negative safety attitudes.

Social Support. It was hypothesized the installations would cluster along national lines, resulting in a cluster solution with a division between the UK and Norwegian installations. As it has been argued throughout the report, Norwegians are associated more closely with collectivist tendencies. This would involve such processes as *communication* and the sharing of ideas to safeguard all. As we know, communication is critical to providing social support. However, this idea was not conclusively reflected in the data. For the most part, the Norwegian installations clustered together, with the exception of three (e.g. Installation 13, Installation 9, and Installation 11). There was also a four-member cluster of the UK installations, as well as some degree of co-mingling of the remaining installations. This provides little support for the initial hypothesis.

Perhaps an explanation for this inter-dispersion of the installations is a result of the organizational support systems following an accident. It is possible that all companies that operate across these two countries, regardless of their nationality, have learned the value of providing social support to employees following the occurrence of trauma, such as an organizational accident. It has been well documented in the literature that social support is effective in facilitating the return to normalcy following a traumatic life event (Rundmo, 1994; Goldenhar, Williams & Swanson, 2003; Sherman, DeVinney & Sperling, 2004).

Sherman et al. (2004) investigated the affects of social support following a spinal

cord injury (SPI). They were trying to determine whether there were differential effects associated with two different types of social support: past-peer mentoring experience (PME) and live-in partner (LIP). The PME typically occurred up to ten years ago, while the LIP was a current form of support. They assessed 62 individuals with SCI with several outcome measures (e.g. Craig Handicap Assessment and Reporting Technique, Brief Symptom Inventory and Satisfaction with Life Scale). The PME social support was associated with higher life satisfaction and occupational activity. While, LIP was related to greater mobility and economic self-sufficiency. If we transcribe these findings to an offshore environment, it could translate into long term effects of social support and safety training that has positive effects for years to come. Moreover, this study exemplifies that there are differing benefits that can be reaped by immediate and past social support. This provides a goal for the offshore industry; both forms of support should be aspired to by the offshore industry. The immediate and long-term support could be provided by an onsite grief/accident councilor. This would increase the benefits incurred through social support for the long-term.

Goldenhar, Williams and Swanson (2003) examined the impact of numerous job stressors, including injuries and near misses in another inherently dangerous industry, construction. Although the nature of the hazards one is exposed to while employed within construction and the offshore petroleum industry are different, the constant threat of injury and accidents is similar across both occupations. Thus, it provides a framework in which to draw parallels to the offshore sample.

Goldenhar et al. (2003) examined the level of work stress in 408 construction

workers through a self-report telephone interview. Their results displayed that there were several work-related stressors that had a direct influence on injury and accidents.

However, poor social support was found to have played an indirect role in the fruition of injuries through physical symptoms, and near misses through psychological strain. These findings provided support for the notion that effective social support can even alleviate injuries and near misses before they occur. Furthermore, the absence of social support can increase the frequency of injuries and near misses.

Continuing within organizational research, Rundmo (1994) reported that in offshore oil personnel there were psychosocial differences between those participants that had experienced an accident and those who did not. More precisely, those individuals that had the perception of greater management support and coworker social support reported lower injury and accident rates. This finding is similar to those reported by Goldenhar et al. (2004) with construction personnel. These studies display the immense positive effects of social support within the offshore sample and other inherently dangerous occupations. Moreover, these studies highlight the importance of providing social support immediately following an occupational accident in order to realize the greatest benefit of its usage.

The cluster analysis was also run with the occupational groups as the clustering variable. At first glance, the results appear somewhat perplexing as occupations with drastically different job characteristics and requirements were grouped together. For example, Administration/Management clustered with Drilling, Technician/Mechanic, Production and Deck Crew. Also, the Maintenance occupational group was within the cluster containing Services, Catering, Logistics, and Medics. It would appear as though

there were only the two occupations that fell within clusters that were not a kin to there job characteristics. The fact that the Administration/Management occupational group was within the cluster that contained the oil and gas personnel (e.g. Drilling, Production, Technician/Mechanic and Deck Crew) raises a valid concern.

It is common practice to view the Drilling and Production personnel as possessing a “macho” occupational subculture. Yet, these results serve to dispel this notion as these occupational groups are found within the cluster that contains the Administration/Management group, as this occupational group must communicate and convey empathy to many employees. It would appear that these occupational groups must share a common trait in order for them to have clustered together in this solution. It may be the case that the importance of conveying social support to co-workers at all times (i.e. not simply after the occurrence of an accident) has begun to enter the industry of offshore personnel, moreover, it transcends all occupational groups. The benefits of receiving social support are not occupational specific, thus, all employees regardless of occupation will not be reluctant to perform this interaction. Another possibility is that the installations may have offered a sensitivity or communication training initiative in the last while that could have increased the amount of social support that all occupations are capable to provide. However, this is simply speculation and further investigation into the issue is required in order to clarify the underlying reason for this unexpected similarity in the occupational groups.

Social support displayed similar trends as the results of the previous two constructs (e.g. risk perception and others commitment to safety). Although there was not

a clear distinction between the sectors, I believe the same cultural phenomenon (i.e. individualism and collectivism), is dictating the expression of all the constructs. This is emphasized by the result that there were no meaningful occupational clusters formed. It is clear that the influence of nationality is not the only factor dictating the perceptions of employees for these variables, as the installation clusters that emerged are not well distinguished. Yet its influence is ever-present, it remains that national culture trends are influencing a wide spectrum of issues in many workplace locals.

Payne (2002) assessed the UK and Norway education systems and stated that the system in the UK fosters individual achievement and competition. Conversely, the Norwegian system favours group learning and team-building exercises. This is done in order to facilitate the learning of social skills (i.e. communication) and the strengths that can be attained if one works as a member within a group. The same fundamental lessons are projected into the work environment. Individuals are encouraged to discuss their daily affairs with their coworkers, and seek to guide and help one another. Thus, *communication* is a vital aspect of the Norwegian lifestyle (Payne, 2002). It could be inferred that a high degree of communication and a resulting high level social support would be prevalent within the Norwegian installations. Thus, it is somewhat of a surprise that the national cultural trends of these nations have not more strongly dictated the manifestation of social support. However, there were nine Norwegian installations that clustered together. Therefore, I would argue that the national culture trends are evident in the offshore installations as well.

In another organizational study on social support, Goodwin and Giles (2003) reported that the national cultures of Britain and Indonesia predetermined the amount of social support that would provide following a traumatic event. This national culture predetermination resulted in a relatively low amount of social support provided in the British sample, while a significantly higher level of social support was provided in the Indonesian sample. With this rationale, comparable low levels of social support could be evident in the offshore industry and this sample in particular, especially following an organizational accident. With this rationale, we would expect the present sample of installations to cluster along national culture lines, in a manner similar to the variable of attitudes to safety.

The resulting clusters displayed a distinction between many of the UK and Norwegian installations and provided convincing support for hypothesis 1 for two of the variables. It would appear as though there are significant differences in the social support level of the UK and Norway. This difference is believed to be the result of the dictates of national culture. I have argued the Norwegians favour collectivist tendencies; intuitively one would expect a culture that is focused on the well being of the group and greatly interactive to provide a high level of social support to those that require it. It is in the interests of collectivist cultures to ensure the physical and mental health of all of the members of society. And social support is but one method of attaining this end.

If we consider the UK culture, which I believe to favour more individualistic cultural norms, it is not surprising that they differed from the majority of Norwegian installations with regard to social support. It is likely that the individualistic culture

tendencies have predisposed the offshore personnel to attempt to alleviate their problems individually, rather than seeking outside help. This would also affect the levels of social support that individuals are likely to provide to others. As the results of this subscale are not conclusive, future research must investigate the area of social support.

Satisfaction with Safety Systems. It was hypothesized that the installations would cluster in two groups that differentiated between the UK and Norwegian installations. However, the results did not support this hypothesis as the installations were commingled with one another. A putative explanation for this result is that the satisfaction with the safety systems is contingent on the safety systems themselves, rather than nationality. Personnel on the installation evaluate the effectiveness of the safety measures and then make an assessment of their satisfaction with these systems. It is likely that the satisfaction with the safety systems is also dependent on the personnel's attitudes to safety, as well as the level of others commitment to safety. If a number of employees are not adhering to a safety procedure, it is unlikely that the remaining personnel will have positive attitudes towards this measure, nor will these individuals perceived all employees as committed to safety. Thus, it makes intuitive sense that the satisfaction with safety systems is directly dependent on the installations specific surroundings and the behaviour of all the personnel. This explains why there were no meaningful clusters produced from either of the cluster analyses conducted on this variable.

Job Situation. The last construct that assessed was job situation. It was hypothesized for job situation that the installations would cluster into two countries. This variable has been shown to have considerable influence and importance in occupational

stress literature (Knoop, 1994; Mikkelsen, Skasvik, Eriksen, and Ursin, 1999; Iwanaga, Yokoyama, and Seiwa, 2000). Therefore, it is of particular importance when examining an industry with preexisting high level of stressors. Mearns et al. (1997) found that job situation differed significantly across the national sectors of the UK and Norway. It appears as though the cultural values of a nation play a vital role in determining the job situations and environments, to which it's people are subjected. The legislation of these countries mirrors the values of its people and specifies how, when and where employees will work. Thus, we would expect the resulting clusters to display installation groups that have a clear demarcation between the sectors. The results of the analysis supported this hypothesis, as there were two main clusters, which differentiated between the UK and Norwegian installations. There is a fundamental difference between these two countries for their corresponding job situations and the prevailing attitudes towards the nature of work.

In Norway, the average workweek is comprised of 30 hours per week (Nextra, 2001). Conversely, in the UK, 73% of employees work less than 45 hours/week, averaging approximately 40 hours per week. The shorter Norwegian workweek could allow the personnel the potential for more leisure time to attend to their outside interests, facilitating a more effective work-life balance. However, the mental and physical well being of employees in Norway is not simply the result of a shorter workweek. Another interesting point related to the amount of hours of work per week pertained to the preference for overtime work in eight European countries (i.e. the UK, Norway, Austria, Czech Republic, Germany, Italy, Slovakia and Sweden). Respondents were asked if they

would object to working additional hours. Of the eight European countries, the Norwegians were the most willing to comply with overtime work. It would appear work in Norway is structured such that it fosters an environment where long hours are desired for 91% of the population (Nextra, 2001). However, this finding must be considered in conjunction with the unemployment and poverty levels in Norway. One might assume that the Norwegians are more prone to partake in overtime hours because there is high unemployment and poverty. However, this is not the case, the unemployment rate in Norway is approximated at 4.70 % (CIA, 2004) and 1.74 % (CIA, 2004) or 8.72 % according to the European Union (EU) live below the poverty line. Also, by the age of 15, 100 % of the population in Norway is literate (CIA, 2004). These figures are quite interesting and portray a picture of a well-educated and employable Norwegian work force. When these figures are contrasted with UK, we observe differences. In the UK, the unemployment rate is 5 %, and there is 17 % of the population living below the poverty line (CIA, 2004). These differences are contrary to notion that the Norwegians work overtime due to poverty and unemployment. If poverty and unemployment were the primary motivators for accepting overtime hours, then those in the UK would be more prone to accept them. Thus, there are some inherent characteristics in the workplace that facilitate an enjoyable work experience that does not lead the Norwegians to refuse overtime.

A report by Nextra (2001) assessed the working conditions and job situation of several European countries, which included: the UK, Norway, Austria, Czech Republic, Germany, Italy, Slovakia and Sweden. The sample was comprised of small and medium-

sized businesses (SMBs) and evaluated the attitudes of 800 European managers (i.e. 100 managers/country). There were samples drawn from several sectors: government, technology/media/telecommunications, finance and others. With respect to a progressive employment initiative such as work from home, the UK had a high proportion of participants (i.e. 39%) that have never had the opportunity to do so. Moreover, the Scandinavian countries (i.e. Norway and Sweden), 40% have the opportunity to work from home once per week and typically worked fewer hours/week than the other countries. Another interesting finding of the Nextra (2001) study pertains to the propensity to work extra, or overtime hours. The Norwegians had the highest proportion of the workers (i.e. 91%), which were willing to partake in supplemental work hours. This could denote their work environments are positive and conducive to eliciting a pleasurable work experience in the employees. Thus, they are not in opposition to working more work hours. There were also differences in the prevalence of the option to work from home, with the UK having fewer options than the Norwegians to exercise that option. These findings display the Norwegian employees are subjected to significantly different work conditions and job situations.

In the same survey of eight European countries the flexibility in work schedules was evaluated. Norway ranked third while the UK ranked fifth, for such initiatives as flexible shifts and work from home (Nextra, 2001). Furthermore, a startling 78% of Norwegians claimed that they have never had any adverse health affects associated with work. It is even more startling if we consider that they were second only to the UK at 90% (Nextra, 2001). These results suggest that the UK has also implemented a number of

workplace initiatives for the purpose of bettering their citizens. However, I believe that these initiatives are in their infancy and have not realized their true potential. There is room for improvement in order to attain the wellness levels enjoyed by the Norwegian working class.

If we examine the occupational groups within the installations, we would expect to find a cluster solution that displays no meaningful occupational clusters. Therefore, we would expect that there would be no meaningful clusters of occupation groups because their subculture would be subservient to national culture. This was supported by the data, as there were occupations with drastically different working conditions (e.g. Catering and Technician/Mechanic) and relative exposure to hazards (e.g. Drilling and Medic), inter-dispersed with one another. This could display that national culture influences the perception of job situation of offshore employees. This further exemplified the hypothesis that the nationality of the personnel determined the job situation on the installation.

Patterns and Trends

Let us collapse the results across the occupational variables to determine if a trend is evident. Once a review of all the cluster analysis conducted with installation as the clustering variable were reviewed, there were a number of interesting findings. For instance, the UK Installation 3 was found clustering with the Norwegian installations for social support. Is this due to the fact that the culture of Installation 3 has more in common with the Norwegians installations? Could this be despite that fact that Installation 3 is operated by a British organization with a greater proportion of its interest within UK installations? It is perplexing to determine the cause of Installation 3 clustering with the

Norwegian installations for the social support variable, because social support was found to be a representation of the cultural trends of a nation (e.g. collectivism and open communication), rather than installation characteristics. Perhaps within Installation 3, they have implemented an effective reporting policy following the occurrence of accidents that fosters employees to discuss their experiences openly without repercussions. It could also be the case that if Installation 3 was administering a policy the fostered social support that was not in conjunction with national culture and also was not maladaptive, it is possible that the employees would more easily subscribe to said policy and enact it within their daily lives.

UK Installation 6 showed another interesting trend displayed within the cluster analyses. For several variables in which there were clusters that divided between the UK and Norwegian installations, Installation 6 clustered within the Norwegian installations. For risk perception, others commitment to safety, Installation 6 was more similar to the Norwegian installations. Employee risk perception could be a function of the real risk within the installations rather than a manifestation of national culture. Thus, the result which displayed Installation 6 clustered with Norwegian installations was most likely the result of similar hazard exposure on the installations. The others commitment to safety cluster solution displayed Installation 6 together with the Norwegian installations. Perhaps, Installation 6 has implemented a safety policy that effectively encourages the employees to adhere to the established guidelines. Moreover, the UK installation Miller was also grouped with the Norwegian cluster for the risk perception variable. As stated previously, this could be the result of the location of the Installation 4 and Installation 6 in

proximity to the Norwegian installations. Both operate in the same local and are subjected to extreme weather conditions. Perhaps both installations require further assessment to determine if there are any other organizational similarities. This is a matter that requires further investigation in order to clarify the specific areas of similarity.

Another interesting finding pertains to the cluster analysis for the occupational groups. If we examine the clustering of the Maintenance personnel, it is apparent that this occupational group has grouped with the support staff. For risk perception, attitudes to safety, social support, job situation and others commitment to safety, the Maintenance group was clustered with the support staff. These results are not problematic due to the fact that these variables were hypothesized to have a greater influence exerted from national culture. As it has been repeatedly stated throughout the report, there are fundamental cultural differences between the UK and Norway. These differences have manifested themselves in the occupational variables measured. As a collective these results suggest that for important matters (e.g. safety and well being), individuals will depend on the value system that is most enshrined in their being. For this sample, it would appear that their national culture was such a system. This is not to say that occupational subcultures do not exist, perhaps their role is to dictate the daily affairs on the job, pertaining to non-life altering issues. A similar pattern was also displayed for the Administration/Management group. This is another occupation that grouped with occupations with dissimilar job characteristics and requirements. Social support, risk perception, and job situation are several areas that this particular occupational group clustered with dissimilar occupations. Once again, it would appear that the national

culture of these individuals has outweighed any occupational subculture they possess in their value system.

It would appear that similar to individual attitudes and value systems, a natural hierarchy of importance is displayed pertaining to the interplay between national and organizational culture. It would appear that for occupational elements that pertain to important matters (e.g. the safety and well being of persons), the prevailing national culture norms would dictate the expression and perceptions of employees. Mearns, Rundmo, Flin, Gordon and Fleming (2004) reported that perhaps the offshore personnel are “tapping into more deeply held beliefs” pertaining to safety. What is even more interesting is the hierarchy of values and culture that exists within the cultures as well. If we consider the organizational culture within the installation, some of the data display that occupations with similar environments and requirements are grouped together. However, this occurs for lesser matters that do not directly affect the well being of the individuals.

Hierarchical Linear Modeling (HLM)

All of the constructs assessed with cluster analysis were also included in one of the theoretical models evaluated by HLM. This group of analyses was conducted to clarify the relationship between these individual level occupational variables after the inclusion of organizational level characteristics. There were two levels of hypotheses for the HLM analyses, all of which are re-presented below.

Model I

Hypothesis 2: There are significant differences between the 147 groups in terms of the influence of the predictor variables on risk perception.

Model II

Hypothesis 3: There are significant differences between the 147 groups for the influence of the predictor variables on the satisfaction with safety systems.

Models I and II

Hypothesis 4: Differences in the relationships between the predictor and outcome variables within the models will be attributed to geographic sector.

Hypothesis 5: Differences in the relationships between the predictor and outcome variables of the models will be attributed to operating company.

Hypothesis 6: Differences in the relationship between the predictor and outcome variables of the model will be attributed to location.

Model I: Risk Perception. Mearns et al. (1997) conducted a MIMIC model, which assessed the influence of several independent variables on a singular latent variable. Specifically, the influence of satisfaction with safety systems, perceived working conditions and job situation and risk perception were assessed. The results indicated that satisfaction with the safety systems was the most significant predictor. Moreover, there were similar values obtained for the relative influence of the other variables across the geographic sectors of operation. Mearns et al. (1997) postulated that poor working conditions and safety status might simultaneously affect both job situation and risk perception. Moreover, it could be possible that both organizational membership and nationality were jointly exerting an influence on risk perception. However, this question could not be answered conclusively with the analysis conducted by Mearns et al. (1997). The present study utilized HLM in order to answer this, as well as a number of other concerns.

The evaluation of Model I pertained to the outcome variable risk perception and its level 1 and 2 predictor variables. The goal of this analysis was to determine the nature

of the relationships between the level 1 predictor and outcome variable. If significant relationships existed, the following step was to ascertain the influence of the organization level variables on these relationships.

The results of the WABA HLM step revealed that there was no significant variance in the intercepts (i.e. mean levels) of the risk perception for the constructed groups. In other words, the average of the risk perception scores of the groups was not significantly different from zero. This could reflect that the individuals on the installations perceived little or no risk; however, this is highly unlikely. It is possible that with the number of participants, statistical regression towards the mean was occurring, which could have biased the results. Yet this is not clear at this point and future research is required in order to clarify this result.

The random coefficients model was then conducted. The slopes (i.e. beta weights) between the three (others commitment to safety, satisfaction with safety systems and job situation) of the level 1 predictors and risk perception were significantly different between the groups ($p < 0.05$). Moreover, all of the relationships were positive, except for that between attitudes to safety and risk perception. If the scoring of the items is reviewed, the very satisfied (i.e. positive) items were scored as “1’s” and the not very satisfied (i.e. negative) items were scored as “5’s”. Thus, as the personnel were not satisfied with each of these variables, the recorded scores were closer to “5’s”. This would denote that as the personnel perceived each of the variables in a more negative light, their perception of risk or hazard exposure increased.

This relationship seems to make intuitive sense if we consider the others

commitment to safety variable. If personnel view their coworkers as not committed to safety, they would rate this subscale with values closer to the negative end (i.e. “5’s”). In turn, as the safety commitment on the installations was not high, they would also view their hazard exposure as increasing as the safeguards in place for their protection were not being adhered to. The same can be said for the satisfaction with safety systems subscale. The more dissatisfied the personnel are with the safety measures, the closer the scores for these items are to “5”. This would influence their perceived level of risk. If they were not satisfied with the safety systems, they would perceive a proportionate increase in their risk perception. This was the strongest relationship of the three predictor variables. Job situation also displayed a similar relationship with risk perception. As the personnel viewed their job characteristics negatively, the more their risk perception increased. Once again, if one’s job situation is viewed negatively it is highly probable that their perception of the risk on the installation will also be elevated.

The other significant relationship was between attitudes to safety and risk perception and it was negative in direction. This is quite interesting because one could assume that if an offshore employee had negative attitudes towards safety, they too would have an increased perception of risk. Alternatively, if an employee had an elevated perception of risk, they would likely have negative attitudes to safety. At this point it is unclear why this relationship was displayed in the data. However, if we review the reliability estimates of this measure, it casts substantial doubts on the reliability of this measure.

The reliability estimates reported by HLM of each of the predictor variable

subscales were all extremely low (e.g. 0.006 to 0.191). This result casts doubt on the consistencies of the samples utilized in each of the analyses and suggests the data set could require extensive screening and revision. This was unexpected because this sample has been evaluated numerous times in previous studies (Flin et al., 1996; Mearns et al., 1997).

It is likely that the measures need to be reevaluated if they are intended for future use within cross-cultural research. Perhaps these scales are overlooking important sub-factors within each construct that would account for significant proportions of variance in risk perception. If we consider the results of the significant relationships between the level 1 predictors and risk perception, it raises major concerns. For instance, are the results a true representation of the perceptions and attitudes of the offshore personnel, or has the data been compromised by poor nature of the questionnaire? There still remain significant concerns pertaining to the integrity of the measure.

Another drawback occurred with the review of further result of the random coefficients model. Analysis of Model I displayed that very little variance could be accounted for by the level 1 variables. When the variance components of these variables were reviewed, there was a non-significant proportion of the variance explained for each of the three significant predictor variables ($p > 0.05$). This suggests that the slopes do not have significant variance between the groups. Hypothesis 2 stated there are significant differences between the 147 groups in terms of the influence of the predictor variables on risk perception. Although there were significant relationships between the predictor and outcome variable, these relationships did not differ significantly between the groups.

Thus, there was no support for hypothesis 2. The predictive relationships with risk perception did not differ significantly between the groups; the results did not support this hypothesis. Thus, there is no variance to be explained by the level 2 variables and the final level of the analysis was not conducted. Despite the lack of variance accounted for by the level 2 variables, it does not negate their importance in the examination of offshore safety attitudes. Because the initial hypothesis for Model I was not supported, in turn there is no support for Hypotheses 4, 5 and 6.

Rundmo (1992) showed that the constructs of risk perception and job situation were significantly related to the perception of safety and satisfaction with safety on an offshore installation. These previous findings contradict the results of the present study. Furthermore, poor job situation and safety systems can lead to negative changes in risk perception (Flin et al., 1996a). Results of their path model determined that risk perception is an important construct worthy of further investigation because numerous physical, organizational, and social variables influence this variable. As previously stated, Mearns et al. (1997) viewed risk perception as an important outcome variable, yet this conceptualization was not supported with the present results. The results of Model I left many questions unanswered. Yet, the relationships, although no significant variance across groups, still displayed dynamics that were intuitively in the right direction. It is clear that future research is required to clarify the nature of this relationship.

Model II: Satisfaction with Safety Systems. Mearns et al. (1997) presented a model in which, others commitment to safety, attitudes to safety, and social support were predictors of the outcome variable satisfaction with safety systems. There results

displayed similarity of the strength of these variables in predicting the employees' satisfaction with safety systems across national borders (Mearns et al., 1997). The predictors accounted for 38% of the variance in the UK and 28% of the variance in Norway. Because of their cross-border importance, the current analysis maintained these variables as predictors in the HLM analysis of satisfaction with safety systems.

The WABA analysis OLS final estimation of fixed estimates results showed that there was not significant difference in the intercepts of the groups from zero for satisfaction with safety systems ($t(143) = -0.546, p > 0.05$). However, the variance component of the satisfaction with safety systems displayed that there were significant differences in the slopes of the groups ($X^2(2, n = 147) = 310.353, p < 0.05$). The significant variance components established to total amount of variance in the slopes and intercepts, and I proceeded to the next level of analysis.

The random coefficients model OLS final estimation of fixed effects showed that two level 1 variables, others commitment to safety ($t(143) = 9.761, p < 0.05$) and social support ($t(143) = 6.990, p < 0.05$) had significant differences in their relationships with satisfaction with safety systems across the groups. The variance components of the random coefficients model also displayed significant variability for others commitment to safety ($X^2(2, n = 147) = 147.403, p < 0.05$) and social support ($X^2(2, n = 147) = 149.055, p < 0.05$). Hypothesis 3 stated that there were significant differences between the 147 groups for the influence of the predictor variables on the satisfaction with safety systems. The results supported this hypothesis.

This provided further support to proceed to the slopes as intercepts model of the analysis. One must interpret the results with caution as there is an issue with the df for the variance components. The $df = 108$ for the two analyses, displaying that there were not enough representation of each of the constructed groups in order to effectively complete the analyses. To remedy this concern, in future research a more representative sample of all the occupational groups would result in a more complete analysis.

The aforementioned results are not surprising if we consider the outcome variable, satisfaction with safety systems. It makes intuitive sense that if we view others as committed to the safety system, the system is more likely to be operationally effective and safeguard the well being of employees. In turn, this will increase the amount of satisfaction that is held by the employees working within this system.

For the significant differences for the social support variable, the relationship most likely shares some of the rationale with the previous construct. If an accident occurs on the installation, it is important that the proper support system is in place to provide the employees involved, the time and consideration required to return to optimal physical and mental health. Therefore, if an employee is unfortunate and finds him/herself involved in an accident, effective social support would facilitate their rapid recovery (Sherman et al. 2004; Goldenhar et al. (2003). This in turn will increase their satisfaction for the safety systems and alter the perception of others commitment to safety following accident involvement. Moreover, this beneficial experience will only be transferred to other employees through first-hand exposure, as well as word of mouth communications. It can

be observed how these two constructs have a significant relationship with the satisfaction with safety system levels.

The results of the slopes and intercepts as outcomes model were unsupportive of the initial hypotheses. When the level 2 variables were added to analysis, only the intercepts of the level 1 predictors (others commitment to safety ($t(1586) = 2.577$, $p < 0.05$) and social support ($t(1586) = 2.007$, $p < 0.05$) had significant predictive relationships. There was no significant affect on these relationships exerted by operating company, sector or location. Hypothesis 4 stated differences in the relationships between the predictor and outcome variables within the models will be attributed to geographic sector. This hypothesis was not supported by the results. Hypothesis 5 and 6, which stated that, differences in the relationships between the predictor and outcome variables of the models will be attributed to operating company and work location. These hypotheses were also not supported by the results; there was no significant affect for any of the level two variables in predicting the differences in the slopes.

As it can be observed the relationship between operating company and satisfaction with safety systems was positive, while the relationship between location and the outcome variable was negative. Yet, both of these relationships were non-significant. As these two variables were categorical in nature, it is difficult to discern that exact nature of these relationships. However, this does not reduce the importance of including more extensive measures of these entities in future studies of offshore petroleum safety.

The negative relationship suggests that as the higher the value of the location variable, the lower the level of others commitment to safety. This would be displayed as

“inside employees” having a lower commitment to safety than “outside employees”. If we consider social support and its negative relationship with location, it could be displayed as “inside employee” giving lower levels of social support than the “outside employees”. This could insinuate that there are characteristics of the location of work that influence the safety attitudes of personnel.

One could speculate about the characteristics of the level 2 variables that could account for the difference in the relationships. A key difference between the two work locations is the term of employment. The deck crew are typically long-term staff, while those personnel that work within the confines of the installations are temporary staff. This is of particular importance as the most rapidly growing form of occupation in the United States is temporary employment (Reiners, 1999), it was important to consider this variable in the present study. Although the present sample is comprised primarily of Europeans, this occupational trend is likely to transcend continental borders in the coming years. Parker, Griffin, Sprigg and Wall (2002) investigated the effects of employment status on perceived work characteristics in 257 UK employees. They reported that there were significant differences between the attitudes of temporary and permanent employees for job security, and decision-making. The permanent employees possessed higher satisfaction for each variable and were also more committed to the organization. Moreover, the temporary employees reported lower job strain that was proposed to be the result of their reduced organizational role demands (Parker et al. 2002). It is likely that these findings would transcend all occupations including offshore oil and gas.

When variance components of the level 1 variables were reviewed, there was significant variability in these slopes that remained unexplained after the addition of the level 2 variables (others commitment to safety ($X^2(2, n = 147) = 142.081, p < 0.05$) and social support ($X^2(2, n = 147) = 131.133, p < 0.05$). A possible explanation for this unexplained variance is the result of the nature of this study. As the study was retrospective in nature and involved the reanalysis of preexisting data, no additional information was collected. Thus, I was limited to the examination of the existing data and the formulation of new variables that were categorical in nature. As a result, there were no measures administered that ascertained the exact nature the level 2 variables. It is likely that there is a wealth of information that was not collected about the operating company and the work location.

If the results of operating company are reviewed, it clear that it did not have a significant affect on the relationships between any of the level 1 predictors and the outcome variable. Moreover, the non-significant affects that were displayed with the level 1 predictor variables were both positive and negative. These results make it difficult to determine the exact cause of these conflicting results. Moreover, interpretation is complicated because the variable contains no specific information. In order for an accurate assessment of the influence of the operating companies, a valid measure of organizational culture must be administered to participants to pinpoint precise differences in organizational objectives and approaches. Only with this information can the true affect of organizational culture be ascertained.

It must be reported that the variable of sector did not have a significant affect on any of the variables. As this variable was included as a proxy measure of national culture, I still strongly believe that with a proper measure of national culture, a significant portion of variance would be accounted. There were several level 2 variables that could potentially account for significant differences in the relationships between the level 1 and outcome variables; however, it is likely that the poor nature of the data did not meaningful analysis. I must emphasize that I still believe that a proper assessment of the level 2 variables would account for a larger portion of variance in the level 1 predictors. It is clear that a more accurate measures of the organizational level variables is essential for the proper evaluation of these complex relationships.

Another interesting finding within Model II was that the attitudes to safety variable also approached significance. This is not surprising if we consider the rational presented for the previous two constructs. It would appear as though all of these attitudinal constructs are related to some degree and display similar affects on the satisfaction with safety systems variable. It is unclear as to why the attitudes to safety systems also did not reach significant levels. Perhaps the items of the measure did not accurately evaluate all aspects of the construct. A revision of the items could lead to a more accurate assessment of the variable and lead to significant results. We must also consider that the poor nature of the level 2 variables also underestimated the influence of the organizational level variables. Thus, if a revision of the items assessing attitudes to safety was conducted and more effective level 2 measures were administered, I believe that this variable would also display significant differences in intercepts and slopes.

Implications

As global companies are becoming “mainstream”, organizations are operating in unfamiliar territory. The need to understand the local cultures is imperative if success is to be realized across borders. It is only through cross-culture research, such as within the present study, that we as a people can begin to understand the subtle differences that exist in the manner in which the citizens of the nations of the world conduct themselves in their daily affairs as well as in their professional lives. As the media brings the nations of the world closer together, there is an ever-increasing need to understand one’s “global neighbor”. As companies transcend international borders the need for local employees is paramount in order to ensure that the organization will be met with understanding and compassion, rather than being viewed as a bully entering to exploit the needy. Employing local personnel ensures an organization’s willingness to establish a positive relationship with a nation and its people. Working in conjunction with a nation is more apt to result in an effective working relationship, rather than entering a country and attempting to conduct “business as usual”. We as researchers must display the importance of accommodation over assimilation when organizations become international, such that cultural diversity is maintained and work teams with multiple perspectives are fostered.

A specific situation in which cross-cultural knowledge is imperative occurs within mergers and acquisition (M & A’s). Many organizations involved in M & A’s become international in scope (David, 2004). Thus, when this form of business interaction occurs, not only must the resulting merged organization accommodate the differing national cultures, but they also must consider the different organizational cultures. Due to the fact

that M & A are an extremely complex and detailed process, organizations could benefit from organizational teams that are comprised of diverse individuals. Work teams that are composed of heterogeneous members are more productive for complex tasks and are more creative (Basadar and Head, 2002), and this is a prime situation in which these skills are necessary. Also, this would result in a team that is more representative of the population outside of the team. In this situation, knowledge pertaining to national and organizational culture is imperative. These organizations must seek to keep the majority of the employees positive and commitment to the newly formed entity.

If we consider accident involvement and recovery, the discussion must include the topic of social support. The differing benefits that can be reaped by immediate and long-term social support must be harnessed by the offshore industry. This provides a goal for the offshore industry; both forms of support should be aspired to by the offshore industry. The immediate and long-term support could be provided by an onsite grief/accident councilor. This would increase the benefits incurred through social support for the long-term and likely speed the mental recovery of accident victims. Moreover, as social support has also been found to reduce the occurrence of accidents, it could also decrease LTI and increase the margin of profit. It is essential that the industry provide effective social support to all their employees in order to maximize its benefits.

It is clear that researchers and practitioners alike must come to a better understanding of safety, especially in high reliability industries. Evidence from the initial analysis suggested that installation characteristics exerted on strong influence on workplace attitudes of personnel. As the attitudes that were assessed pertained to the

workplace, perhaps organizational membership played a stronger role influencing employee perceptions. However, if one were to assess attitudes more closely held to the individual and dealing with constructs outside of the organization, nationality would exert a more pronounced influence. Further investigation of the influence of these two cultural entities is required on a wider array of attitudes to clarify the nature of these relationships. The recognition of the various influences of culture and the implications they have on organizational issues such as safety, have great relevance to safety officers and management operating in culturally diverse regions and across national borders.

Future Research

There is a need to further examine the occupational groups within the offshore installations to determine the putative presence and strength of occupational subcultures. As there was the emergence of sector groups, it is clear that risk perception is a variable that is influenced by the national culture of individuals'. Yet, we still cannot rule out the influence of the immediate surroundings and occupational characteristics as having a role in determining personnel risk perception. This is an important finding because it once again exemplifies the wealth and importance of information that is possessed by the front-line staff. It is to these employees that an organization must seek guidance from when they are attempting to instill organizational change initiatives in areas such as organizational health and safety.

Another important finding that must be assessed involves the composition of the sample. As the most rapidly growing form of occupation in the United States is temporary employment (Reiners, 1999), it is important to include this variable in future research. I

believe that there is a difference in the subculture of the two employment types, which is likely differentiated by work location as well. Parker, Griffin, Sprigg and Wall (2002) investigated the effects of employment status on perceived work characteristics in 257 UK employees. They reported that there were differences between temporary and permanent employees for job security, and decision-making, with permanent employees possessing higher satisfaction for each variable. Moreover, the temporary employees reported lower job strain that was proposed to be the result of their reduced organizational role demands.

It is my contention that those individuals in the contract employment possess a weaker organizational culture. Therefore, they will not be influenced by the organizational culture to the same magnitude as long-term employees. This will result in a differential impact of this variable on the group differences present at level 1. This variable could also influence the influence of geographic sector. Essentially, if an individual is not strongly affiliated with the organizational culture, perhaps they more strongly associate with the national culture.

Another study could utilize HLM to assess the longitudinal nature of the safety attitudes. It has been said that HLM is effective in the evaluation of nested variables, and multiple assessments within individuals could also be conceptualized as a nested variable. Therefore, HLM could be used to assess the degree of change across time within installations and individuals. A future study could involve the reassessment of the installations utilized presently. This could result in a longitudinal analysis that would track the changes in the occupational variables.

A potential project could involve the expansion of the sample. In order to ascertain any further commonalities or differences cross-culturally, the sample could be expanded in order to include installation from the American and Canada sectors. This would serve to examine the culture on both sides of the Atlantic Ocean, in varying environments and national culture. It is probable that the American and Canadian national cultures will mirror that of the UK, therefore, another collectivist nation such as China will need to be assessed in order to gain a more balanced sampling. However, such a project would provide a more comprehensive investigation into similarities and differences between national and organizational cultures.

If one desired to compare and contrast several industries, this would also be a project with great merit. As the results from this study have suggested, national culture has the ability to over-ride the influence of organizational and occupational culture. It was the choice of the researcher to label the influence of the organization and occupation as subcultures. However, is the case for all occupations in and industries? Are organizational and occupational cultures truly “subcultures”? Does this hierarchy of cultures apply equally to occupations in which your co-worker may have your life in their hands? In occupations such as the military and to a lesser degree law-enforcement, perhaps the organization and the smaller occupational units might exert a greater influence on the attitudes and behaviours of its members. At the very least, the influence of these *subcultures* may be stronger than the influence displayed in the offshore sample. This is a question that will require extensive research to clarify the nature of this complex relationship.

Limitations

Although there were 10 occupational groups assessed in the study, there was a concern in this regard. Their sample sizes for each occupation were not equivalent and often disproportionate. This could have led to results that were unrepresentative and biased. Thus, it is plausible for a future study within this industry to attain a more holistic and representative sample of all occupational groups. HLM presents a potential solution to this problem. HLM allows one to “borrow strength” when there are not enough individuals in each of the subgroups. This process combines information from various sources in an effort to attain an estimate of “pooled” variance (Raudenbush & Bryk, 2002). This could involve ‘pooling’ smaller occupational groups within the same sector. Although this could combat the problem of limited sample size in each of the subgroups, it does not occur without a cost. Conducting the “borrowing strength” procedure increases the potential for error; moreover, it can decrease the accuracy of the hypothesized equation. Thus, there must be great empirical rationale and imperative to execute this procedure.

Another issue that is related to small sample sizes pertains to the size of the entire data set. Although there were approximately 1600 personnel evaluated for the present study, there exists a concern about the number of groups. Although there are no concrete rules dictating the necessary number of groups to conduct an HLM analysis, it has become convention that a minimum of 30 groups is required to successfully complete the operation. Within the present analysis, there were a total of 28 groups. Although this is below the “required” minimum, it provided little resistance when conducting the

procedure. It was not believed to have significantly limited the strength of the obtained results. It seems highly unlikely that a greater number of occupational groups could have been obtained because the entire spectrums of occupations within an offshore installation were sampled. Thus, there may not be enough occupational groups to satisfy the recommendations; however, this does not negate the importance of examining this population of employees. It is unlikely that the results would have been different if more groups had been obtained. This may be an issue for future research to address.

A concern with the present study occurs when one examines the composition of the sample. Almost the entire sample was male. This is not the result of poor data collection, it the nature of the offshore industry, it is dominated by men. With the exclusion of an adequate proportion of females, we must ask ourselves:

- Are the results accurate, or could they be biased?
- Are the results generalizable?

Although the dominant male proportions are the trends in the industry, perhaps a future study in which the patterns and attitude of a greater number of women are evaluated would provide a more holistic review. Branzei (2002) demonstrated that cultural values affected the types of organizational goals that were pursued by employees. Moreover, there was a significant affect of gender. A study involving a more comprehensive sample would provide results that are reflective of the entire population. Researchers could look to draw a comparison between similar industries that contain a higher proportion of women. It could be the case that women have attitudes that are quite

different that the male population sampled in the present study. This not the only concern pertaining to the composition of the sample.

Range restriction was likely a factor in the sample. As I was interested in the differences between individualistic and collectivist values, it could be that the UK and Norway are more similar than not with regard to this cultural facet. If we conceptualize the individualism-collectivism facet as a spectrum, it could be the case that the UK and Norway would fall closer to the center and not in the extreme left or right. This would result in national cultural values that were more similar to each other than not. This could have lead to non-insignificant results for a number of the predictors in the models; moreover, it could have lead to poor distinction between the resulting clusters. If one were to asses two countries that were more “distinct” in terms of their levels of individualism-collectivism, perhaps there would be a clearer distinction between their values and in turn their clustering. This requires further investigation.

When one reviews the questionnaire itself, there are a number of issues that arise. Although the Offshore Risk Perception Questionnaire has been utilized in many studies (Rundmo, 1990; 1992; 1994; Mearns, et al. 1997; Fleming, 1998), this does not guarantee that it is consistent and reliable. Through the analysis of the present results, it would appear as though there should be concerns pertaining to the reliability of the measure and its continued use in the offshore population. The relatively low reliabilities of two of the subscales raise concerns about the reliability and validity of the measures themselves. These results casts doubt on the consistencies of the measures and suggest that their content and the items themselves could require extensive revision. One should ask

themselves if the results a true representation of the perceptions and attitudes of the offshore personnel or has the data been compromised by the poor nature of the questionnaire. As the HLM results display the low reliability estimates for the subscales, one must also question the nature of the sample and contemplate further screening before future research and analyses. There still remain significant concerns pertaining to the integrity of the measure. It is clear that a reanalysis of the reliability of the questionnaire must be conducted prior to its use in future studies and publications.

It is possible that the multiple translations that occurred during the formulation of the final questionnaire could have affected the language and content, and generalizability. Perhaps an extensive re-evaluation of the nature of the items in the scale and the form of the translation is required in order to ensure the scale is accurate. Despite the fact that the scale has been used in several studies, it does not negate the possibility that a number of the items may still be biased. It would be feasible to conduct a further reliability analysis on the scale and possibly remove or revise any items that display aberrant patterns.

The present study was a re-analysis of data that had previously been collected. No new data was obtained in order to answer the hypotheses of the study. A limitation of conducting a re-analysis of an existing data set is the researcher is forced to evaluate the theoretical relationships between the data collected during the original study. The result of any study can be compromised by model misspecifications and the omission of essential variables (Goldher et al. 2003), and it is likely that this problem has plagued the present study.

This issue is of quite relevant when one examines the significant results of the HLM analyses. In the present study there was no opportunity to collect any supplemental information to clarify the nature of previous results. Although, the slopes between several outcome variables and level two predictor variables (e.g. installation and company), were found to be significantly different between the groups, we have no further information that localizes specific areas within these level two predictors that could account for more of the variance in the outcome variables. In a future study, it would be adventitious to collect information pertaining to a wider array of the characteristics involved with the installations, companies and nations. This would allow for the accurate and inclusive explanation, and would likely account for a greater proportion of the variance that remains unexplained.

The HLM analyses displayed that the influence of sector, the proxy measure of national culture, was non-significant in all of the permutations that were executed. This could also be due to the fact that a single item represented the influence of national culture. Perhaps if the questionnaire had included a number of items representing a wider array of the components of the national culture, we would have been able to account for more of the variance that was present in the slopes and mean differences of the groups evaluated in the present study.

There are several variables believed to have an intricate role within the Model I relationship. A number of the variables have been used as both predictor and outcome variables (Mearns et al., 1997). Perhaps the nature of relationship is incorrect. It may be that we are omitting crucial variables that would more accurately predict risk perception.

However, as the present study is a reanalysis, we are limited in the variable at our disposal. In future research, it may be worthwhile to include a wider array of organizational variables to better predict risk perception. It could also be the case that the direction of the relationship is not yet correct. Perhaps risk perception is predictor in the relationship with another outcome variable.

The models assessed through HLM were inspired by the path models of Mearns et al. (1997). The models were simplified for the HLM analyses, and many of the interrelations between the predictor variables were not evaluated in the present study. Although the HLM 5.0 program has great computational power, the researchers believed that the entering of a model with multiple interactions may have overwhelmed the program and produced results that were biased. Additionally, the entering of all of the level 1 predictor variables at the same time could also have overwhelmed the computational power of the program. In a future if there multiple predictor variables, perhaps they should be entered individually in order to determine their differential impact on the models. The absence of the previously determined interactions could also have led to results that do not articulate the entire relationship among the variables. However, at this point HLM 5.0 is not designed to undertake that depth of analysis, we will have to be patient until the program has the capacity to assess complex multi-level interactions to ascertain the true relationship between these models.

Tables

Table 2

Component matrix for the risk perception subscale

Rotated Component Matrix

	Component		
	1	2	3
explosion	.187	.822	.317
fire	.233	.825	.277
blow out	.180	.829	.255
toxic gas	.356	.703	.093
shock	.531	.376	.157
burning	.654	.151	.133
crushing	.702	.289	.041
slipping	.678	.143	.113
lower level	.734	.191	.234
falling object	.683	.178	.251
weather and wind	.516	.050	.444
sabotage	.093	.186	.744
falling overboard	.472	.187	.530
helicopter crash	.174	.307	.758
vessel hitting	.192	.198	.767
structural	.279	.443	.492

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 5 iterations.

Table 3

Component matrix for the satisfaction with safety systems subscale

Rotated Component Matrix

	Component		
	1	2	3
safety control	.589	.407	.180
PTW system	.563	.296	.216
safety instructions	.704	.337	.130
follow up after accident	.700	.262	.121
first aid training	.721	.091	.119
emergency response training	.672	.087	.248
housekeeping	.225	.683	-.009
safety devices on machines	.133	.656	.277
escape routes on the platform	.223	.701	.250
marking and sign-posting	.222	.642	.248
availability of personal safety equip	.289	.530	.302
reliability of alarms	.267	.232	.789
fire and gas detection	.229	.197	.862
deluge system	.166	.247	.782
temporary refuge	.352	.424	.382
safety officer	.573	.285	.384

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Table 4
 Component matrix for the job situation subscale
Rotated Component Matrix

	Component			
	1	2	3	4
own work pace	.723	.170	.021	-.001
know what others	.076	.023	.814	.131
several tasks	.097	.040	.063	.753
planned in detail	-.357	-.004	.308	-.475
short breaks	.675	.155	-.076	.011
expect from others	.173	.266	.612	.081
work independently	.730	.031	.211	.051
work in own way	.778	-.009	.194	.047
tasks varied	.186	.225	.150	.338
busy periods	.386	.042	-.036	-.618
influencing supervisors	.382	.456	.219	.195
satisfied with info	.064	.739	.146	-.123
consulted before	.187	.763	.051	.152
communication between main	.064	.737	-.021	-.067
communication				
crew changes	-.021	.621	.254	.115
contradictory orders	.050	.209	.449	-.306

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 5 iterations.

Table 5
 Component matrix of the attitudes to safety subscale
Rotated Component Matrix

	Component			
	1	2	3	4
ignore safety regs for production	.495	-.015	.317	-.310
production before safety	.761	-.064	-.058	.042
most accidents could be prevented	.015	.542	-.048	.338
safety rules make it difficult to keep up with prod	.595	.135	.112	.128
I point out breaches in safety	-.198	.204	-.161	.620
necessary to take chances	.552	-.067	.389	-.095
small accidents indicate more serious ones could occur	.048	.714	-.135	.004
accidents due to bad management	.177	.725	-.097	-.112
Pointing out Breaches of Safety Instructions	.607	-.045	.134	.048
good proposals stopped if cost too much	.607	.242	-.010	-.049
accident prone	.311	-.108	.148	.747
machines make accidents unavoidable	.221	-.066	.634	.249
accidents due to human failure	-.112	.532	.326	.061
accidents just happen	.063	-.031	.694	-.314
never think about the risks	.075	-.015	.608	-.002

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 5 iterations.

Table 6
Component Matrix of others commitment to safety subscale
Component Matrix

	Component
	1
fellow workers	.689
yourself	.568
safety rep	.768
safety rep	.772
trade union	.566
medic	.735
current supervisors	.763
platform management	.739

Extraction Method: Principal Component Analysis.
a 1 components extracted, therefore it cannot be rotated

Table 7
Component matrix for social support subscale
Rotated Component Matrix

	Component			
	1	2	3	4
supervisor support	.094	.888	.014	-.025
fellow workers sp	.408	.504	-.009	.202
safety rep	.657	.247	-.015	-.203
family	-.027	.044	.747	-.030
friends onshore	-.010	.029	.904	-.006
supervisor job prob	.156	.867	.010	.003
fellow workers jobprob	.573	.421	-.013	.247
safety rep job prob	.754	.222	-.014	-.129
supervisor pers prob	.364	.666	.037	-.045
fellow workers pers prob	.699	.236	.030	.200
safety rep job prob	.839	.046	.030	-.134
medic pers prob	.144	-.073	.000	-.184
own family personal prob	.041	-.081	.001	.871
friends onshore personal prob	.050	-.036	.746	.036

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 6 iterations.

Table 8
Risk perception HLM WABA variance components
Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	df	Chi Square	P value
Intercept	0.15618	0.02439	143	263.5547	0.000

Table 9
Risk perception HLM random coefficients model variance components
Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	df	Chi Square	P value
Intercept	0.09564	0.00915	99	134.6866	0.010
<u>Other Commt.</u>	0.01491	0.00022	99	89.9252	> 0.500
<u>Satis. Safety</u>	0.04357	0.00190	99	96.9255	> 0.500
<u>Job Sit.</u>	0.03435	0.00118	99	80.7652	> 0.500
<u>Attitudes</u>	0.03134	0.00098	99	88.0735	> 0.500

Legend

<u>Other Commt.</u>	Others Commitment to Safety
<u>Satis. Safety</u>	Satisfaction with Safety Systems
<u>Job Sit.</u>	Job Situation
<u>Attitudes</u>	Attitudes to Safety

Table 10

Satisfaction with safety systems HLM WABA variance components
Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	df	Chi Square	P value
Intercept	0.17742	0.03148	143	310.3536	0.000

Table 11

Satisfaction with safety systems HLM random coefficients model variance components
Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	df	Chi Square	P value
Intercept	0.14164	0.02006	108	199.0523	0.000
<u>Other Commt.</u>	0.12654	0.01601	108	147.4038	0.007
<u>Attitudes</u>	0.09422	0.00888	108	131.5648	0.061
<u>Social Supp.</u>	0.46961	0.22053	108	149.0559	0.006

Legend

<u>Other Commt.</u>	Others Commitment to Safety
<u>Attitudes</u>	Attitudes to Safety
<u>Social Supp.</u>	Social Support

Table 12

Satisfaction with safety systems HLM slopes as intercepts model variance coefficients
Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	df	Chi Square	P value
Intercept	0.11386	0.01296	102	156.4617	0.001
<u>Other Commt.</u>	0.13086	0.01712	102	142.0805	0.006
<u>Attitudes</u>	0.12234	0.01497	102	131.5153	0.026
<u>Social Supp.</u>	0.17239	0.02972	102	131.1334	0.027

Legend

<u>Other Commt.</u>	Others Commitment to Safety
<u>Attitudes</u>	Attitudes to Safety
<u>Social Supp.</u>	Social Support

Figures Captions

Figure 5. Risk perception clustered into installations.

Figure 6. Risk perception clustered into occupational groups.

Figure 7. Attitudes to safety clustered into installation.

Figure 8. Attitudes to safety clustered into occupational groups.

Figure 9. Social support clustered into installations.

Figure 10. Social support clustered into occupational groups.

Figure 11. Job situation clustered into installations.

Figure 12. Job situation clustered into occupational groups.

Figure 13. Others commitment to safety clustered into installations.

Figure 14. Others commitment to safety clustered into occupational groups.

Figure 15. Satisfaction with safety systems clustered into installations.

Figure 16. Satisfaction with safety systems clustered into occupational groups.

Figure 17. Model I level 1 HLM with beta weights.

Figure 18. Model II level 1 HLM with beta weights.

Dendrogram using Ward Method

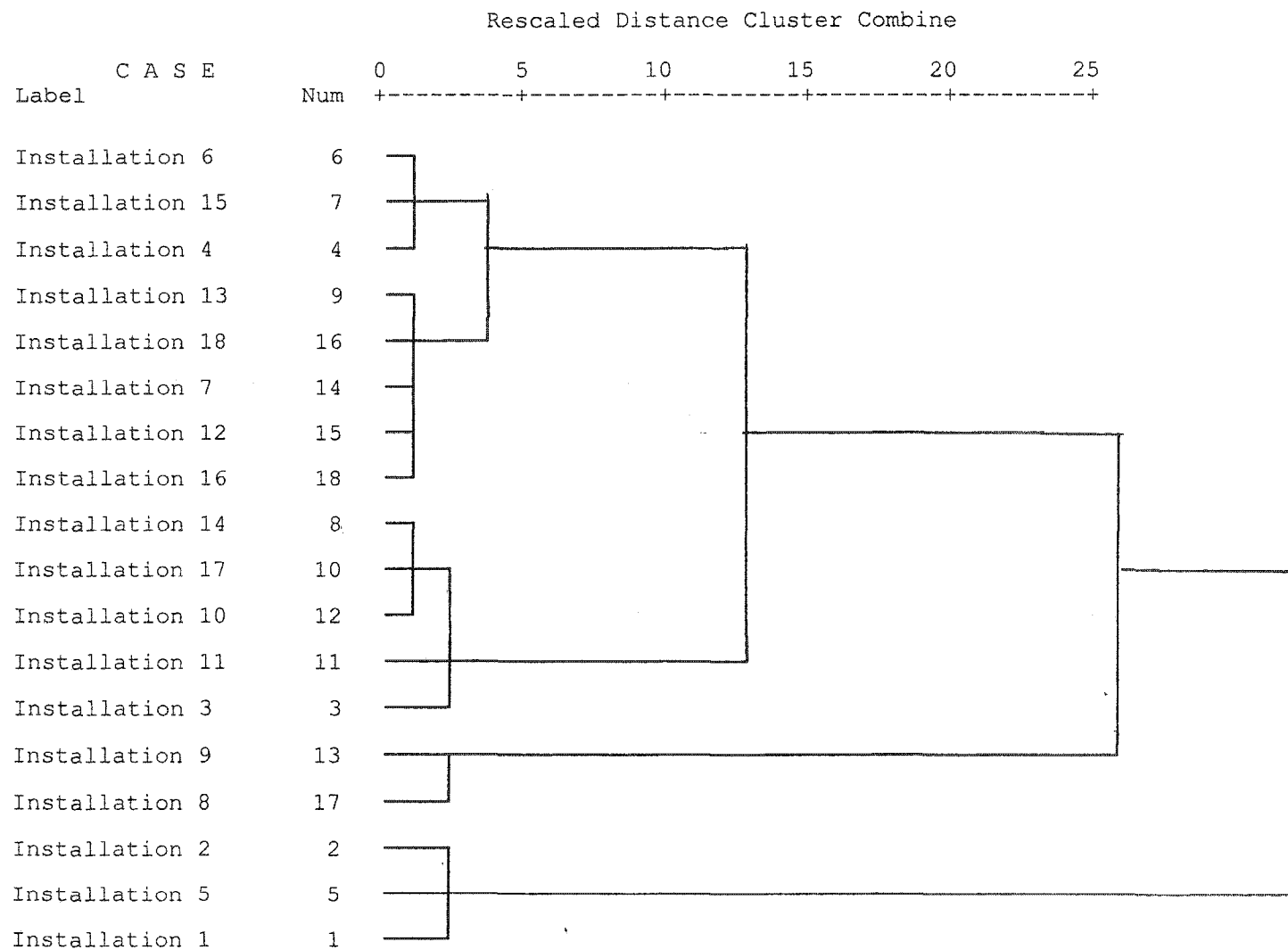


Figure 5. Risk perception clustered into installations.

Dendrogram using Ward Method

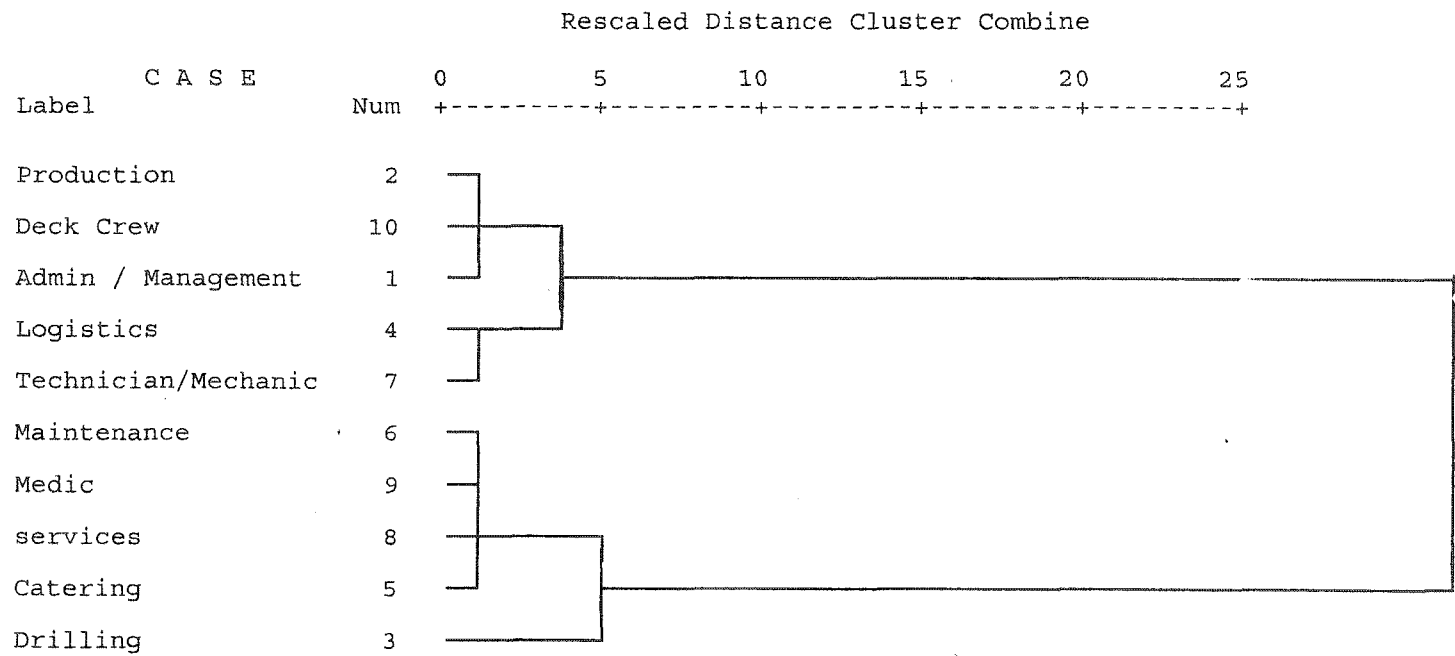


Figure 6. Risk perception clustered into occupational groups.

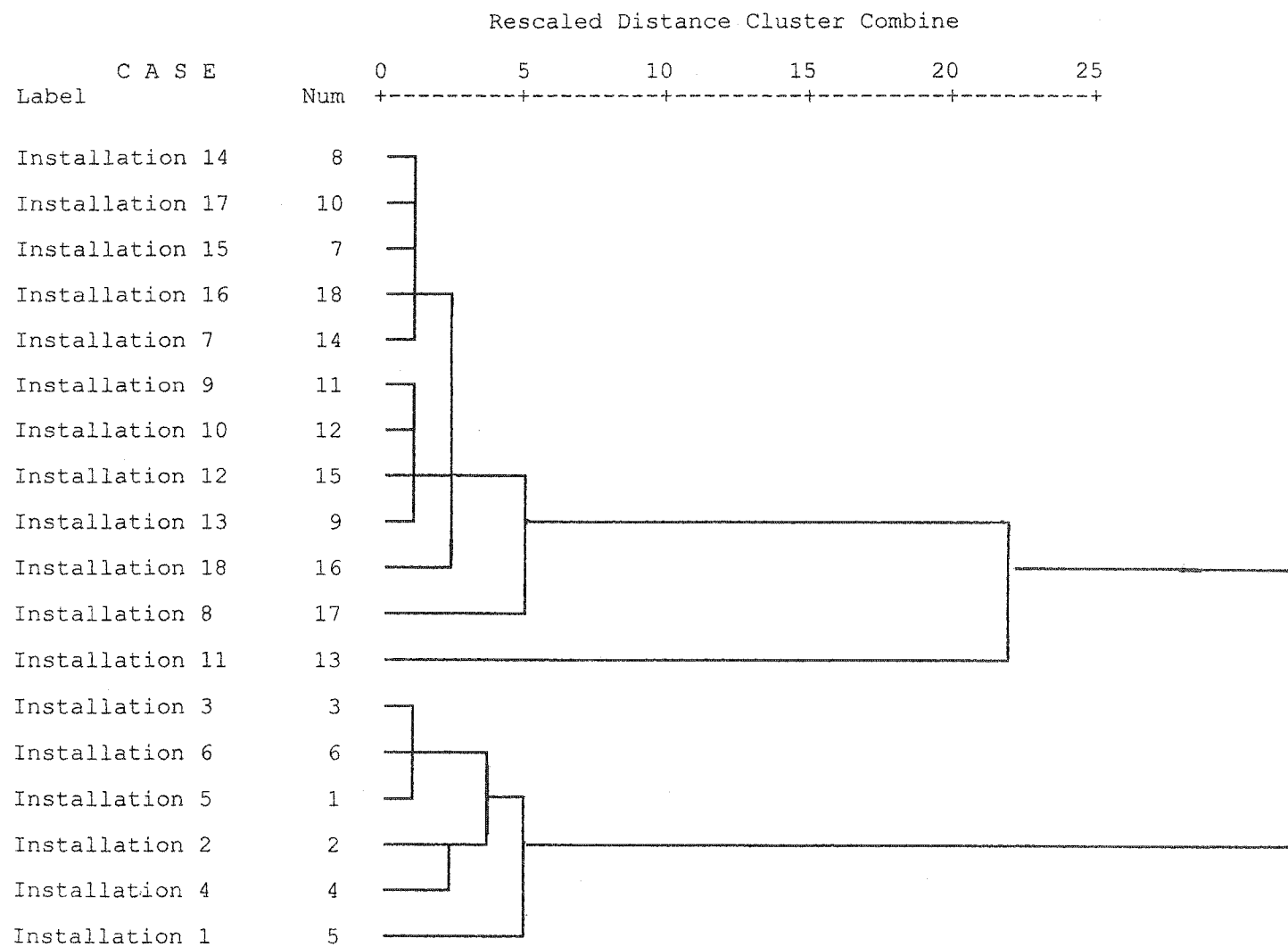


Figure 7. Attitudes to safety clustered into installation.

Dendrogram using Ward Method

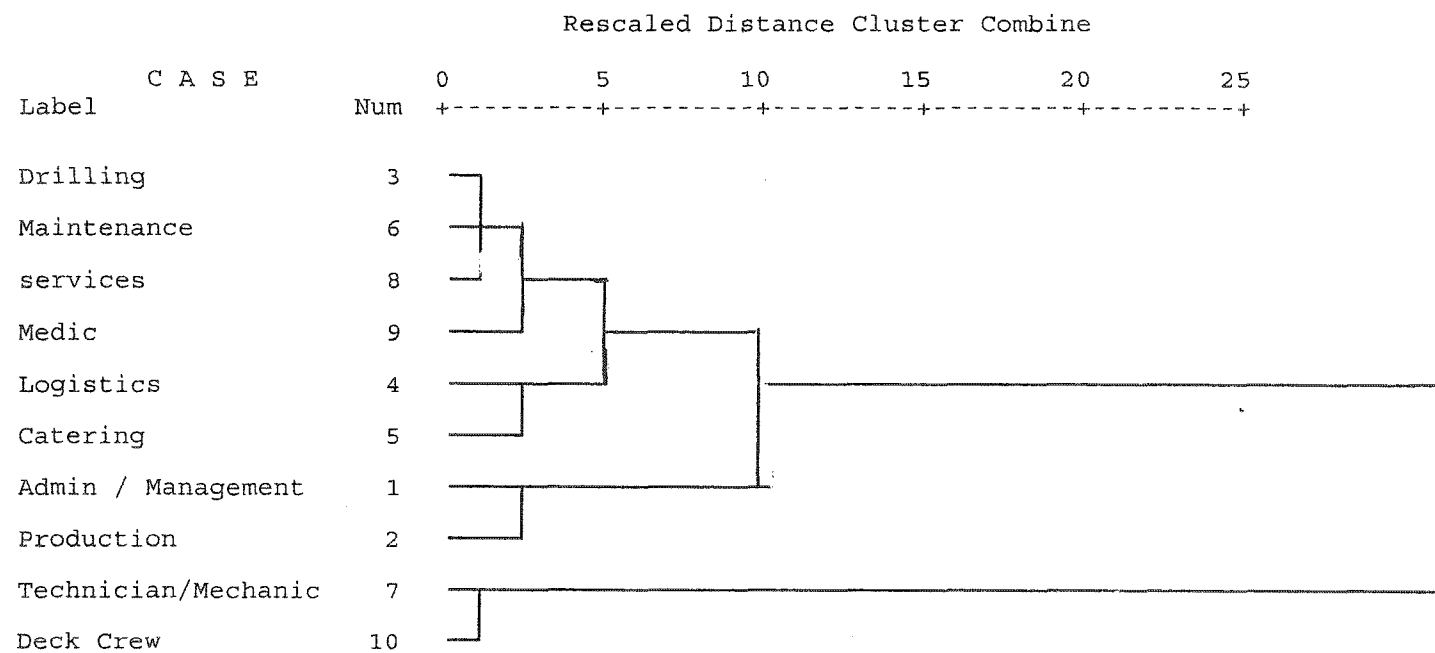


Figure 8. Attitudes to safety clustered into occupational groups.

Dendrogram using Ward Method

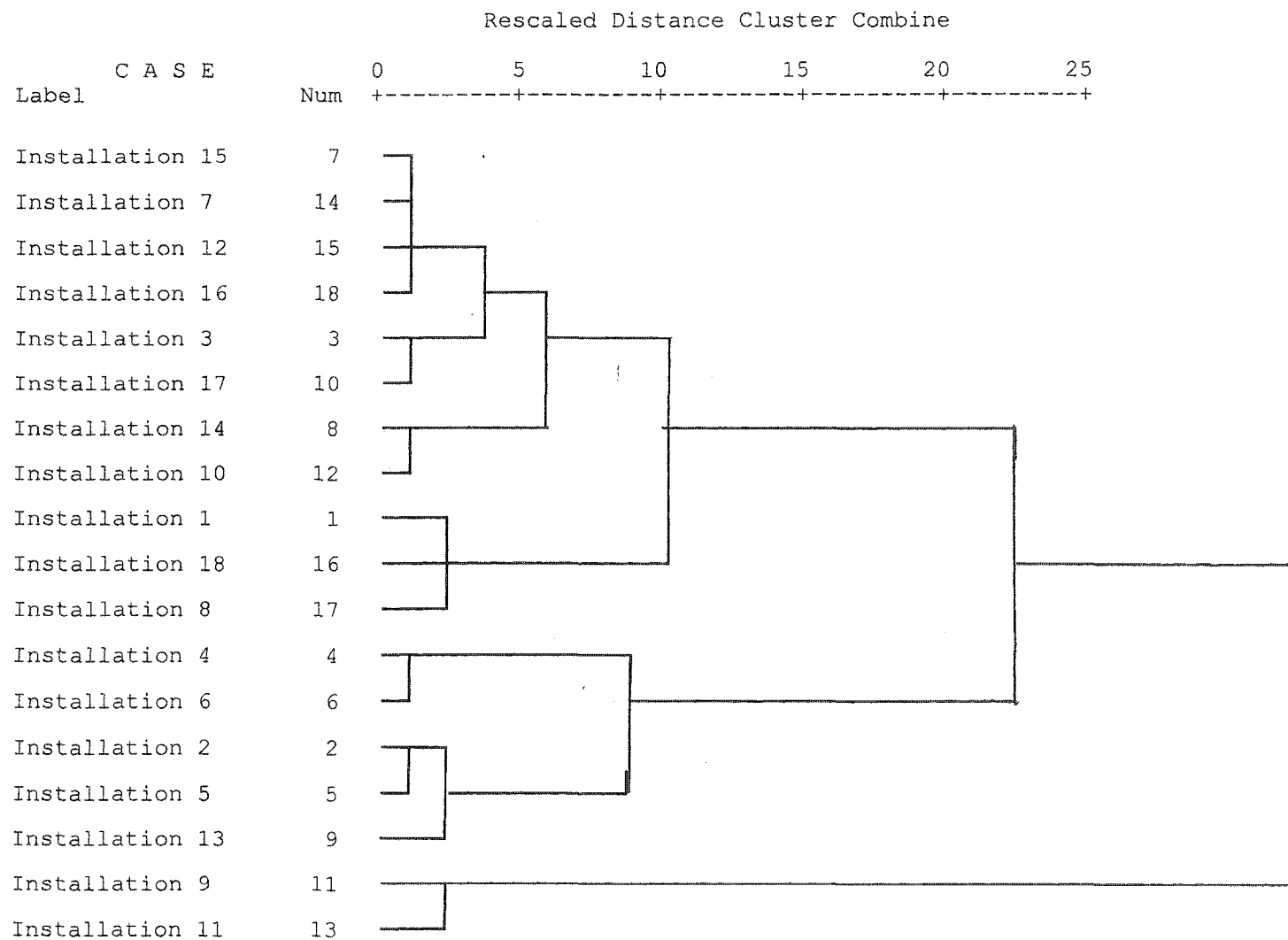


Figure 9. Social support clustered into installations.

Dendrogram using Ward Method

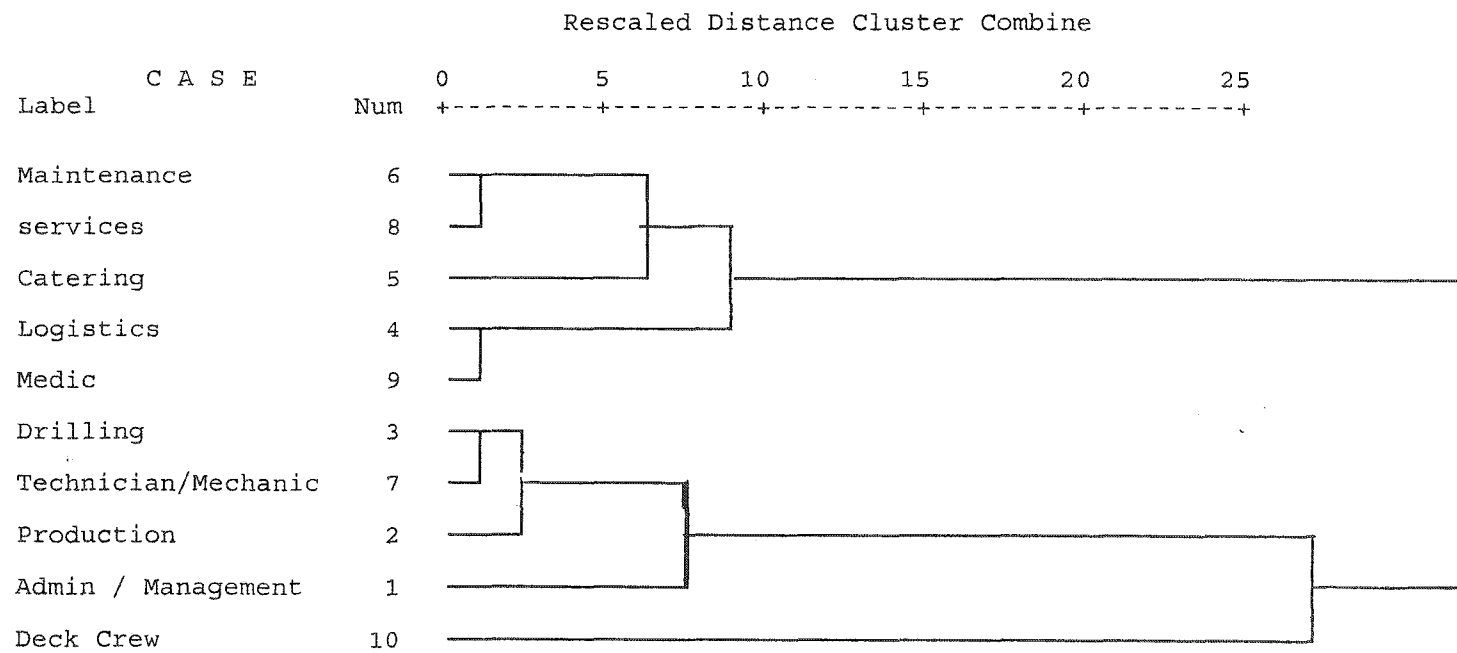


Figure 10. Social support clustered into occupational groups.

Dendrogram using Ward Method

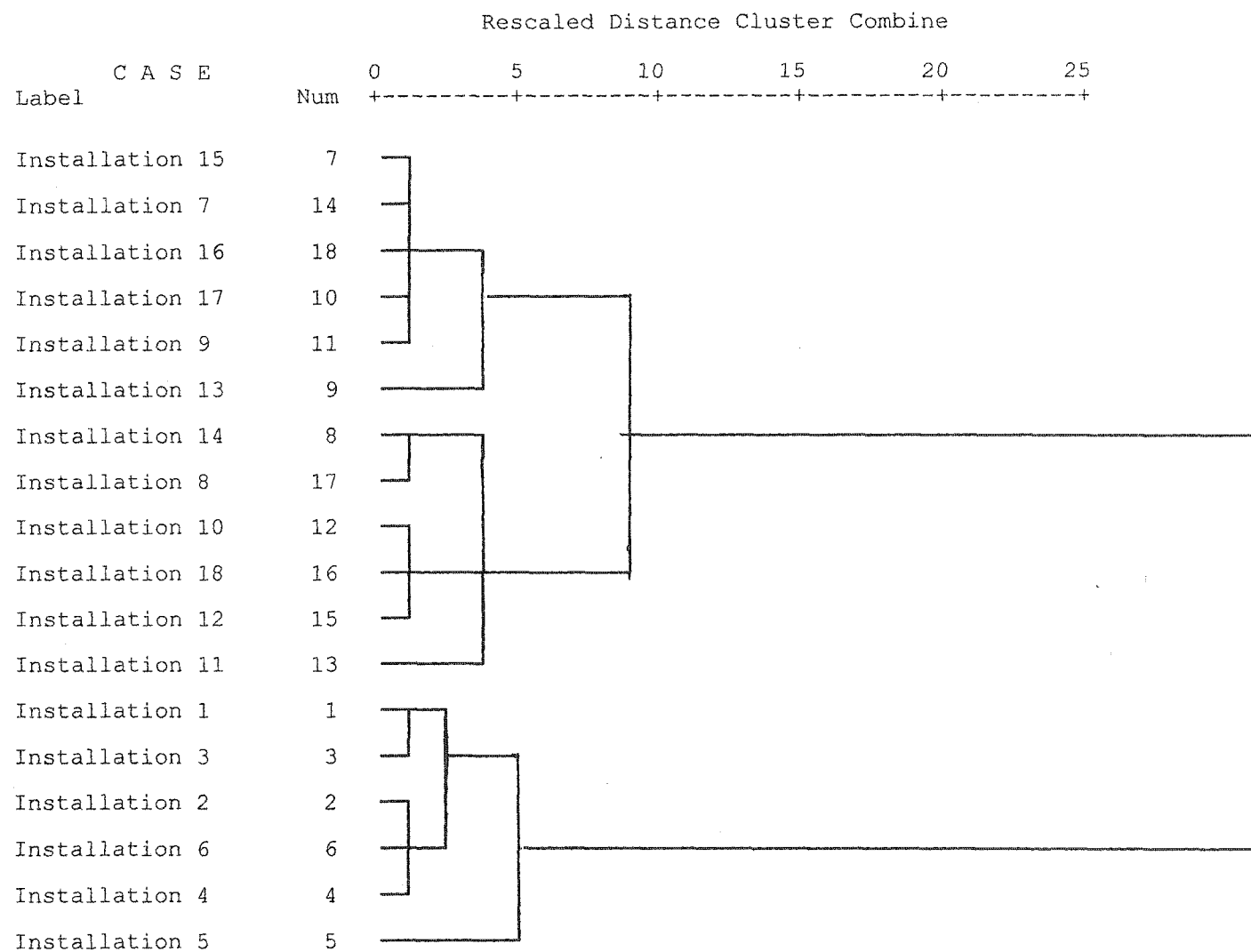


Figure 11. Job situation clustered into installations.

Dendrogram using Ward Method

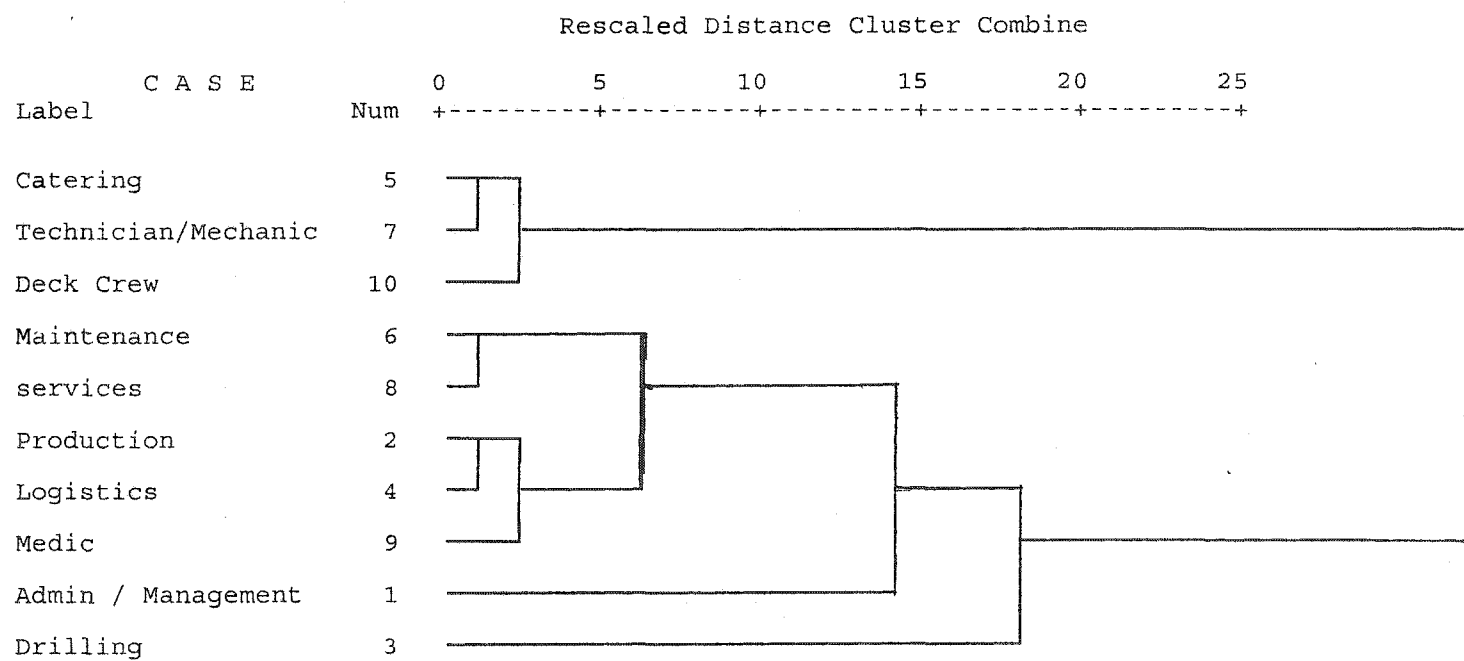


Figure 12. Job situation clustered into occupational groups.

Dendrogram using Ward Method

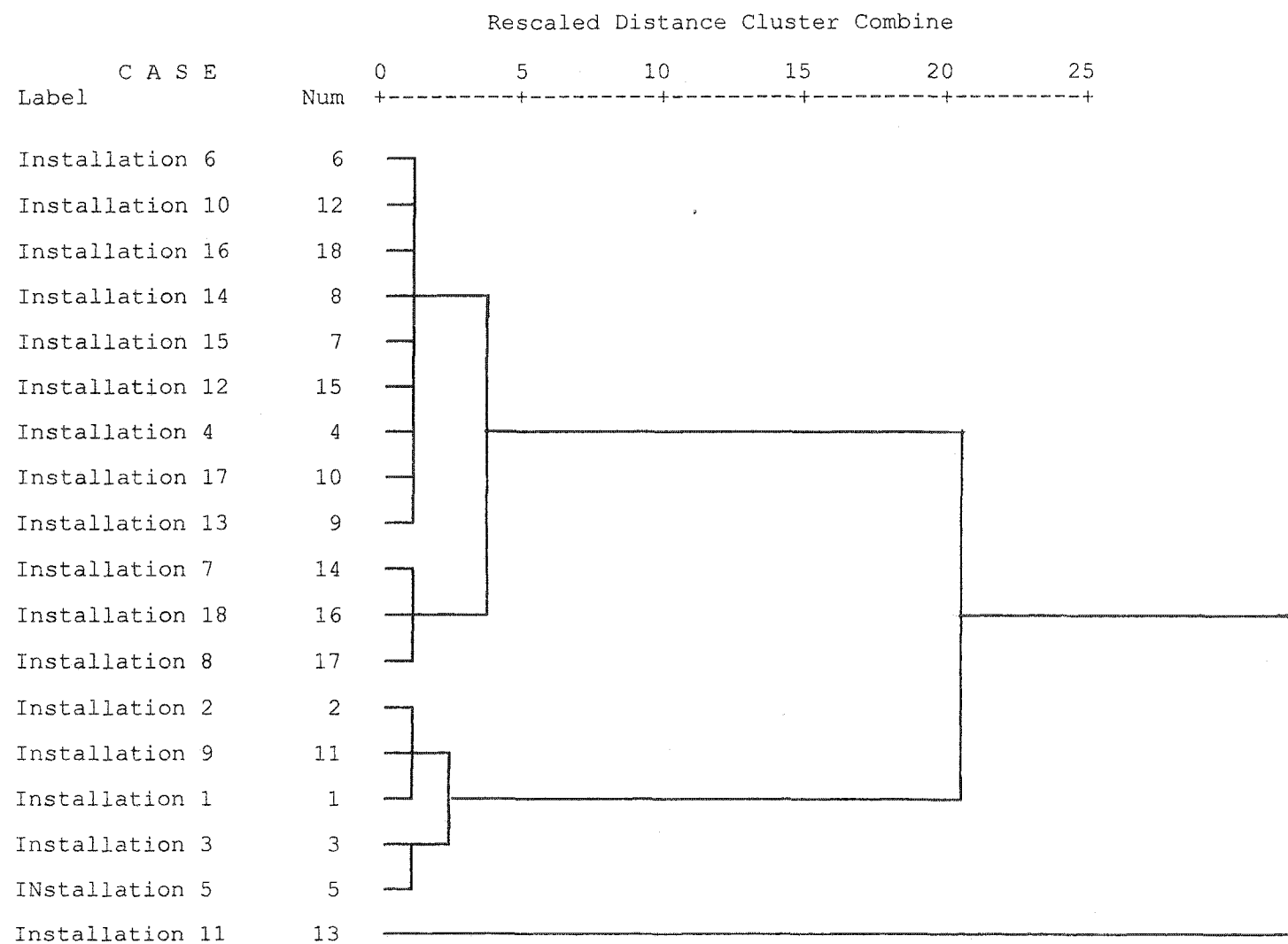


Figure 13. Others commitment to safety clustered into installations.

Dendrogram using Ward Method

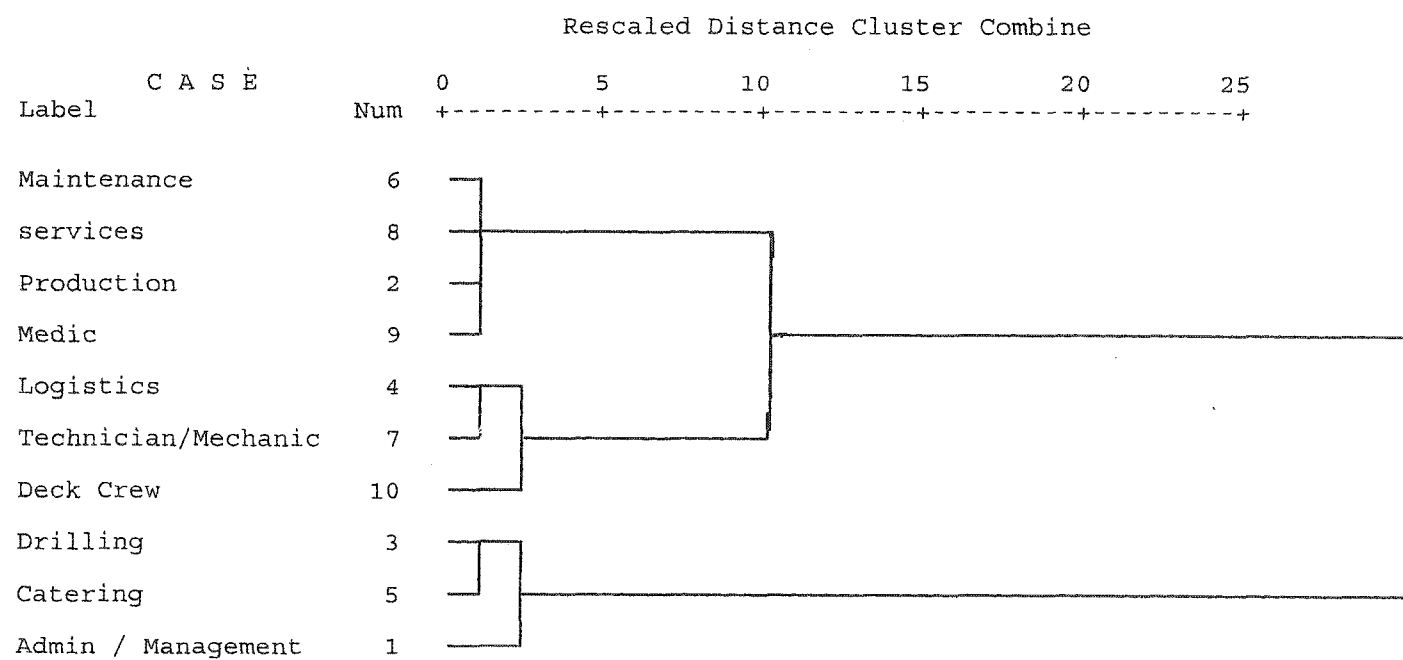


Figure 14. Others commitment to safety clustered into occupational groups.

Dendrogram using Ward Method

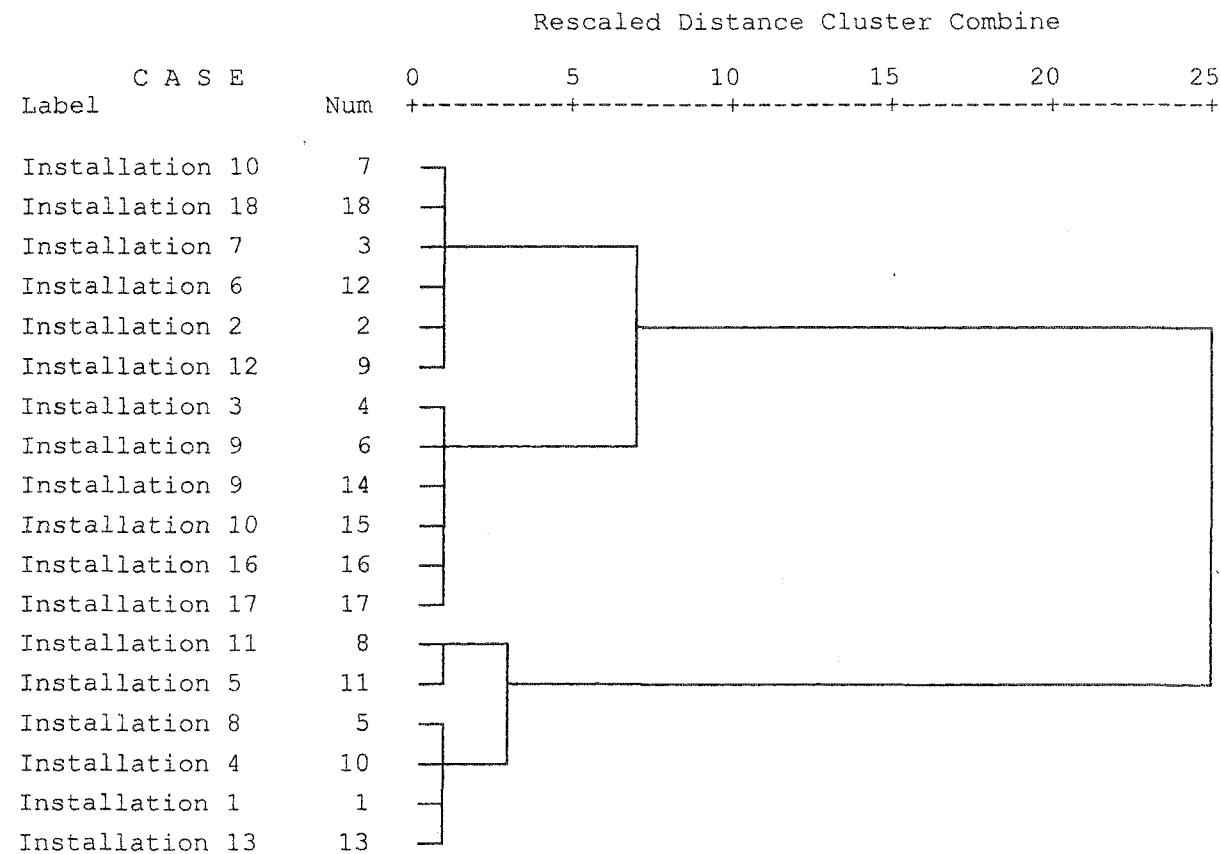


Figure 15. Satisfaction with safety systems clustered into installations.

Dendrogram using Ward Method

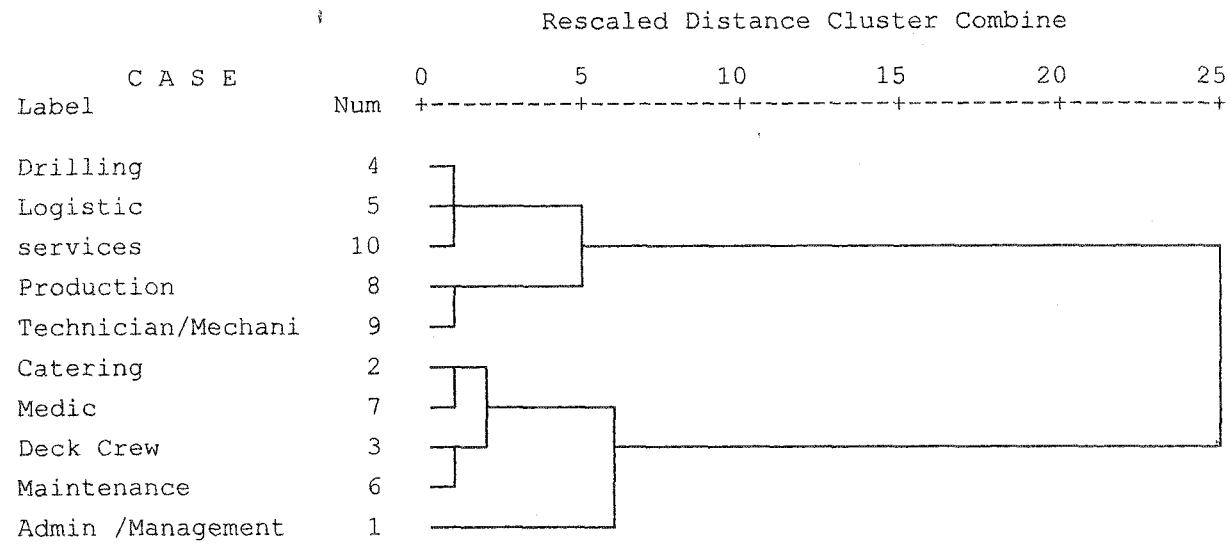
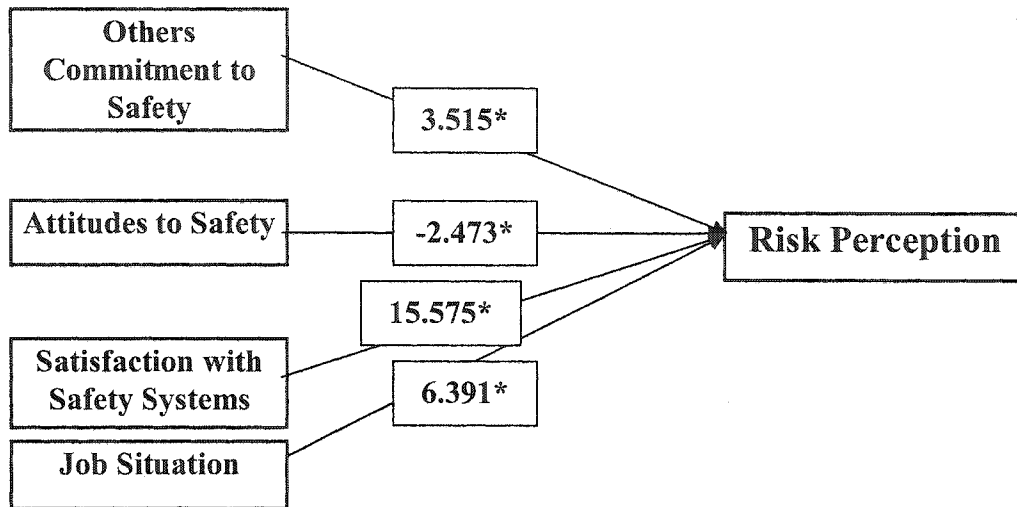


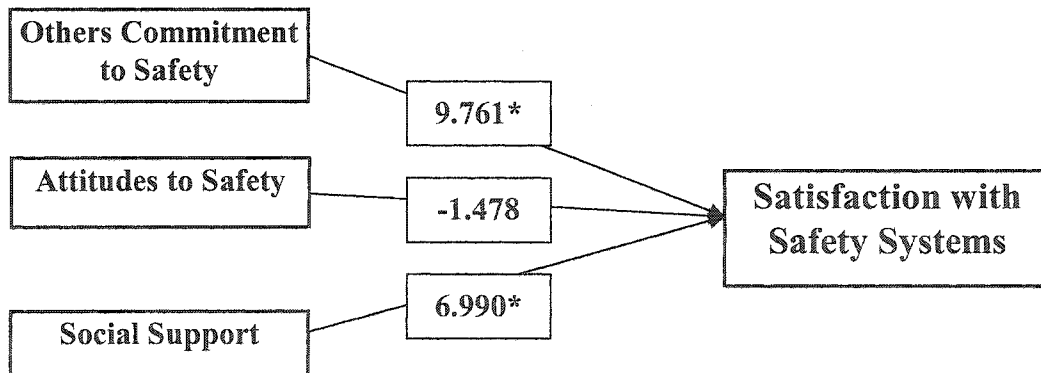
Figure 16. Satisfaction with safety systems clustered into occupational groups.



Model I

Slopes of the Level 1 predictors appear in bold face numbers

* Slopes significant at the $\alpha = 0.05$ level



Model II

Slopes of the Level 1 predictors appear in bold face numbers

* Slopes significant at $\alpha = 0.05$

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Appendix A

Supplemental Cluster Analysis Information

There are a multitude of scenarios that can be evaluated with cluster analysis. Below are several examples that could be grouped with the cluster analysis procedure. They are meant only as a brief introduction to the applicability of the statistical process. Thus, the specifics of such studies will not be discussed in the following list.

- Automobiles (Each case is a different make of car)

The following would serve as the variables of clustering: miles per gallon, frequency of repair, head room, number of cylinders, and braking distance, initial cost, and resale value.

- Mammals (Each case is a different mammal)

The following would serve as the variables of clustering: percentage of water, characteristics of their breast milk (e.g. protein, fat, and lactose), and size.

- Countries (Each case is a different country)

The following would serve as clustering variables: gross domestic product (GDP), gross national product (GNP), population, ethnic composition, official spoken languages, and socioeconomic status (SES).

The above examples exemplify the immensely diverse uses of cluster analysis. The last example stated above displays the potential for clustering across national borders. This example has relevance in the current paper, in which the clustering of employee attitudes is of particular interest. As stated previously, the current paper assessed attitudes in the offshore oil industry in both the United Kingdom and Norway. We are assessing the potential similarities and differences between these two geographically distinct countries. We used these putative similarities as a means of grouping these offshore oil installations. There are two main procedures one can utilize when implementing cluster analysis: hierarchical and K means.

Hierarchical Clustering. This method of cluster analysis is utilized when the researcher desires to cluster either cases or variables. Thus, there is great utility in this procedure because of its ability to classify both variables and cases. The hierarchical clustering process begins with the SPSS v.11 finding the closest or most similar pair of objects (e.g. cases or variables). The degree of similarity between objects is determined with a mathematical algorithm distance measure. The most similar objects are clustered to form the initial group. The algorithm then continues progressively and stepwise to join pairs of objects, and pairs of clusters, or an object into an existing cluster. This process continues until all of the objects in the data set have been placed into a cluster. The process is entitled hierarchical clustering because once two objects are joined together; they remain together until the end of the process. The results of this procedure are displayed graphical in a *dendrogram*, or *icicle plot* (name so for its appearance). This analysis is well suited for smaller samples, and can be used on interval, frequency data, and binary data as well.

K Means Cluster Analysis

The K means procedure begins by using the values of the first k cases of the data set as the temporary estimates of the k cluster means. In this case, k represents the number of cluster that is specified by the researcher. Once the initial cluster has been formed, additional cases are assigned to the cluster with the center closest to its individual mean. Once this is done, the cluster center is recalculated to account for the new addition. Thus, there are re-computations of cluster mean until all of the cases in the data set are accounted for. Finally, an iterative process is used to determine the final cluster center. This process is repeated until there are no further changes in the cluster centers. A further characteristic of the k means procedure is that the researcher can specify the cluster centers such that experimental results can be added to previous data sets. Thus, this procedure is extremely useful for larger data sets. It is better suited to analyze interval or ratio data with the k means procedure.

There are several caveats one should be aware of when conducting either of the cluster analysis procedures. First, when assessing a data set that is comprised of larger values they can contribute more weight, than the smaller values, to the calculations conducted by the statistics program. In essence, they can bias the results of the analysis, and cause then to portray similarities that in reality do not exist in the data. In order to combat this problem, one can transform, or standardize the values in the data. For example, you could transform all of the raw data into *z scores* such that all values are on the same scale. Within SPSS v.11.5, the hierarchical cluster analysis provides you with several avenues for standardizing the values within the process itself. However, with the k means cluster analysis; you need to standardize the data prior to conducting the cluster analysis. The second caveat is also in relation to the larger values in a potential data set. In cluster analysis, the squared Euclidean distance is the primary distance measure used to determine the similarity, or distances within a data set. However, the squared Euclidean distance is greatly affected by larger values. This also provides motivation for the standardization of the data set prior to conducting the cluster analysis. The third caveat pertains to the linking method used to cluster the similar cases or objects. The hierarchical process provides several methods for linking the clusters. It is suggested that you try several different linking procedures to determine if there are differing results. If the clustering results are different across the different methods, your data set is unlikely to have highly distinct clusters. This can serve as a check against poor data.

There are several major differences between the hierarchical and k means cluster analysis procedures. The k means cluster analysis is better equipped to deal with large populations, 200 or more cases. With sample sizes this large it becomes an exercise in futility to implement the hierarchical cluster analysis, the icicle plots become unmanageable. This graphical representation of the potential clusters is excellent for smaller data sets. Another major difference between the two procedures that was mentioned above, are the steps involved in standardizing the raw data. Hierarchical cluster analysis has a number of methods incorporated within the analysis itself, while the k means procedure requires the researcher to standardize the values prior to attempting to cluster the cases together. Furthermore, the k means cluster analysis procedure requires that you specify the number of clusters. The final demarcation between the two

procedures is that the hierarchical procedure excludes all cases that have missing values. Alternatively, the k means procedure allows the researcher to assign cases to clusters based on the distance measures based on all non-missing values (SPSS handbook, 2000).

Perhaps some of the appeal associated with cluster analysis, is that similar to both factor analysis and multidimensional scaling (MDS), the researcher can either *explore* or *confirm* a theorized clustering. Essentially, one can either examine the data set to determine the number of potential clusters, or you could examine the applicability of a specified and theoretically grounded number of clusters. However, there are a number of limitations associated with cluster analysis. First, there several different methods of calculating the clusters often produce very different results. Thus, it is up to the discretion of the researcher to determine which solution best fits the data. Second, the results are affected by the way in which the variables are ordered for the analysis. This puts the onus on the researcher to understand the importance of each variable and enter them into the analysis accordingly. Lastly, there are large changes in the cluster analysis results when cases are dropped. It is in the best interest of the research to have as many values as possible without compromising the integrity of the data set.

Applied Research

Cluster analysis has been used to study the groupings and similarities of a number of psychological constructs. For example, Storms, Dirikx, Saerens, Verstaeten, and De Deyn (2003) used cluster analysis to assess the clustering of semantic deficits. They were assessing the semantic storing deficits that accompany Alzheimer's disease, contrasted with a normal control population. They found the analyses of the patients' proximity data did not provide unambiguous evidence of a general semantic storage deficit (Storms et al., 2003). In a similar vein of research, Barrantes, Fananas, Rosa, Caparros, Riba, and Obiols (2003) were investigating neurocognitive, behavioural, and neurodevelopmental correlates of schizotypy clusters in adolescence from the general population. Their aim was display the use of standard correlation statistics could overlook the simultaneous display of schizotypy behaviours in adolescence. Barrantes et al, (2003) used cluster analysis to establish clusters of normal adolescence based on schizotypy dimensions and then compare them to behavioural, neurocognitive and neurodevelopmental markers. The results showed that schizotypy behaviours were displayed concurrently with some, if not all of the behavioural markers. This study showed the effectiveness of cluster analysis in proposing a more in depth explanation of experimental grouping results.

An area that lends itself to cluster analysis is cross-cultural research. Recently, cross-cultural research goes "hand in hand", or dictates a number of statistical analyses that are utilized by the primary investigator. For example, Bridger (1999) assessed the presence of seven temperament clusters in children age's two to seven from the United States and Finland. A two-step cluster analysis procedure was used in which hierarchical agglomerative cluster analysis was followed by K means partitioning. The results revealed the presence of six of the seven theorized clusters. Furthermore, the stability of the clusters was found to be better than chance.

Puddifoot and Cooke (2002) used cluster analysis in a study assessing the differences in representations of handguns in U.S. and UK young adults. There was

support for the existence of distinct regional representations of “gun culture”. In another cross-cultural study, Skevington, Bradshaw, and Saxena (1999) assessed items for the World Health Organization Quality of Life (WHOQOL). They used cluster analysis to determine the structural relationship of the national items, and their response rates to other cultures, to determine their rate of inclusion for national surveys. The results of their study lead to the selection of new facets and individual items for amending the national surveys. The last study that will be used to illustrate the use of cluster analysis in cross-cultural research, Bridger (1999) was assessing temperament of U.S. and Finish children. Bridger (1999) used a two-step clustering procedure in order to determine the presence of a theoretical seven-cluster grouping. This involved the use of a hierarchical cluster, followed by a K-means cluster analysis. This procedure facilitated the discovery of a cluster grouping quite similar to the theoretical groups.

Appendix B

Supplemental Hierarchical Linear Modeling Information

HLM is a method of modeling nested or grouped data that allows the researcher to attribute variability to both the within and between groups components of the theoretical model (Raudenbush & Byrke, 2002). The analysis facilitates the examination of interaction affects that occur across the levels as well. Moreover, HLM is not limited to the evaluation of group means; it also incorporates the relationships between the predictor and outcome variables. The most typical form of HLM involves a two-level analysis. The first level of the analysis, level 1, pertains to the group that is nested within the larger entity. This includes employees in organizations, such as teachers nested within a school. Alternatively, a two-level HLM analysis could involve the same individuals reassessed over time. Thus, the units of time are nested within the individual. An example of this form of analysis could involve a teacher that is evaluated several times throughout the course of the academic year. HLM analyses are not limited to two-level models, although three-, and four-level models are less frequently conducted. A three-level model could involve a teacher that is nested within a school, and a school that is nested within a district. So we could evaluate multiple teachers within multiple schools, and compare the results between school districts.

The core of HLM is similar to simple regression. If we take the normal regression equation:

$$Y = a + bx + e$$

Y – outcome variable

a – y intercept

b – slope of the line

x – predictor variable

e – error component;

We can then transcribe this basic regression equation into HLM form. This would result in:

Level 1: $Y_{ij} = \beta_{0j} + \beta_{1j}(X1) + r_{ij}$

Y_i – outcome variable

β_0 – y intercept

β_1 – slope of line

$X1$ – predictor variable

r_i -- Unique/random error

j – refers to each group

It can be observed that the underlying models of these two approaches are quite similar. However, when the influence of level 2 variable are added to the HLM equation, it can increase the wealth of information that can be obtained from: level 1, level 2, and the interactions between the two levels. The equation from level 1 can be conceptualized as similar to a linear regression equation, with β weights for each predictor for each group (Raudenbush and Byrke, 2002). At level 2 of HLM, the β weights from level 1 become outcome variables within the level 2 equations. For simplicity sake, at this point in the HLM analysis, we are treating the group level β weights as outcomes. Therefore, the components of the level 1 equation gain individual equations.

Level 1: $Y_{ij} = \beta_{0j} + \beta_{1j}(X1) + r_{ij}$

<p>Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}(W_j) + u_{0j}$</p> <p>$\beta_{1j} = \gamma_{10} + \gamma_{11}(W_j) + u_{1j}$</p>	<p>β_0 – y intercept for each group</p> <p>γ_{00} – y intercept for the predictor</p> <p>γ_{01} – slope for each predictor</p> <p>W - level 2 predictor variable</p> <p>u_0 – random error at level 2</p> <p>β_1 - β weight or slope</p> <p>γ_{10} – level 2 coefficient</p> <p>γ_{12} – level 2 coefficient</p> <p>W – level 2 predictor</p> <p>u_{1j} – random error at level 2</p>
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Although it appears as though the HLM is a fairly robust analysis, in order to successfully run this form of analysis, the data must satisfy all of the assumptions of general linear modeling multivariate analysis (e.g. linearity, multicollinearity, check the bivariate distribution, no outliers, normality). Furthermore, it is of utmost importance that the model that is being assessed through HLM have an empirical rationale, essentially it must mirror reality (Raudenbush and Byrke, 2002). Despite all of the conditions that must be satisfied in order to conduct a proper HLM analysis, the HLM software program also provides the researcher with an effective tool for evaluating the quality of the data. The output of a HLM analysis provides both an ordinary least squares (OLS) and robust solutions. If there are significant differences between these two solutions, then the researcher must proceed with great caution for the data may contain characteristics that can bias the results. The OLS solutions are more easily influenced by violations of normality and kurtosis.

Applied Research

Within the field of hospital administration, HLM has proven to be a useful tool. Greenberg, Rosenheck, and Fontana (2003) investigated the relationship between continuity of care (COC) and outcome measures in a multi-site monitoring effort with veterans diagnosed with post-traumatic stress disorder (PTSD). There were six measures of COC and six outcome measures of interest revealed that there were few significant associations (Greenberg et al, 2003). There were a number of significant associations between COC and reductions in substance abuse at the individual level. However, when COC was averaged to the site level and assessed with HLM in an effort to reduce intrasite selection bias, they were no longer associated with reduced substance abuse. In this case, the use of HLM revealed the presence of selection bias at the individual level. It is important to use the proper statistics to assess the true nature of the relationship between the variables of interest. HLM revealed the true nature of the non-significant relationship at the site level. HLM has the ability to assess the proportion of variance that is accounted for by the individual as well as the site level variables simultaneously.

Walker-Barnes and Mason (2001) displayed another use of HLM. They were interested in the relationship between ethnicity, peer behaviour and parenting style and their affects on juvenile gang involvement and delinquency. Furthermore, their study was of a longitudinal nature, HLM permits modeling change over time on an individual basis.

It permits you to model the slope and intercept for every single participant. The intercept represents the initial level of variable at the beginning of the study, and the slope represents the amount of change in the outcome through the experiment. Thus they could assess the changes within individuals as well. Their participants were 300 ninth-grade students evaluated at eight separate occasions. As stated, there were seven follow-up observations for each participant; however, participants can leave the study for a multitude of reasons (e.g. maturation, relocation, mortality, etc.). Walker-Barnes and Mason (2001) were still able to analyze their data because HLM operates in the presence of missing data. The results showed that in general, the teens decreased in the level of gang involvement over the duration of the study, while the average level of gang delinquency was held relatively constant. The levels of gang involvement and gang delinquency were most strongly associated with peer gang involvement and delinquency (Walker-Barnes and Mason, 2001). Regardless, parenting behaviour predicted change in both gang involvement and delinquency even after controlling for the influence of peers. Furthermore, the parental affects displayed ethnic and cultural differences. This affect was the most pronounced for the Black students. Specifically, higher levels of behavioural control and lower levels of lax parental control were related to better behavioural manifestations in students over time. Conversely, high levels of psychological control were related to worse behavioural outcomes over time.

An unconventional use of HLM, Zickar and Slaughter (2000) examine the levels of creative performance of film directors over time. They used HLM analyses to model intraindividual performance trajectories and interindividual differences in the trajectory parameters. They posit that more thorough knowledge can be attained through the assessment of all the films in a director's career, rather focusing on an individual film. The ratings of critics were used as a measure of the caliber of each director's films. There were 73 film directors all of whom were men with no fewer than 20 film credits, served as participants in the study, and HLM was used to generate reliability coefficients for each within-person parameter. The level 1 equation served as the regression for creative performance. The level 2 equations used individual difference variables to predict the intercept, slope, and acceleration of the level 1 equation. Both of these equations work in conjunction with one another to link intraindividual performance to interindividual analyses. The results displayed that directors' performance over careers, measured by critic's ratings, is described using a quadratic trajectory. This quadratic trajectory illustrates an initial increase in ratings following the first film, succeeded by an eventual decline in ratings as the number of films increases. If we then shift our focus to the intraindividual level, we can see that directors not only differ in their initial level of ratings, they also differ in terms of the rate of change, with some directors following an accelerated trajectory and others decelerating. This study displayed the utility of HLM in evaluating both intra, and inter-individual differences once again.

A number of the studies discussed thus far in this report have focused on the ability of HLM to effectively evaluate intraindividual differences. We will now examine a number of studies that will illustrate the applicability of HLM to cross-geographic and cross-cultural research. Terrill and Reisig (2003) were interested in the relationship

between neighborhood context and the use of police force during encounters with suspects. Force was defined as any acts that were wither physically or emotionally threatening. Observers rode along with police officers and recorded their behaviours. There were 12 police "beats" in each city (e.g. St. Petersburg Florida and Indianapolis Indiana) that were matched on pertinent variables. The researchers also assessed characteristics of the suspects as well. These included such things as their SES, age, sex, and ethnicity. The results of their model 1 analysis (e.g. assessing neighborhoods only), displayed that police were significantly more likely to use higher levels of force when the suspects were encountered in disadvantaged communities that had a history of high crime. With regard to model 2 (e.g. assessing suspect variables as well), showed that male, minority, youthful, and lower income suspects were subjected to higher levels of force. Terrill and Reisig (2003) then simultaneously regressed level of force on neighborhood and suspect variables using HLM. This resulted in 4 per cent of the variance being accounted for by neighborhood. The results of the mixed effects model 3 showed that the use of police force occurred more frequently in disadvantaged neighborhoods with high crime rates independent of suspect characteristics, suspects behaviours, and officer characteristics. This results once again display that results found in model 1 may be reduced once they are assessed with a mixed model. It is important that researchers implement the proper statistical procedures in order to attain an accurate representation of the relationships between variables. HLM is once such procedure that facilitates for nested variable analysis, as well as longitudinal data evaluation, and cross-sectional analysis. To further exemplify the cross-sectional data analysis ability of HLM, let us consider cross-cultural studies.

Within the field of cross-national research and cross-cultural psychology, HLM has also been found to be quite successful at evaluating the influence exerted by various individual level variables. Mason, Wong, and Entwistle (1983) assessed economic indicators at the national level, with the nested variables of education and fertility appraised at the household level. Their study was an evaluation of the effect of maternal education and urban versus rural residence on fertility across 15 countries (Mason et al, 1983). These investigators were interested in determining whether country level variables including national economic development and family planning issues. They found that there were differences across all countries; specifically higher levels of maternal education were associated with lower fertility rates (Mason et al, 1983). However, there were differences between urban and rural fertility rates varied across countries. Thus, in this study there was an evident differential effect of the national level variable across the nested variables.