PSYCHOLOGICAL FACTORS AS PREDICTORS OF EMPLOYEES' ATTITUDES TOWARDS WORK PLACE SAFETY IN A PUBLIC ELECTRICITY COMPANY IN SOUTH AFRICA

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DECLARATION

I, the undersigned, declare that the thesis hereby handed in for the qualification of Doctor of Philosophy (Industrial Psychology) at the University of the Free State, is my own work and that I have not previously submitted the same work for a qualification at/in another University/Faculty.

Signature: ______________

Date: 30 November 2010

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CHAPTER 1

1.1 INTRODUCTION AND BACKROUND

Every organisation, private or public, is experiencing significant changes in the manner in which they do business and is being forced to develop new visions and strategic goals (Van der Linde & Coetzer, 2004). Economic growth in South Africa since 1994 and the demand for electricity as a primary source of energy have become particularly evident since 2004. This sudden increase in demand together with other macro and micro environmental influences such as high inflation, budget constraints, government legislation, economic and social investments, new technology and changes within the electricity distribution industry, has placed tremendous pressure on the electricity industry in South Africa to meet the demand on a continuous basis, and at the same time to ensure the stability of the electricity network.

The pressure has created additional challenges for employees in all occupations to cope with their increasing job demands, and for the organisation to provide the required resources for optimal functioning (Schaufeli & Bakker, 2004). Organisations and employees that fail to achieve a balance create the ideal environment for the occurrence of work place incidents/accidents. Hence, occupational health and safety, and most importantly, the prevention of unintentional occupational injuries, has become and will remain a strategic and moral objective of managing a business in the competitive global village (Barling & Frone, 2004).

Within the safety risk management fraternity an incident refers to an unplanned or unwanted event which disrupts the work process and has the potential of resulting in injury, harm or damage to persons or property, for example a transformer blown out by lightning or an operating error (e.g. near miss) by the field operator. An accident, on the other hand, arises out of and in the course of an employee's employment and results in a personal injury, illness or fatality (e.g. Greenwell, Knight & Strunk, 2003; Hollnagel, 2004; Svenson, 2001). In this study, both of these concepts are used equally when referring to work place safety.

Work place incidents/accidents and serious work-related injuries were reported to result in fatalities and permanent disabilities costing employers almost one billion dollars a week in

2002 (Babcock, 2005). According to a study done by the Liberty Mutual Insurance Co., it was found that employees are experiencing fewer but costlier injuries than in the past. The study also reveals that the number of work place injuries causing workers to miss six or more workdays decreased by 0.7% in 2002 from the previous year, but the costs of those injuries increased by 6.5% after adjusting for wage and medical cost inflation. According to SA Statistics (2004, p. 9.41) 5 950 industrial accidents were reported in 2000, of which 493 resulted in fatalities, 4 577 in temporary and 800 in permanent disabilities.

According to Denton (1986), the first attempts at minimising work place incidents/accidents were focused towards the control of technical aspects and physical hazards, as seen from an engineering perspective. However, work place incidents/accidents are still taking place, and researchers continue to study the so-called "human factor" as primarily related to work-related incidents/accidents (Tomás, Melia & Olivier, 1999). Several authors have accepted that human error or unsafe people behaviour is associated with 80-90% of incidents/accidents (e.g. Reason, 1997; Lawton & Parker, 1998). In relation to vehicle accidents, researchers agree that human error has been the sole cause in 57% of all incidents/accidents and a contributing factor in over 90%. A mere 2.4% were due exclusively to mechanical fault and only 4,7% were caused by environmental factors (www.driveandstayalive.com). Korsten et al. (2004) report that human interaction plays a significant role in a large number of serious accidents – and in an even greater number of under-reported or less noticeable events (incidents). The effect of such events impacts not only on the individual, family members and those closely involved in the error, but also on the organisation, community and sometimes even beyond national borders.

Major events such as the Tenerife runway collision (1977), the Three Mile Island nuclear accident (1979), the Bhopal tragedy (1984), the Challenger and Cernobyl disasters (1986), the loss of the Mars Orbiter (1999), the Concorde crash (2000) the Enron (2001) and Saambou Bank Liquidations (2002) and many other incidents/accidents cited in the literature demonstrate that errors can occur in all human or human-initiated activities, whether they be in transport, the nuclear field, mining, services sector, advertising or finance (Korsten et al., 2004). No activities, from working with electricity to driving the company-owned vehicle, can therefore be excluded from the possibility of human error-related incidents and accidents. There are many work place injuries/accidents that could be prevented by implementing a comprehensive safety programme with policies and procedures, behaviour-based training, personal protective equipment and so forth. Du Pont (2007) suggests that management commitment and culture-change interventions in a mature organisation can improve safety performance by 20-25% for the first two years and there-after by 10-15% per year. According to Barling and Frone (2004) several studies have examined the variables that are related to or determine the occurrence of incidents/accidents and/or unsafe behaviours. Safety climate, work-site characteristics, leadership and organisational culture, individual differences and attitudes towards work place safety have been implicated in the occurrence of work-related incidents and accidents. All of these studies supported the concept of unintentional occupational incidents and accidents as "the result of a sequence of events" (Chhokar, 1990, p. 1, Reason, 1995). According to Tomás et al. (1999), the occurrence of incidents/accidents is determined by and/or related to a number of variables, which may at the same time be predictors of other variables such as health, job satisfaction, job insecurity (Probst, 2004) or absenteeism.

At the level of the individual, many variables can influence a person to respond either positively or negatively to perceptions or attitude towards work task hazards and safety interventions (e.g. Langford, Rowlinson & Sawacha, 2000; Tam, Fung, & Chan, 2001; Barling & Frone, 2004; Babcock, 2005). According to Glendon, Clarke and McKenna (2006) an increasingly number of safety practitioners and organisational leaders realises the importance of people's attitudes and behaviour toward risk and hazards. The researchers further argues that a step change is necessary to understand the factors that influences people's attitude towards work place safety and what needs to be done to change unsafe attitudes and behaviours. An abundance of studies (e.g. Barling & Frone, 2004; Cox & Cox, 1991; Iversen, 2004; Langford et al., 2000; Mearns, Flin, Gordon & Flemming, 1998; Reason, 1990, 1995; Yilmaz & Celik, 2004) have been published linking workers' attitudes with unintentional work place incidents and accidents or intentional violations (e.g. violations of traffic rules).

From the literature it is evident that possible variables that could influence employee attitude towards work place safety are intelligence, personality traits and work wellness with specific reference to burnout, work engagement and sense of coherence (e.g. Arthur, Barett & Alexander, 1991; Carty, Stough & Gillespie, 1999; Clarke & Robertson, 2005; Frone, 1998; Lawton & Parker, 1998; O'Toole, 1990; Rundmo, 1995; Schmidt & Hunter, 2004; Zohar, 2000, etc.). Two psychological perspectives and their influence on attitude towards work place safety exists, namely the trait and state approaches. From a trait perspective, intelligence and personality are included and refer to the habitual patterns of behaviour, thoughts, and emotions which are relatively stable over time and quite difficult to change. The work wellness factors, namely burnout and work engagement variables, fall under the state approach and can be described as a relatively stable or temporary phenomenon that fluctuate because of the continued presence of specific job and organisational characteristics such as the presence or absence of job demands-resources. (e.g. Allport, 1937; Cattell, 1943; Coetzer & Rothmann, 2007; Deary & Matthews, 1993; Edwards, 2008; Schaufeli & Bakker, 2004; Sparks, Fragher & Cooper, 2001). Sense of coherence is argued from both perspectives (e.g. Antonovsky, 1993; Erikson & Lindström, 2005; Feldt, 1997).

Intelligence involves the internal mental processes such as one's preferred and typical modes of perceiving, remembering, thinking and problem-solving (e.g. Messick et al., 1976), which may according to Lawton and Parker (1998), involve failures in information processing or skill, and result in reduced safety compliance, because people make slips, lapses, or mistakes. Although many theories or approaches in the field of personality psychology exist, no universally accepted definition of personality could be found in the literature. However, there are some agreements amongst personality researchers in that personality focuses on individual differences in how people think, feel and behave, personal dispositions that lead people to behave as they do and also in how these dispositions interact with situations that influence their behaviour (e.g. Arnold, Cooper & Robertson, 1995; Sternberg, 1995; Pervin & John, 1997; Bergh, 2003). Furthermore, Aiken (1994) argues that personality is much more than merely individual differences, but is rather a composite of mental abilities, interests, attitudes, temperament and other individual differences in thoughts, feelings and behaviour.

Cattell, Eber and Tatsuoka (1970) developed the freedom from accidents profile according to which factors such as abstractness and low ego strength were shown to be related to accident behaviours. Russel and Karol (1994) suggest that high dominance and high liveliness may play a role in favouring greater risk taking and aggression and impatience in dealing with certain situations. Arthur and Doverspike (2001) found that conscientiousness was significantly related to total vehicle crashes and not-at-fault crashes. Celler, Nelson, Yorke and Bauer (2001) found significant opposite correlation between conscientiousness and not-at-fault and at-fault accidents reported. In addition, a significant opposite correlation was found between agreeableness and the sum of both at-fault and not-at-fault accidents.

No significant relationships were found between the factors openness, extraversion and neuroticism and accident involvement. However, this study takes one step back in investigating the influence of both intelligence and personality characteristics on employee's attitude towards work place safety.

The work wellness paradigms burnout, work engagement and sense of coherence focus on both "negative" and "positive" aspects of health and wellbeing. From a pathogenic perspective, the Maslach Burnout Inventory-General Survey (MBI-GS) (Maslach, Jackson & Leiter, 1996) defines burnout as a crisis in one's relationship with work and not necessarily as a crisis in one's relationship with people at work. Furthermore, burnout is a state of exhaustion in which one is cynical about the value of one's occupation and doubtful of one's capacity to perform caused by an increase in job demands and a lack of resources to effectively meet their expected job performance (Schaufeli & Bakker, 2004; Rothmann & Joubert, 2007). The cynicism scale suggests a distant attitude towards work causing individuals to distance themselves from their work. Positive associations between burnout and ill health (Schaufeli & Bakker, 2004; Rothmann & Joubert, 2007) were reported. However, no research evidence could be found where the influence of burnout on individual attitude towards work place safety had been investigated. Therefore, it is anticipated that employees who experience high levels of burnout are likely to develop negative attitudes towards the organisation, management and their work environment, which may negatively influence their attitude towards work place safety.

Work engagement on the other hand may be described as a state in which one experiences eustress as a positive psychological response to a stressor as indicated by the presence of a positive psychological state (Rothmann & Joubert, 2007). Therefore, from a positive psychology perspective work engagement as measured by the Utrecht Work Engagement Scale (UWES) is a positive, fulfilling, work-related state of mind that is characterised by vigour, dedication and absorption. Hence, work engagement is characterised by a high level of energy and strong identification with one's work (Schaufeli & Bakker, 2003). Work engagement is positively associated with work characteristics such as support from colleagues and supervisor, performance feedback, coaching, job autonomy, task variety, and training opportunities (e.g. Demerouti, Bakker, De Jonge, Jansse & Schaufeli, 2001; Salanova, Schaufeli, Llorens, Pieró & Grau, 2001; Schaufeli, Taris & Van Rhenen, 2003; Schaufeli & Bakker, 2004). Statistically significant associations were found between work engagement and low turnover intention (Schaufeli & Bakker, 2004), work engagement and organisational commitment (Rothmann & Joubert, 2007), and work engagement with routine violations and situational violations (Hansez & Chmiel, 2010). No research evidence could be found whereby the influence of work engagement on individual attitude towards work place safety was investigated. Therefore, it is anticipated that a positive attitude towards work place safety could be predicted by experiences of work engagement.

Much subsequent work has confirmed that a person's sense of coherence is an important component for one's health and well being (Antonovsky, 1987, 1993; Bengtsson-Tops & Hansson, 2001; Strang & Strang, 2001, Rothmann, 2004, Erikson & Lindström, 2005). Sense of coherence (Antonovsky, 1987) has also been recognised to influence an individual's state of mind positively when the employee believes that his/her work environment is predictable and manageable, and where participation in decision making which relates to his/her tasks is possible. Most studies (e.g. Rothmann, Jackson & Kruger, 2003; Steyn, Rothmann & Mostert, 2004; Rothmann, Steyn & Mostert, 2005; Van der Linde & Coetzer, 2004) have found that sense of coherence (as measured by the Orientation to Life Questionnaire) (Antonovsky, 1987) moderates the effect of burnout, but also as a personal resource in strengthening positive experiences of work engagement. Hence, it is predicted in this study that sense of coherence could have a dual effect on both burnout (minimise the effect of burnout on employee's attitude towards work place safety) and work engagement (maximise the effect of work engagement on employee's attitude towards work place safety). Thus, employees who experience a fulfilling, positive work-related state of mind are unlikely to compromise the way they think, or make decisions that will influence (positive attitudinal processes) how they are likely to behave in safety sensitive situations.

Both personality and attitudes are complex cognitive processes. Luthans (1995, p. 121) explains that the difference between personality and attitudes "is that personality usually is thought of as the whole person, while attitudes may make up the personality". Attitude is frequently used in describing people and explaining their behaviour. Lee (1994) and Williamson, Feyer, Cairns and Biancotti (1997) argue that attitudes, defined as stable predispositions, are the most comprehensive and useful indicators of a safety culture. People with lower attitudinal safety awareness are at greater risk, and may cause more accidents and injuries (Forgarty & Shardlow, no date; Reams, 2007).

Huff (1999) and Forcier, Walters, Brasher and Jones (2001) studied the construct safety consciousness and found that behavioural attitudinal factors that relate to safety are safety control, risk avoidance, and stress tolerance. Safety consciousness refers to the values, attitudes and beliefs that underlie the awareness of safety hazards and the ability to handle potentially dangerous situations effectively (Forcier et al., 2001). An important assumption of this construct is that certain individuals have a greater probability of being involved in a work place incident/accident that others, and that these individuals differ in not just safe working behaviours, but in the values, attitudes and beliefs that manifest those behaviours. Safety control refers to the extent to which a person takes personal responsibility for maintaining a safe work environment and risk avoidance refers to a person's tendency to avoid high-risk, dangerous, or thrill-seeking behaviours, and is a good indicator of whether a person is likely to comply with organisational rules and procedures. In addition, stress tolerance is an indication of a person's ability to cope with stress, and people who have higher stress tolerance scores are generally at a lower risk of on-the-job incidents/accidents, as they are not as susceptible to distraction and fatigue. Included in the safety attitudinal measurement are two secondary scales that measure individual attitude towards safe driving behaviour (driver attitude) and attitude towards the overall quality of the work being performed (quality orientation). (Forcier et al., 2001; Fogarty & Shardlow, no date).

1.2 PROBLEM STATEMENT

Eskom Holdings Limited (Director's annual report, 2007, pp. 67-68; Director's annual report, 2008, pp. 90-93) reported 10 fatalities in 2006, 8 in 2007 and 17 in 2008, of which 2 in 2006, 3 in 2007 and 8 (seven were caused by third parties) in 2008 were caused by vehicle accidents. Although the lost-time incident rate (reflecting a rough estimate of the percentage of the workforce that suffered a lost time injury in the preceding 12 months) decreased from above 0,40 in March 2005 to 0,35 in March 2007 and to 0,34 in March 2008, the vehicle incident rate (VIR, number of company-owned vehicle incidents multiplied by 1 000 000 divided by the total number of kilometers driven) remains a concern. The lost-time incident rate (LTIR) of the organisation, which falls within the scope of this research project, reported 0,68 in March 2006, 0,45 in March 2007 and 0,29 in March 2008. Although the March 2008 figure indicates a significant improvement, the LTIR increased to 0,45 in November 2008. An area of concern is the vehicle incident rate (VIR) which reflects a VIR of 5,75 in April 2005, 5,81 in April 2006, 5,83 in April 2007 and 5,55 in April 2008. Specific work place incidents/accidents that are of importance to this organisation are electrical contact incidents, operating errors, near misses, medical injuries and vehicle accidents. From the literature (e.g. Tomás et al., 1999; Barling & Frone, 2004; Korsten et al., 2004) it seems reasonable to suggest that these incidents/accidents may be attributed to human error or unsafe human behaviour components.

The leadership of the public electricity company believes that safety is an important part of their future success. In 2006 Eskom appointed Du Pont Safety Resources to perform a comprehensive safety review of its operations. The "switched on to safety excellence" programme was launched in 2007 to address Eskom's current safety culture, which includes leadership, safety communications, line management commitment, and operational discipline. A safe work place is more productive, and helps in the recruitment and retention of new talent. It enhances how the business is perceived by both internal and external stakeholders and customers. It demonstrates the value of caring for one another's safety and wellness. The bottom line is: A safe work place is first-class business. Therefore, evidenced-based empirical studies give a sound foundation to support this research that a person's overall intelligence (e.g. verbal, numerical abstract reasoning and spatial reasoning), personality (e.g. conscientiousness, neuroticism, detail orientation, optimism-pessimism, and extraversion-introversion, locus of control, etc.) and lower levels of wellbeing (high burnout, low work engagement and low sense of coherence) are likely to influence a person's attitude towards work place safety, which may cause work place incidents or accidents in a public electricity company in South Africa (e.g. Tomas et al., 1999; Cellar et al., 2001; Wallace & Vodanovich, 2003; Barling & Frone, 2004; Van Der Linde & Coetzer, 2004; Venter, Tredoux & Kriek, 2004; Feldt et al., 2007).

As previously stated, 95% of all work place incidents/accidents (including driver accidents) can be attributed to human error and non-compliance. Many human error incidents/accidents and injuries are related to behavioural factors and unsafe work place attitudes. Although environmental, organisational leadership and culture contribute towards work place incidents/accidents, the primary responsibility for working safety remains with the individual employee. It is evident in the literature that variables such as intelligence, personality, and work wellness factors, namely burnout, work engagement and sense of coherence are likely to influence a person's attitude towards work place safety that could result in work place incidents/accidents. The influence of psychological factors on a person's attitude towards work place safety (including driver accidents) in South Africa has not been widely researched or documented. Risk management practitioners in South Africa are inclined to be more concerned about compliance with safety, health and statutory environmental requirements than about broadening their attention to include the identification of those occupational hazards and individual behavioural tendencies causing work place incidents/accidents. Addressing the behaviour component in safety risk management may be viewed by risk practitioners as a human resources intervention rather than a risk management responsibility.

The other side of the coin is also true: human resources practitioners may believe that risk management does not form part of their scope of work. As a result the blaming game continues whilst employees still engage in unsafe work behaviour. As mentioned in section 1.1, Du Pont (2007) suggests that management commitment and safety culture change interventions in a mature organisation can improve safety performance by 20-25% for the first two years and thereafter by 10-15% per year. The question that comes to mind is what is a mature organisation? Is it possible for an organisation to reach maturity or a certain level of maturity to improve safety performance by 20-25%?

Hence, the number of incidents and accidents occurring in a public electricity company in South Africa warrants this study to investigate, examine and understand those psychological factors as predictors of employees' attitude towards work place safety. The particular problem that arises is two-fold:

- how the different independent variables (intelligence, personality, burnout, work engagement, and sense of coherence) can be conceptualised in a model that can empirically demonstrate the statistically significant relationship between the different variables of the model influencing attitude towards work place safety (dependent variable), and
- whether the path relationships between the variables in the model are statistically significant so that the model can be confidently applied within a public electricity company in South Africa.

1.3 RESEARCH QUESTIONS

The specific research questions pertaining to this study can be stated as follows:

- Can a sequential model be developed that could predict that employee's attitudes towards work place safety could be influenced by means of psychological factors, such as intelligence, personality, burnout, work engagement, and sense of coherence in a public electricity company in South Africa?
- Will the model demonstrate statistically significant evidence to confirm that employee's attitudes towards work place safety could be influenced by psychological factors in a public electricity company in South Africa?

1.4 RESEARCH OBJECTIVES

The aim of this study is to investigate the influence of psychological factors as predictor of employees' attitude towards work place safety in a public electricity company in South Africa. Although the impact or consequence of workers attitude on work place incidents/accidents is evident, this aspect falls outside the scope of this study. In addition, the use of safety performance data as the criterion variable is reported to be problematic in cause-and-effect work place safety research, because the processes for collecting accident data generally falls short of the scientific rigour that would be required to ensure high reliability and normally requires a larger sample size (e.g. Tomás et al., 1999).

Resulting from the problem statement as described above, the following general and specific aims of this research can be stated:

1.4.1 General aim of the study

The general aim of this research is to develop and evaluate a sequential model of psychological factors that could predict employees' attitudes towards work place safety in a public electricity company in South Africa.

1.4.2 Objectives of the study

- To develop a sequential model of psychological factors that could predict employees' attitudes towards work place safety in a public electricity company in South Africa.

- To evaluate whether the sequential model could provide statistically significant evidence that employees' attitudes towards work place safety could be predicted by psychological factors, in a public electricity company in South Africa.

1.5 RESEARCH HYPOTHESES

Based on the above discussions the following hypotheses are formulated:

Hypothesis:

H_1: Statistically significant correlations exist between the predictor variables of intelligence, personality, burnout, work engagement and sense of coherence on the criterion variables of safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude and quality orientation in a public electricity company in South Africa.

H_2: Statistically significant path coefficients exist which confirm that employees' attitudes towards work place safety can be predicted by intelligence, personality traits, work wellness (burnout, work engagement, and sense of coherence) in a public electricity company in South Africa.

1.6 CONTRIBUTION OF THE STUDY

Contributions of this research could be as follows:

- A sequential model of psychological factors should exist, which could be used to predict employees' attitudes towards work place safety in a public electricity company in South Africa.
- Information should exist regarding the relationship between intelligence, personality traits, work wellness (burnout, work engagement and sense of coherence), and their relationship with employees' attitude towards work place safety.
- The findings could assist the organisation to gain insight into the effect of psychological factors on employees' attitudes towards work place safety and to propose interventions towards a more positive attitude towards work place safety.

- The model could be used as a foundation for future research regarding the prediction of other variables (individual and organisational) on employees' attitudes towards work place safety.

1.7 CHAPTER OVERVIEW

Chapter 1 introduced the study theme and briefly placed the study research and its practical application into perspective. In addition, a brief description followed on the theoretical psychological variables included in this study as predictors of employees' attitude towards work place safety. The study objectives and hypotheses which include the development an evaluation of a sequential psychological model and possible significance of this study were also introduced.

Chapter 2 – 4 will focus on an in-depth literature review and discussion on the dependent and independent variables, namely attitude towards work place safety, intelligence, personality, and work wellness (burnout, work engagement and sense of coherence). Chapter 2 provides information on the meaning and nature of work place safety and ends with a discussion on the dependent variable, namely attitude towards work place safety. In this section, the safety attitudinal constructs that will be measured in this study, namely safety consciousness (safety control, risk avoidance, and stress tolerance), driver attitude and quality orientation are introduced. After Chapter 2, the focus turns to the independent variables, namely intelligence (Chapter 3), personality (Chapter 4), and work wellness which include the constructs burnout, work engagement, and sense of coherence (Chapter 5).

Chapter 6 focuses on the development and evaluation of the measurement and theoretical model. The chapter provides an in-depth explanation on the anticipated path relationships of the psychological factors in predicting employees' attitude towards work place safety.

Thereafter the research methodology (Chapter 7), the presentation of the statistical results (Chapter 8), and discussion of the results, conclusions, limitations and recommendations (Chapter 9) are presented.

CHAPTER 2

WORK PLACE SAFETY AND ATTITUDE TOWARDS WORK PLACE SAFETY

2.1 INTRODUCTION

As presented in Chapter 1, most of the research on work place incidents/accidents including vehicle accidents causation focus on the influence of individual dispositions, such as intelligence, personality and attitude on work place incidents/accidents and vehicle accidents. In contrast, limited studies have reported the potential influence of individual dispositions/psychological factors, such as intelligence, personality, and work wellness factors on attitude towards work place safety. Hence, the importance of this study to investigate whether psychological factors, such as intelligence, personality, burnout, work engagement, and sense of coherence could explain or predict a significant amount of variance/influence on employees' attitude towards work place safety.

Therefore, it is important to firstly understand the meaning and nature of work place safety and then to link it with the dependent variable, attitude towards work place safety. Thus, the aim of this chapter is two folded. Firstly, the concept of work place safety is introduced. In this section, the reader is familiarised with concepts such as risk, at-risk behaviour and the role of the human factor in work place incident/accident causation. Secondly, in the latter part of this chapter, the concept of attitude is introduced. The focus is on the meaning and nature of attitude and how attitudes are formed. In addition, the influence of the psychological factors (intelligence, personality, burnout, work engagement, and sense of coherence) on the forming of attitudes is explained. Thereafter, a theoretical overview is presented on attitude towards work place safety as the dependent variable in this study. Next, a description on the constructs that are used to measure employees' attitude towards work place safety follows. The chapter conclude with a brief summary, as well as conclusions regarding the implications of the content of the chapter for the empirical part of the study.

In the next section, the concept work place safety is introduced.

2.2 WORK PLACE SAFETY

For the foreseeable future, work place safety will remain a major concern for organisations and employees, as it is a cause of substantial direct (e.g. medical insurance costs, employee absenteeism, equipment replacement costs, production loss, etc.) and indirect (e.g. loss of employment, personal tragedies for bereaved family, friends and co-workers, etc.) costs (e.g. Barling & Frone, 2004; Neal & Griffin, 2006). According to Barling and Frone (2004), the number of work place fatalities and injuries has dropped substantially in the economically active work force, in both the industrialised and the developing world. Despite this progress, however, statistics show that work-related incidents and fatalities are still happening at an alarming and unacceptably high rate.

In light of the above, work place safety remains a critical research issue worldwide. In South Africa, this is no less true, and the goal is to understand the predictors and correlates of safe and unsafe behaviour. In order for one to conceptualise the concept of work place safety, one needs to understand the concept of risk as the basic source of accidents or incidents. In addition, prominent safety-related concepts such as hazards, loss, unintentional occupational injuries, human error, incidents and accidents, amongst others, are explored.

2.2.1 The meaning and nature of work place safety and related concepts

Contemporary research on work place safety highlights the important contribution of human behaviour specialists such as industrial/organisation psychologists in understanding the psychological processes influencing risk cognition or risk perception (Glendon, Clarke & McKenna, 2006). Their contribution is recognised in supporting health and safety practitioners as well as line managers in the development of specific approaches (e.g. learning of specific job-related stress management strategies). Therefore, it is important to understand the meaning and nature of related work place risk concepts and their affect on work place incidents or accidents.

2.2.1.1 The concept of risk

According to Fuller and Vassie (2004, p. 3) "every living organism is exposed to risk, either through genetic make-up or through the environment in which it exists". The authors further argue that people consciously seek risks and even draw risks upon themselves. This means that people's lives are continuously affected by risks and as human beings, from birth until death, engage in some sort of risk behaviour or are being subjected to risk(s) on a daily basis. From early childhood, human beings explore the unknown, increasing their level of risk, and as they progress through life, accidents and incidents happen, sometimes taking the form of cuts, bruises and even broken bones. According to the Health and Safety Commission (2003), slips, trips and falls continue to be the primary causes of work place accidents and injuries. People constantly expose themselves, other people and the environment to all kinds of risks: through substance abuse, bad driving behaviour, taking short-cuts or affecting the environment with ozone-depleting chemicals, to name just a few. According to Glendon et al. (2006, p. 15), "risk has been integral to human cognition and behaviour since our species emerged and in some form to all our predecessors".

It could be argued that people adapt to these risk situations because of certain benefits in relation to needs of survival, procreation, and extending the boundaries of the human race by means of travel and exploration, trade within and between nations, long-term employment, or completing a task quicker for some financial incentive, personal gain or accomplishment (Glendon et al., 2006). According to Fuller and Vassie (2004), people are learning to understand (e.g. to cognitively reason about and to deal with) risk situations, suggesting that some people appear to make every effort to reduce levels of risk, while others selectively attempt to increase their exposure to risk. The reason may be that the nature of risk as the human race experience it today has changed compared to that of previous generations, due to our own interventions (as a result of the increased demand to control risk, for example) (Glendon et al., 2006).

The next section focuses on the meaning and nature of risk, whether there is any acceptable level of risk, and possible reasons why people engage in risk behaviour.

2.2.1.1.1 The meaning and nature of risk

Hornby (2006, p. 1264) defines risk as "the possibility of something bad happening at some time in the future; a situation that could be dangerous or have a bad result". From a risk management perspective, Fuller and Vassie (2004, p. 5) argue that risk "is the chance of a particular situation or event, which will have an impact upon individual's, the organisation's or society's objective, occurring within a stated period of time". In addition, Erkut and Verter (1998) state that risk has to do with the probability and the consequence of an undesirable event. Similarly, according to an electricity distribution safety procedure (2007, March, p. 14), risk is defined as "the probability that a loss, injury or damage may occur".

According to an international standard (IEC, 1995), risk is defined as a combination of the frequency, or probability, of occurrence and the consequence of a specified hazardous event. Hannson (2005) warns against the notion that risk must have a single, well-defined meaning or definition. The researcher identified five essential aspects related to risk, namely an unwanted event, cause of the unwanted event, probability of the unwanted event, statistical expectation value (probability *x* outcome), and decisions made under conditions of known probabilities. The researcher proposes that the aspect of decisions made under conditions of known probabilities (International Organisation for Standardisation, 2002) is the most frequently cited description of risk. Hence, it may be argued that risk is the product of both the probability of and the consequence of the undesirable event.

All risks, be they on an individual, organisational, work-specific or environmental level, can be ring-fenced as situational or event-based risks (Fuller & Vassie, 2004, p. 5). Freitag (as cited in Harms-Ringdahl, 2004, p. 14) defines an event as a "deviation in an activity or technology which leads towards unwanted negative consequences". An event may be an accident, an incident, a near miss, or, a defect or barrier in a safety system (Harms-Ringdahl, 2004). The outcome of a risk occurring can be either negative or positive, and when the outcome is negative the event will normally be referred to as an adverse event (e.g. an event that produces a near miss, harm, fatality or damage). Within the health and safety domain, a risk relates more to the chance of a negative than a positive outcome (Fuller & Vassie, 2004). As mentioned before, an adverse event is normally described or referred to as an accident or incident; this includes near misses. These concepts are very important as their meaning and practical applications give substance to accident investigations, risk analyses and safety management systems (Fuller & Vassie, 2004; Harms-Ringdahl, 2004). A situational risk, according to Fuller and Vassie (2004 p. 5), occurs where a hazard "may be continuously disposed to impact upon a system" e.g. severe weather conditions that can cause vehicle accidents or damage to properties. An event-based risk is likely to exist where the "probability of an event occurring arises from the failure, under certain circumstances, of protective systems, which may or may not have been implemented to control the risk" (Fuller & Vassie, 2004 p. 5). Examples here could be the failure of a plant safety mechanism or completing a task without the correct training. A practical example of an event-based risk within an electricity supply organisation is illustrated in Figure 2.1.

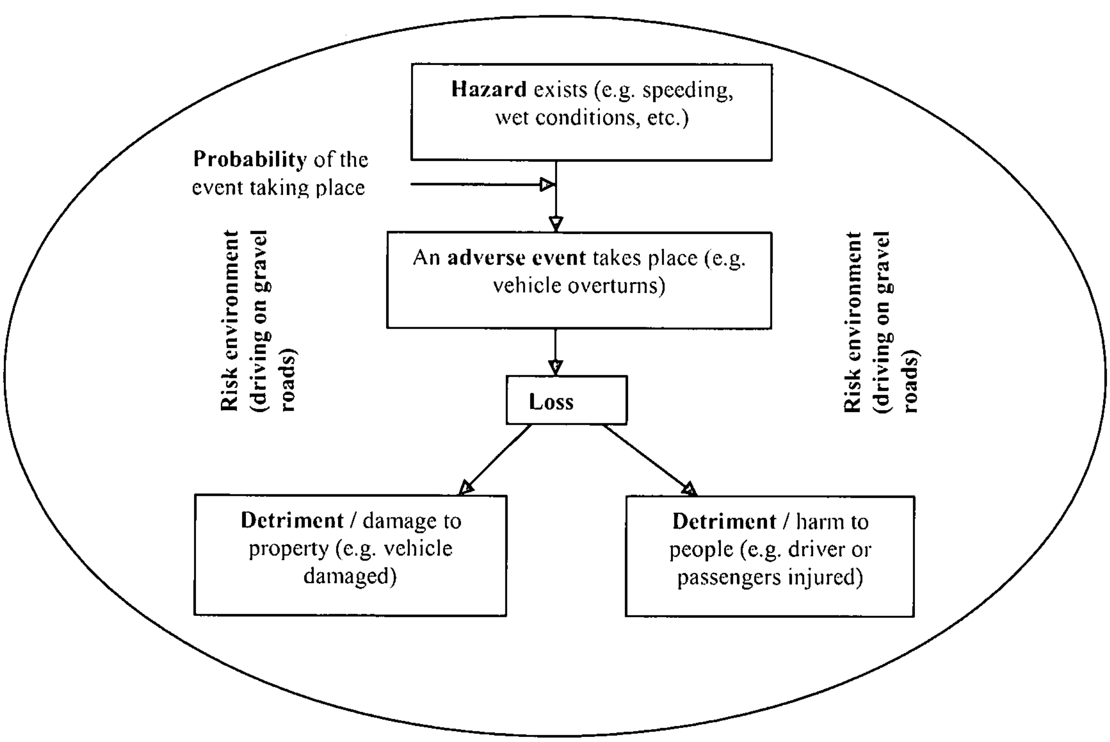


Figure 2.1 Practical example of an event-based risk (as cited in Fuller & Vassie, 2004, p. 5)

The risk environment in this example has been identified as the driving of 4 x 4 pick-ups on uneven surfaces (e.g. gravel roads, etc), loaded with a ladder, tools and equipment that the operator uses in the execution of his or her daily tasks (e.g. building, repairing and maintenance of rural electrical lines). The identified hazard(s) in this situation are likely to be speeding, condition of the road, driver's driving skills, and so forth. The probability of an event taking place is high due to the nature of the work and the driving conditions. In this example, the adverse event is that the driver loses control over the vehicle, hits a sand wall next to the road and the vehicle overturns. Two types of loss occur, namely damage to the vehicle and the suffering of multiple injuries by the driver.

The general definitions and meanings of incidents and accidents are explained next.

2.2.1.1.2 The meaning of the concepts incident and accident

The concept incident could be thought of as the first of a series of events which could lead to a situation in which harm or damage occurs. Focusing attention on the concept of "incident" in safety management empowers organisations to determine the root cause of the incident and to use the information to stop processes and behaviours that could have resulted in an accident. For example, a hand tool falls out of a worker's hand whilst the worker is working on a pole-mounted structure eleven meters from ground level and lands near a worker standing on ground level. This event is unplanned, unwanted, and has the potential to result in an injury.

Other researchers such as Greenwell, Knight and Strunk (2003), Hollnagel (2004), and Svenson, (2001) explain that "incident" refers to an unplanned or unwanted event, which disrupts the work process and has the potential of resulting in injury, harm, or damage to persons or property. However, an incident that disrupts the work process and does not result in injury or damage should not be ignored, but treated as a wake-up call. These types of incidents are normally referred to as near misses. Most researchers agree that a near miss or near accident refers to an incident that could have involved a serious injury or has the potential for serious damage to property or the environment (e.g. Glendon et al., 2006; Fuller & Vassie, 2004; Hollnagel, 2004; Reason, 1990). In addition, according to an electricity distribution safety procedure

(2007, March), an incident refers to "an unexpected sudden occurrence, including a major emission, fire, explosion or criminal activities that may result in serious injury to persons or damage to property and the environment or interruption of business" (p. 11).

The South African Occupational Health and Safety Act (Act 85 of 1993, as amended) (2004, p. 3) defines an accident as "arising out of and in the course of an employee employment and resulting in a personal injury, illness or the death of the employee". The term incident is defined as contemplated in section 24(1) of the same Act (2004, pp. 14-15); which reads:

> "(1) Each incident occurring at work or arising out of or in connection with the activities of persons at work, or in connection with the use of plant or machinery, in which, or in consequence of which-
>
> (a) any person dies, becomes unconscious, suffers the loss of a limb or part of a limb or is otherwise injured or becomes ill to such a degree that he is likely either to die or to suffer a permanent physical defect or likely to be unable for a period of at least 14 days either to work or to continue with the activity for which he was employed or is usually employed;
>
> (b) a major incident occurred; or
>
> (c) the health and safety of any person was endangered and where-
>
> (i) a dangerous substance was spilled;
>
> (ii) the uncontrolled release of any substance under pressure took place;
>
> (iii) machinery or any part thereof fractured or failed resulting in flying, falling or uncontrolled moving objects; or
>
> (iv) machinery ran out of control ..."

The National Safety Council (2009, December 18) defines "accident" as "... the occurrence in a sequence of events that produces unintended injury, death, or property damage". In this definition, "accident" refers to the event, not the result of the event. Similarly, according to an electricity distribution safety procedure (2007, March), accident refers to "an undesired event, caused by sub-standard acts and/or conditions that result in physical harm to persons and/or damage to property" (p. 9). Researchers such Greenwell, Knight and Strunk (2003), Hollnagel (2004) and Svenson, (2001) define "accident" as an unexpected or unintentional event, that in many cases is reasoned to be just bad luck or an act of God. The researchers further argue that the occurrence of accidents is more often than not predictable or a foreseeable eventuality. Hence it may be reasoned that an accident is an unplanned and unwanted but a controllable event, which disrupts the work process and causes property damage or personal injury, minor or serious, and which occasionally results in a fatality. This view is supported by Loimer, Driur and Guarnieri (1996), who strongly advocate against the concept "accident" in the study of injury prevention. They argue that adverse events do not happen at random or by chance, but that such events can be expected to happen, even if the time, place, and precise circumstances cannot be foreseen; dismissing the more biblical connotation or defensive notion of claiming the occurrence of accidents to be an act of God (e.g. beyond their control) especially in human error investigations or when the human factor is involved.

Furthermore, Zohar (2000) refers to near misses as micro accidents and no injury events, which are predictors of actual work place injuries. Most work place injuries and illness are not to the result of accidents, but rather of the failure of a complex system of barriers (e.g. organisational factors, such as working conditions, climates, and cultures, senior management decisions, poorly trained staff, unsafe acts, lack of work wellness e.g. stress, excessive work demands, including technological or plant safety mechanisms/procedures) designed to protect a system and/or employees from one or more hazards (Hollnagel, 2004; Reason, 1997). Referring back to the example of the falling hand tool (section 2.2.1.1.2), the tool may fall a second time and this time it may hit the worker on ground level, causing an injury. In this case the event can be seen to be both predictable and preventable.

2.2.1.1.3 At-risk behaviour

Why do people engage in at-risk behaviour? This question has been extensively debated from engineering, natural and social science, political and psychological perspectives (Fuller & Vassie, 2004; Glendon et al., 2006). From an engineering science perspective, Kasperson (1992, as cited in Fuller & Vassie, 2004, p. 10) argues that the concept of risk focuses narrowly on the probability of events and the enormity of the consequences that follow. Social and behavioural scientists, on the other hand, have directed their attention towards the study of human activity in risk identification and hazard causation such as human factors, personality, role of management and interpersonal relationships. Both groups however fail to offer a unified approach for integrating the technical and social orientation of risk. The reality is that risks and hazardous events are inclusive in the daily operations of people and organisations despite technological advancements to reduce individual and organisational exposure to unnecessarily high levels of risk or through risk-averse behaviour (Reason, 1997).

According to Glendon et al. (2006), the normal risk sequence assumes that an individual perceives a hazard and then, via rational and emotive cognitive processes, interprets this as risk. This means that the identification of risk and efforts to mitigate the risk hazard lie solely with the individual. However, according to cultural theory the opposite holds, because the identification of risk and efforts to mitigate the risk hazard actually belong to the institution or organisation (Douglas, 1985). Thus, the attitudes and behaviours of a broad social or cultural group need to be taken seriously when one conceptualises at-risk behaviour.

Consequently, people willingly take risks, but one needs to understand whether the risk is a speculative or a pure risk. According to Fuller and Vassie (2004), a speculative risk offers the possibility of either a gain or a loss (for instance, a gambler who places a bet and the throw of a dice determines the gain or loss), whereas pure risks (e.g. hurricanes and floods) provide only the prospect of a loss with no possibility of a gain. Hence, MacCrimmon and Wehrung (1986) propose that an individual's propensity to risk could be described by the magnitude of the potential loss or outcome, the probability of the potential loss or consequence from happening, and the person's level of exposure to the risk.

Three issues are of importance regarding the impact of the above-mentioned views, namely the measures that are in place to control the risk, the information or knowledge provided about the risk, and the time available to manage the risk. Fuller and Vassie (2004) suggest that an individual can in most situations only control his or her own exposure to a risk, whereas the organisation is in a better position to control or change the magnitude of the potential losses and the probability of an adverse event taking place. To accomplish this, the organisation has at its disposal tools such as effective risk management systems, effective employer/employee and stakeholder communication, manager's support, and employee health and safety training.

The next factor that is a common debate in the work place is about who must take responsibility for risk. On the one hand, employees argue that it is the organisation that should be responsible (e.g. role of managerial leadership or the organisation's culture/climate), while on the other hand, managers argue that the individual is responsible (e.g. individual responsibility). In this context two arguments are important: (1) exposure to involuntary situations and an unfavourable outcome (e.g. employees exposed to inadequate personal protective clothing or devices: and (2) exposure to risk arising from people's own voluntary actions (e.g. parachute jumping, for instance, or driving a car too fast on a gravel road). It is clear that the organisation has to take responsibility in the first argument and the individual directly or indirectly in the second.

2.2.1.1.3.1 Categorisation of at-risk behaviour

According to Fuller and Vassie (2004), risks to people and society in general can be categorised as negligible, acceptable, tolerable and intolerable. A negligible risk refers to a state of existence where one would not consider the probability or outcome of adverse events. An acceptable level of risk is likely to be where one's own and other people's lives as well as the environment would not be severely affected, but where reasonable precautions are still needed to achieve this state. A tolerable level of risk could be described as risks that are known and a regularly accepted practice, because the benefits of the activity are deemed to outweigh the human cost of the risk.

A tolerable level of risk is not one that should be considered negligible or ignored, but rather one that needs regular review. Lastly, an intolerable level of risk is one that cannot be accepted under any normal circumstances (Fuller & Vassie, 2004).

Hence, the debate around acceptable levels of risk depends on the hazards (e.g. fluids, polluted water resources, working at heights, etc.) that are involved, the stakeholders (e.g. government, organisations, employees or members of the public), and on whether exposure to these hazards is voluntary/intentional or involuntary/unintentional. Within health and safety management, the focus is on involuntary or unintentional injuries because these are unplanned, whereas voluntary or intentional occupational injuries happen as the result of self-inflicted human action directed either at oneself (e.g. suicide) or other people (e.g. assault or homicide) (Barling & Frone, 2004). Unintentional injuries range from fatal injuries, accidents and incidents to near misses.

The vital link between involuntary or unintentional injuries and human factor or error in accident causation is discussed next.

2.2.1.1.3.2 The human factor and human error in accident causation

The concept of the human factor or ergonomics is more concerned with the human system, human engineering, or the engineering psychology interface (Salvendy, 1987; Sanders & McCormick, 1993). Past views on human factor investigation were concerned with identifying and punishing people guilty of causing those accidents. Contemporary views on human factor investigation take into account its complexity as integrated relationships between human science (e.g. behavioural, cognitive and biological characteristics), systems engineering (e.g. equipment design, training, management practices) and the environment (e.g. affects of global warming, social-political climate, working conditions) (e.g. Adams, 1995; Reason, Parker & Lawton, 1998). Therefore, in support of the discussion as highlighted in section 2.2.1.1.3 at-risk behaviour could be conceptualised as a complex interaction between, (1) latent organisational hazards (e.g. hardware defects, organisational failures), (2) individual unsafe acts/behaviours (e.g. slips, lapses, rule violations), and (3) environmental/situational conditions (e.g. driving on on-even roads, weather conditions) which have the capacity for undesirable negative safety outcomes (Reason, 1993).

Although the concept of the human factor is a large and complex subject, it remains an important field of study in accident causations, because it provides strong motivation to build better and safer products and systems, design processes and procedures that are more efficient, and encourages the development of specific management and employee health and safety-related training programmes. A detailed coverage of this concept is beyond the scope of this chapter, which will focus rather on a general explanation of the concept human error.

The concept of human error is briefly explained, focusing on the meaning of human error, why it occurs and types of human error. A fundamental aspect of human behaviour is that humans make mistakes or errors. Human error is a complex phenomenon, the study of which dates as far back as Sigmund Freud's introduction of the expression "Freudian slip", which is derived from the notion of some unconscious need or purpose resulting in erroneous actions (Glendon et al., 2006). In earlier research conducted by Reason (1990) and Reason and Mycielska (1982), the researchers argued for a cognitive interpretation for most (if not all) human errors. Reason (1990, as cited in Glendon et al., 2006, p. 109) defines human error as, "a generic term to encompass all those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some change agency".

As highlighted earlier, committing errors is part of the learning process because it has been central to our survival as a human race. Thus, one needs to recognise the fact that making errors and responding to feedback is essential for human learning to take place (for example, direct experiences, how to treat other road users, how to behave at work). However, from earlier days of learning by trial and error, a large amount of knowledge about error making has been recorded and transferred across the generations. Hence, in the modern world, learning through trial and error or the inherent variability of human susceptibility to error making is not necessarily the most relevant way of learning (Glendon et al., 2006).

According to Reason (1997), current views on human error in accident causation suggest that the occurrence of accidents is a direct result of organisational decisions and culture, with the conditions under which tasks are performed being the causative factor. The root cause may have its origins in advance of an actual event, but it is still important to understand how human ability and function play a part in the event (Reason, 1990, 1997). According to Fuller and Vassie (2004, p. 66) "all errors are deemed to be a direct consequence of human behaviour". Their reasoning suggests that all errors are the end result of actions that in most cases are deemed to produce the desired outcome but failed or certain actions that may work but also have the potential for a negative outcome as well. A well-known researcher in the field of human error investigation (Reason, 1990; 1995) categorises the causes of human error as: (1) behavioural or what happened: (2) contextual or where did it happen: and (3) conceptual or how did it happen. The behavioural level provides observable information about what caused the error (e.g. the actions before the error occurred or the consequences of an error). This approach has its limitations because similar behavioural errors may be caused by significantly different inputs and the outcomes from the same input may be significantly different.

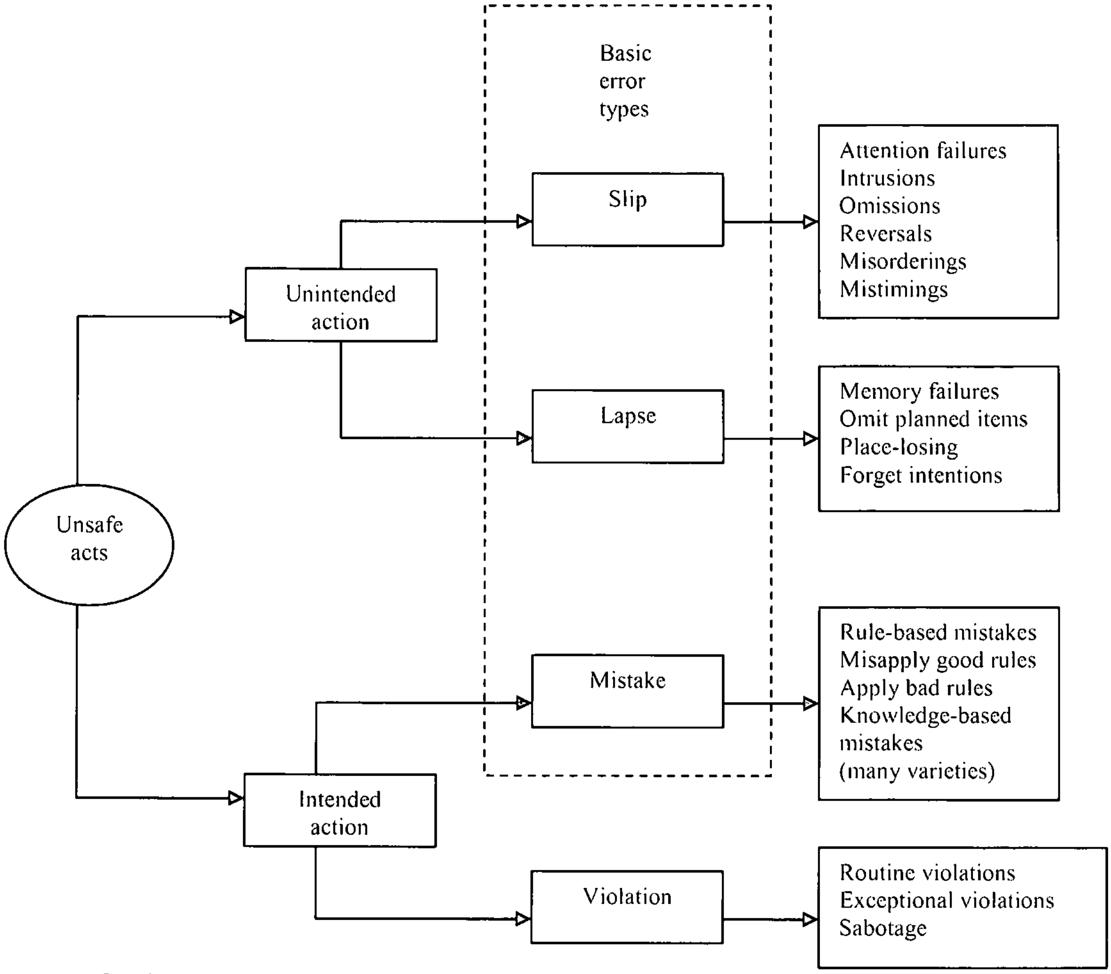
On a contextual level, information is gathered about were the error occurred in terms of the work place environment. On this level, it is important to relate the error to the local conditions and circumstances that prevailed at the time of the error. As with the behavioural level, this approach has its limitations because it does not explain why the same work place environment produces different errors or why different work place environments produce similar errors. Lastly, on a conceptual level the investigator makes certain assumptions about the cognitive aspects, focusing on the possible reasons why an error occurred and not relying solely on information gathered through the observable and environmental approach (Reason, 1995).

According to Reason (1995), the above-mentioned approaches require an understanding of the causes of human error. However, Rasmussen (1996) argues that although the findings of major accidents have highlighted the role of human error and the fact that 80-90% of organisational accidents may be the result of human error involvement, the concept of human error is still very vague. Nonetheless, individuals are involved on a daily basis in the execution of certain operational procedures and each operational procedure defines how the tasks need to be correctly completed. Yet, individuals by nature have found ways and means to complete tasks incorrectly. Hence, the prediction is valid that many tasks or operational procedures are executed incorrectly, without an adverse affect because employees may take corrective actions before the incorrect action leads to something negative. Only in a small number of cases do people fail to either recognise the error or fail to correct them before the consequences of the errors are realised (e.g. Adams, 1995; Fuller & Vassie, 2004; Reason 1997). The fact remains that errors do exist and that the contributing effect of human error causation may or may not be a daily phenomenon. Health and safety practitioners as well as researchers are concerned to understand the predictability of these errors because predictable errors can be managed.

Many researchers (e.g. Mashour, 1974; Rumar, 1985; Wagenaar & Groeneweg, 1987) have accumulated research findings in order to classify human errors. In order for one to predict human error one must understand the circumstances that lead to such errors (Fuller & Vassie, 2004). The circumstances, according to Reason (1995, 1997), include the concept of intention, namely intentional (intended action) and non-intentional/involuntary (unintended) actions. Although there is no universally agreed classified system of human error, Reason (1990) developed a generic classification system, which he termed the generic error modelling system (GEMS). This modelling system proposes three distinct error types, which occur at different levels of performance, namely skill-based (SB), rule-based (RB), or knowledge-based (KB) errors (Rasmussen, 1986). The GEMS model of error types is illustrated in Figure 2.2.

The GEMS identified the following error types (Glendon et al., 2006, p. 114):

- Skill-based slips and lapses: Unconscious automatic actions resulting in slips (observable, at behavioural stage) and lapses (inferred, at storage stage, e.g. memory failures), many of these being monitoring failures due to either inattention or over-attention.
- Rule-based mistakes: Following a serious of steps and making a mistake, either applying good rules incorrectly or applying bad rules to a situation.
- Knowledge-based mistakes: Learning from first principles, mistakes made during problem solving, for example, those subject to attributional baises.



Summary of main error types
Slips – skill-based, actions not as intended, perpetrator unaware, task-execution failures
Lapses – skill-based, unconscious mental errors, perpetrator may become aware of later, storage-stage (memory) failures
Mistakes – rule- or knowledge-based, perpetrator unlikely to be aware of unless deliberate (violations), planning-stage failures
Violations – deliberate deviations from standard practice, carried out to maintain safe operation

Figure 2.2 Human error types (as cited in Glendon et al., 2006, p. 115)

Intentional actions refer to spontaneous activities or actions that followed the intended path but fail to achieve the planned outcome. The errors are often referred to as mistakes and result from failure to plan. Non-intentional or involuntary actions, on the other hand, refer to actions that do not follow the intended route, but which may or may not achieve the desired outcome. These unintended actions are referred to as lapses and slips.

In light of the above, it is clear that human error is inevitable because of the fundamental limitations of human cognitive architecture. As Lawton and Parker (1998), rightfully argued when unintentional acts (errors) combine with intentional acts (such as rule breaking) the environment is set for accidents to occur.

Hence, the specific purpose of this study is to get a better understanding of how individual psychological factors (e.g. intelligence, personality and work wellness factors) predict employees' attitude towards work place safety.

Therefore, it is important to firstly conceptualise the construct attitude, the meaning of attitude and the different theoretical models that make-up the attitude structure, as well as the influence of the independent variables on the forming of attitudes.

2.3 THE CONCEPT ATTITUDE

The survival of the human race depends on people's evaluation and interpretation of their environment, in relation to themselves as well as to those around them in order to plan the future. This process of evaluation and interpretation repeats itself in organisations in situations such as the selection of leaders, appointment and managing of resources, interaction or relationship with different role players (e.g. customers, competitors, business partners, etc.) in making strategic decisions. Hence, such unobserved and observed actions involve judgements about whether objects, events, oneself and others are good or bad, favourable or unfavourable, likeable or unlikeable (Albarracín, Johnson, Zanna & Kumkale, 2005). Therefore, the study of those attitudinal factors in the evaluation and interpretation process that ultimately influences a person's thinking process, motivations and behaviour (e.g. attitude towards work place safety) are of high importance.

The definition of attitude and the theoretical characteristics/models regarding the meaning and nature of attitudes are discussed next.

2.3.1 The meaning and nature of attitude

The meaning of attitude has received much attention from researchers in social psychology. Past and current research (e.g., Albarracín, Johson, & Zanna, 2005; Allport, 1935; Anderson, 1981; Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975; Triandis, 1971; Zimbardo, Ebbesen & Maslach, 1977) on this topic also highlights the volumes of studies on various aspects of attitude formation and change wider than the social psychology domain, such as in the fields of health and safety management, psychology, industrial-organisational psychology, and so forth.

Gordon Allport has been cited as the first researcher to formulate the concept of attitude from a social psychology perspective. He defines attitude as "a mental and neural state of readiness organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (Allport, 1935, cited in Krosnick, Judd & Wittenbrink, 2005, p. 22). After Allport's publication, other researchers began to publish their theoretical views on attitude. Triandis (1971) defines attitude as an idea influenced by emotion that predisposes a class of actions towards a particular class of social situation, person or object. Prominent researchers in the study of attitude, namely Fishbein and Ajzen (1975), define attitude as the general feeling (ranging from positive to negative) or evaluation (good or bad) a person has towards self, other people, objects or events. They further argue that attitude is a learned predisposition to respond in a consistently positive or negative manner with respect to a given object, entity or person.

Zimbardo et al. (1977) propose that attitude consists of satisfaction and dissatisfaction. They argue that these two concepts form the basis of the individual's preference, which includes his attitude towards people, groups, situations, objects or ideas. In addition, attitude is a mental readiness that has a general or continuous influence on a wide variety of evaluative responses. Hence, attitude can be regarded as an internal, private occurrence derived from introspection and displayed through overt or covert actions. Furthermore, Anderson (1981) defines an attitude as a disposition to react with characteristic judgments and with characteristic goals across a variety of situations. Similarly, McGuire (1986) views an attitude as a mediating process grouping a set of objects of thought in a conceptual category that suggest a significant pattern of responses.

Eagly and Chaiken (1993) argue that an attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of acceptance or rejection. In their definition, the researchers emphasise the prominent role of the evaluative process in attitude formation. The researchers further argue that an attitude is focused on a specific entity or object, rather than all objects, situations and people with which it is related. Robbins (1996) describes attitude as evaluative statements that are either favourable or unfavourable towards objects, people, or events. It demonstrates how a person feels about something, suggesting that the affective component (see section 5.3.2. for a more detailed discussion on the components of attitude) of attitudes should not be underestimated. In addition, Krosnick, Judd and Wittenbrink (2005) suggest that an attitude is a predisposition to like or dislike an entity or object, which may result in an approach towards or avoidance of the entity, object or situation. Furthermore, Myers (2008, pp. 531-532) argues that attitude is feelings, often based on beliefs, that predispose us to respond in a particular way to people, objects and situations. For example, if we believe that we cannot control things that happen to us (such as work place accidents) we may feel that the incident is part of life (e.g. an act of God), which in turn may influence our behaviour to become less safety conscious. If we believe that someone is rude, we may feel angry towards that person and act in an unfriendly manner.

It is clear from the above that researchers differ in their views on the construct of attitude, but most researchers would agree that the psychological concept of attitude is learned throughout life by means of social interactions and other influences (e.g. beliefs, values, cognitions, emotions and motivation, and that it is both environmental and situational). This means that some attitudes are relatively enduring (acquired disposition), in some cases formed in early childhood and continuous through one's lifespan. Other attitudes are formed but are altered because of the variability in the evaluative process under differing situations or conditions (Schwarz & Bohner, 2001; Wilson & Hodges, 1992).

There is a process of evaluating (or judging) a particular entity, object or person as something good or bad, positive or negative. This process of evaluating is likely to influence or guide a person's psychological tendency to act in a particular manner, although there is no common understanding that a person with a given attitude will actually behave in any definite manner. That there is some degree of consistency suggests that people tend to have clusters of attitudes that are generally mutually consistent. Thus, people may have multiple attitudes toward the same attitude object, entity or person. Lastly, the attitude is specific towards a particular object, situation or person, meaning that the attitude should not be thought of as being generalisable to other objects, situations or persons (e.g. Albarracín et al., 2005; Allport, 1935; Eagly & Chaiken, 1993; Krosnick, Judd & Wittenbrink, 2005; Myers, 2008; Robbins, 1996; Triandis, 1971).

In addition, attitude consists of three important aspects: namely (1) the direction (e.g. whether a person agrees or disagrees with something), (2) the strength (e.g. how strongly a person feels about something), and (3) centrality (e.g. how important the person feels this attitude is compared with other attitudes). This means that when someone possesses an attitude with a clear direction, higher strength and a strong feeling compared with other attitudes, it would be more difficult to change the attitude (Foster, 2008).

For the purpose of this study, the psychological construct of attitude is defined as a learned disposition towards a specific object or situation, resulting in a tendency to act in a consistently positive or negative manner, mediated by psychological variables such as cognition, affection, motivation, beliefs etc.

The complex nature of the concept of attitude is briefly explained in the next section by focusing on the different theoretical models regarding the meaning and nature of attitudes.

2.3.2 Theoretical models regarding the composition of attitudes

According to Glendon et al. (2006), attitudes have their roots somewhere between deep-seated values and beliefs and relatively superficial views and opinions. Those attitudes found nearest to a person's deep-seated values and beliefs are likely to remain unchanged over a lifetime. Attitudes found nearest to a person's views and opinions are likely to change more often, depending on the information to which a person has most recently been exposed, or on personal experiences.

Attitudes are distinguished from beliefs and values and can be explained as follows (Hicks, 1996):

- Attitudes provide a state of readiness or tendency to act in a certain manner.
- Beliefs are more concerned with how a person perceives the world: they centre around a person's cognitive understanding of, or association between, an object and a descriptive attribute (e.g., work place accidents cannot be prevented).
- Values are concerned with what should be and what is desirable, for example, a belief about what is right (e.g. following safety rules and procedures) or wrong (e.g. non-adherence to safe working rules, procedures and practices).

According to Eagly and Chaiken (1993), attitudes and beliefs are distinct, because beliefs can be verified or falsified with external, objective criteria, whereas attitudes are likely to have more difficulty meeting such criteria. Nonetheless, a person's belief structure plays an important part in the cognitive component of attitude. The different models regarding the components of attitude are discussed next.

2.3.2.1 Different models regarding the components of attitude

In their endeavours to unpack the construct of attitude, most researchers applied many different theoretical frameworks and models (Albarracín et al., 2005). However, most of the researchers have concluded that attitudes can be divided into one of three categories or theoretical models (Foster, 2008; Reber & Reber, 2001), namely: (1) the three-component model according to which attitudes consist of a cognitive, affective and conative component, (2) the two-component model according to which attitudes consist of a cognitive and affective component, and (3) the single-component model according to which attitudes consist of an affective component only.

The cognitive component is concerned with the thinking aspect of an attitude and includes a person's thoughts, opinions, beliefs or realistic knowledge or understanding of a particular object or person. The affective component is concerned with the feelings, emotions or evaluative process people experience and may or may not involve a particular object or person. The conative or behavioural component relates to the tendency to act in a certain way toward an object or person and includes the intention or motive aspect. Each of these individual components is central to the dynamic forces that form and transform current attitudes (see Albarracín et al., 2005; Eagly & Chaiken, 1993; 2005; Foster, 2008; Robbins, 1996)

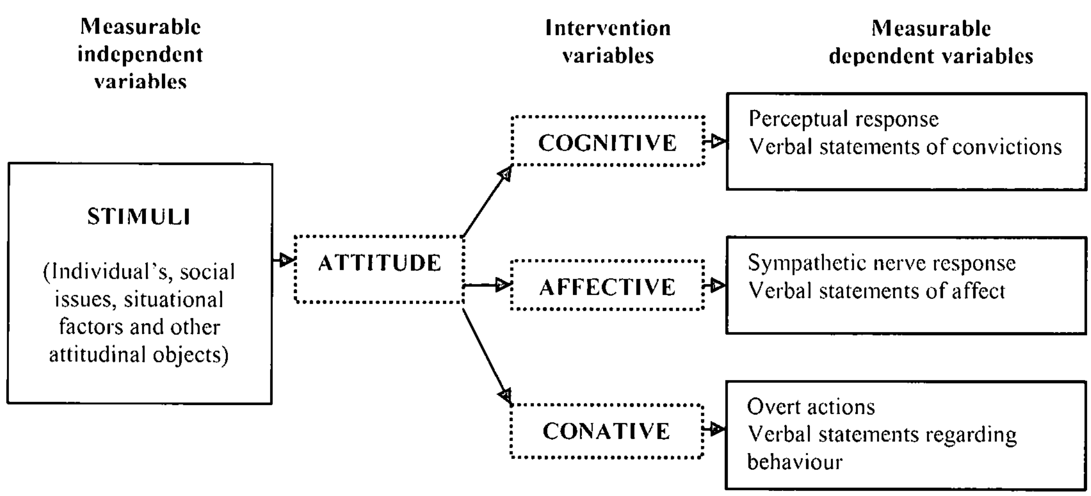


Figure 2.3 The three-component model of attitude (Rosenberg & Hovland, 1960 in Kleynhans, 2008, p. 29)

Figure 2.3 illustrates the interactive and evaluative relationship that cognition, affect and behaviour (conative) have with attitude within the three-component model developed by Rosenberg and Hovland (1960, as cited in Kleynhans, 2008, p. 29). The model demonstrates that a person's responses towards a stimulus are mediated by the person's attitude towards a particular object. The stimulus may include variables such as the individual's and social issues, as well as situational factors such as stressful work demands or hazardous working conditions such as working at heights. The different responses are divided into three categories, namely the cognitive (e.g.

perceptual responses and verbal statements of convictions), affective (e.g. sympathetic nerve responses and verbal statements of affect), and the conative components (e.g. overt actions and verbal statements regarding behaviour). Thus, each response category relates to one attitude component (Kleynhans, 2008; Zimbardo et al., 1977). The model (Figure 2.3) suggests that in order to understand how a person's attitude is formed all three components of attitude need to be taken into consideration. Hence, a person's attitude towards work place safety is likely to consist, amongst other variables, of a cognitive, an affective and a behavioural (conative) component. An important aspect in attitude research is the attitude-behaviour relationship concerning how behaviour can be predicted and what process mediates between attitudes and behaviour. In other words, the prediction of behaviour has always been a core issue in the study of attitudes (Ajzen & Fishbein, 2005). The attitude-behaviour relationship with specific reference to the theory of reasoned action and planned behaviour (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) are discussed in section 2.5, namely attitude towards work place safety.

In the above-mentioned sections, the psychological construct of attitude was defined, followed by an explanation of the meaning and nature of attitudes as well as the primary components that influence a person's intention to act in a particular manner. The different theories regarding the forming of attitudes as well as the influence of the independent variables (intelligence, personality, burnout, work engagement, and sense of coherence) on the formation of attitudes follow next.

2.4 THEORIES REGARDING THE FORMING OF ATTITUDES

According to Taylor, Peplau and Sears (1994), different theories or approaches exist regarding the formation and changing of attitudes. For the purpose of this study, the focus is on attitude formation (e.g. psychological factors influencing a person's attitude towards work place safety) and not attitude change, although the theories and models that are discussed are also relevant to attitude change. A brief discussion of the different theories regarding attitude formation follows.

According to Ottati, Edwards and Krumdick (2005), in discussing the forming of attitudes, a distinction can be made between those that entail minimal cognitive thought or explanation and those that involve a great deal of thought and explanation (e.g. Chaiken & Trope, 1999). Those that entail minimal cognitive processing are labelled peripheral or heuristic processing (simple), while those that require a great deal of cognitive processing are labelled central or systematic processing (complex) (e.g. Chaiken, Liberman & Eagly, 1989; Chen & Chaiken, 1999). The theories or models that represent the peripheral processing of attitude formation and change include classical conditioning (e.g. Krosnick, Betz, Jussin & Lynn, 1992; Staats & Staats, 1958), operant conditioning (e.g. Greenspoon, 1955; Insko, 1965), mood misattribution (e.g. Schwarz & Clore, 1983), and self-perception (e.g. Bem, 1965, 1972). The theories or approaches that represent the systematic style of processing on the other hand, entail the combinatorial (Fishbein & Ajzen, 1981), the cognitive response (Greenwald, 1968), and the information processing (McGuire, 1968, 1985) models of attitude formation and change.

In addition, the theories or models that focus on the cognitive consequences of previously formed attitudes, referred to as attitudes, elicit attitude-congruent processing (e.g. Allport, 1935; Edwards, 1941) is balance theory (Abelson & Rosenberg, 1958; Heider, 1946, 1958; Marsh & Wallace, 2005) and dissonance theory (Festinger, 1957; Olson & Stone, 2005).

The three cognitive processing approaches, namely: the (1) peripheral or heuristic (simple), (2) the systematic or central (complex), and (3) the attitudes elicit attitude-congruent of attitude formation are discussed next.

2.4.1 The peripheral or heuristic processing approaches

The peripheral or heuristic processing approach entails the activation and application of judgemental rules that, like other knowledge structures, are presumed to be learned and stored in memory. Based on this processing approach, judgements are formed based on easily processed judgement-relevant cues (e.g. the length and complex nature of the message), rather than on individualistic or particularistic judgement-relevant information. Thus, heuristic processing creates minimal cognitive demands on the perceiver. Furthermore, the heuristic processing mode is controlled by social cognitive principles of knowledge education and use, namely availability, accessibility, and applicability (e.g. Higgins, 1996). The emphasis is therefore on the availability function through memory, the accessibility and ready to use function through the retrieval from memory within a given judgemental setting, and the applicability of the retrieved information relevant to the judgemental situation at hand (Chen & Chaiken, 1999; Higgins, 1996; Ottati, Edwards & Krumdick, 2005). The different approaches that relate to the heuristic processing in attitude formation include the classical, operant conditioning, mood misattribution, and self-perception.

These approaches are explained below.

2.4.1.1 Classical conditioning

Ivan Pavlov is regarded as the father of classical conditioning. According to his theory, learning is a conditioned response that is the result of the forming of an association between a conditioned stimulus (e.g. learned) and an unconditioned stimulus (e.g. not learned). If a neutral stimulus (NS) is paired with a stimulus that elicits an automatic response, the neutral stimulus will lead to the same response elicited by the unconditioned stimulus. At this point the stimulus is no longer neutral and so is referred to as a conditioned stimulus (CS). His experiments advanced the understanding of learning, and how conditioned responses are reinforced or strengthened if the stimulus is consistently repeated with the unconditioned response (Robbins, Odendaal & Roodt, 2003).

With regard to attitudinal studies of the classical conditioning approach, the attitude object is temporally paired with another favourable or unfavourable object or experience. For example, a study conducted by Staats and Staats (1958) showed that unfamiliar nationalities or disembodied names (e.g. conditioned stimuli) were ranked more positively if their presentation was consistently followed by words with positive rather than negative meanings (e.g. unconditioned stimuli). Walther (2002) found that classical conditioning has been shown to influence evaluations of attitude objects previously associated with the target object. According to classical conditioning theory the conditioned stimuli comes before the unconditioned stimuli, but studies in attitude research found that pairing of unconditioned and conditioned stimuli also influences attitudes when the conditioned and unconditioned stimuli are presented simultaneously (Cacioppo, Priester & Berntson, 1993; Strack, Martin & Stepper, 1988). Similarly, De Houwer, Thomas and Baeyens (2001) found that evaluative influences also consistently occur with backward conditioning, when the unconditioned stimulus precedes the conditioned stimulus, although the effect of learning or evaluative influence is smaller.

Classical conditioning is especially involved with the emotional, or affective, component of attitudes and is often used by advertisers to create positive attitudes towards their products by presenting attractive models in their advertisements. In addition, positive or negative experiences with members of a particular group could lead to positive or negative attitudes toward that group (Wegner & Carlston, 2005).

Alarms in vehicles reminding drivers to wear their seatbelts are an example of classical conditioning, which could create a positive or negative attitude towards driver safety behaviour.

2.4.1.2 Operant conditioning

Operant conditioning relates to the work done by BF Skinner, who theorised that behaviour is determined by the consequences a person expects the behaviour will result in. Behaviours (including verbal behaviours and possibly thoughts) tend to be repeated if they are reinforced (e.g. followed by a positive experience), and behaviours tend to be stopped when they are punished (e.g. followed by a negative experience). Therefore, if one expresses, or acts out, a negative attitude toward safety behaviour for example not wearing your seatbelt, and if this is reinforced by other colleagues, the attitude is likely to be expressed again. The reinforcement of positive safety attitudinal acts can be as subtle as a smile or handshake or as obvious as a cash bonus. Operant conditioning is especially involved with the behavioural component of attitudes (Fishbein, 1967; Wegner & Carlston, 2005; Zimbardo et al., 1977).

Most of the time attitudinal studies concerning classical conditioning start with an object towards which few or no powerful associations exist, whereas operant conditioning studies start with an object towards which there are some existing associations, so that evaluative responses occur that can be rewarded and enhanced (Wegner & Carlston, 2005).

2.4.1.3 Mood misattribution

The concept of misattribution is derived from the attribution theory proposed by Heider (1958), who noted that in most cases people attribute other people's behaviour either to their internal dispositions (individual dispositions such as personality traits) or to their external situations. However, people do fall prey to the fundamental attribution error by overestimating the influence of personality and underestimating the influence of situations (Myers, 2008). For example, a manager may wonder whether one of his direct report's (member of staff reporting to him) unfriendly behaviour reflects a tough-minded, non-caring personality (a dispositional attribution) or a reaction to stress (a situational attribution). In focusing more on the unfriendly behaviour and less on the situation (stressful work demands, for instance), the manager's make certain inferences, which is based on the behaviour of his direct report, is an example of attribution error.

A growing body of literature demonstrates that affective states (emotions and moods) significantly influence social judgments (attitudes towards objects, people or attributes inferred about other people) (e.g. Clore & Schnall, 2005). According to Schachter and Singer (1962), people use their appraisals of situations, people or events as a basis for attributions about the origins of the physiological arousal that they experience. They argue that an event activates bodily reaction and appraisal, and attribute the arousal to a specific aspect of the situation resulting in an emotional experience (such as fear, anger, disappointment, happiness or joy).

As discussed in section 2.3.2.1 (and Figure 2.3), emotional states do influence a person's tendency to act either favourably or unfavourably towards a person, object or situation in attitude formation. Hence, both emotions and attitude have evaluation tendencies towards an object (e.g. something specific), whilst moods and temperament are not dedicated to specific objects, but are evaluative orientations without being constrained by an object. The evaluation embodied in affect can be conditioned, associated, inferred, attributed or otherwise transformed into the evaluative tendencies of attitude formation (Clore & Schnall, 2005, p. 440). Hence, affect can be regarded as an information-evaluation-judgement process, according to which implicit attributions are made that underlie both mere exposure effects and mood effects on attitude.

When evaluating a specific object individuals may simply ask themselves, "how do I feel about it?" (Schwarz, 1990; Schwarz & Clore, 1983). In expressing their feelings, drawing on factors that are objectively unrelated (e.g. happy or sad mood) to the object of judgement can be misattributed to it. For example, a person may experience a sad mood, but may relate positive feelings towards a specific object or person. Hence, the effect of moods on attitude formation could be misattributed (e.g. in a heuristic sense – when judgements are made quickly), whereas specific emotions should be resistant to misattribution, because their affect or valency is already dedicated to an object (Clore & Schnall, 2005).

Mood misattribution could lead to miscommunication or misunderstanding between two field electrical operators resulting in an operating error.

2.4.1.4 Self-perception

The self-perception theory was introduced by Bem (1967) as an alternative interpretation of the dissonance theory (see section 2.4.3.2.), and suggests that at times people do not know their attitudes, but may infer their own attitudes from their current behaviour or previous behaviour and the circumstances in which their behaviour occurred. Hence, people are likely to infer attitudes that are consistent or familiar with their previous or past conscious actions (Olson & Stone, 2005).

Both the cognitive dissonance theory and the self-perception theory make similar kpredictions, but for different reasons. The more traditional view of attitudes displayed through the cognitive dissonance theory is their strong and lasting predisposition. For example, when a person experiences anxiety, as the result of conflicting attitudes and behaviour, adjustments can only be made if the particular attitude is changed. However, the self-perception theory suggests that expressions of attitudes are explained through casual verbal statements of the behaviour of the person at that moment. Thus, according to Bem (1972), when people are asked to express their views on a social issue, they do not perform a thorough review of the large amount of self-knowledge they store in memory that may reflect their stance. They rather retrieve the judgement-relevant information alone (e.g. information based on recent behaviour). Only when they consider the implications of their behaviour to be unclear or unreliable, will they resort to additional information (e.g. from heuristic to a more cognitive systematic approach) (Wyer & Albarracín, 2005).

Self-perception for example could occur when asked why is it important to follow safety rules and procedures. A quick response based on previous behaviour (e.g. always test electrical equipment before working) is likely to influence the person's response or view on the question, why is it important to follow safety rules and procedures.

2.4.2 The systematic processing approaches

The systematic processing approach entails a relatively analytic and comprehensive view of judgemental-relevant information. Judgements formed based on the systematic processing approach are thus responsive to the actual content of the information presented. Given its nature, systematic processing requires both cognitive ability and capacity in attitude formation and change (Chen & Chaiken, 1999; Higgins, 1996; Ottati, Edwards & Krumdick, 2005). The different approaches that relate to systematic processing in attitude formation include the combinatorial, cognitive response, and information processing models. These approaches are discussed next.

2.4.2.1 Combinatorial approach

Combinatorial models of attitude formation, especially the information integration theory and expectancy-value models (e.g. Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975), have, since the mid-1960s, been extensively applied in consumer research on attitudes. These models typically include an information integration stage in terms of which multiple pieces of information (behaviours, attributes, traits, and beliefs) are combined to arrive at a summary judgement of the target person or object. The underlying hypothesis of such models is that an attitude represents the scale value or belief strength of associated cognitive elements, each weighted by an equally weighted algebraic rule of accessibility or importance, and summative via the psychological equivalent of adding or averaging (for example, adding the number of positive attributes and subtracting the number of negative attributes) (Ottati, Edwards & Krumdick, 2005).

According to Ajzen (1996), the combinatorial models of attitude formation are a rational and reasoned version of a subjectively expected utility model in terms of which some set of cognitions and beliefs weighted by their evaluations leads to an attitude and subsequent behavioural tendency (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975, 1981). The combinatorial attitude models imply that evaluative information is generated when a subset of the knowledge of beliefs about the object becomes salient. Depending upon what beliefs become accessible, the attitude can be computed (e.g. the positive or negative valence to the person) and the assessed implications of those beliefs become the main determinant of attitudes toward the object or entity (Johnson, Maio & Smith-McLallen, 2005; Ottati, Edwards & Krumdick, 2005). For example, a person buying a new vehicle can generate an attitude toward the specific vehicle in mind by considering specific features of the attitude object (e.g. external and interior design, price, model, engine capacity etc.) and the evaluative implications of those features (I like the model and design, but the vehicle is out of my affordable price range, etc.).

2.4.2.2 Cognitive response approach

Greenwald (1968), who emphasises the important notion that individuals are not passive recipients of verbal cues pertaining to an attitude object, introduced the cognitive response theory. When a person receives information (verbal communication), he generates cognitive responses that evaluate the pro and cons of the presented arguments, and relates the information to his prior knowledge (e.g. Chaiken, Liberman & Eagly, 1989; Greenwald, 1968; Petty & Cacioppo, 1986). The cognitive response theory also emphasises the individual's ability to recall objectively presented information pertaining to the object. The attitude that the receiver forms towards the communication topic is not determined by the evaluative tone of the communicated arguments, but is rather determined by the evaluative tone of these cognitive themes (e.g. Albarracín & Wyer, 2001; Eagly & Chaiken, 1993; Johnson, Maio & Smith-McLallen, 2005).

Earlier models suggest that attitude change would continue only if the receiver is able to remember the originally presented communication arguments. In contrast, cognitive response theory proposes that attitudes toward the communication topic are mostly determined by the receiver's cognitive responses to the message, and not the presented message itself (Greenwald, 1968; Ottati, Edwards & Krudick, 2005). The evaluative tone of these self-generated themes and discussions determines the receiver's attitude toward the topic and not the originally presented arguments. Therefore, continuous attitude change requires that the receiver remember the cognitive elaborations (Petty, 1977a, 1977b) and not that the receiver have the ability to recall the presented arguments (Cacioppo & Petty, 1979a).

Thus, substantial evidence suggests that cognitive responses can also influence, rather than justify, attitudes (Albarracín & Wyer, 2001; Petty, Schumann, Richman & Strathman, 1993).

2.4.2.3 Information-processing approach

According to Wegener and Carlston (2005), the information-processing model or approach provides a framework for breaking down and organising processes. In the earlier days of social cognition, the logic of the computer metaphor prevailed, as a framework for organising social cognitive processes. The information-processing model allows for the information input, storage, retrieval, and computation stimulus to be seen in manageable sub-processes that could be examined separately (Broadbent, 1958; McGuire, 1968). According to Baddeley (1987), the information-processing model consists of three stages that take place in the memory process namely:

- encoding (receiving information into memory)
- storage (keeping information in memory)
- retrieval (getting information from memory)

The encoding process of information refers to the receiving of information and storage in memory. During this stage, neither encoding nor storage of information is taking place, unless a conscious effort is made to act on the information received. Similarly, if a person does not focus attentively on the information with which he is confronted (e.g. thinking about something differently) no encoding will take place Hence, in attitude formation the receiver needs to focus and consciously act on the information presented by the object, situation or person in order for the encoding and storage of the information to happen.

The storage of information occurs when changes in the nervous system allow the information to be stored over time. Technically, these changes are referred to as the paving of memory traces. According to Atkinson and Shiffrin's (1968) multi-store model, storage of information can take place by means of three stages, namely the sensory, short-term and long-term memory. Sensory information (e.g. selective attention) stores an exact replica of the information stimulus for a fraction of a second. This stage is referred to as the heuristic process in attitude formation (e.g. acting on or forming an attitude instantly). Depending on the complex nature of the information received and the encoding process, the information is transferred to short-term memory for about 20 seconds or to the long-term memory (e.g. need several or deeper levels of cognitive processing) if needed to be stored permanently. Thus, only listening and thinking about the information does not guarantee that encoding and storage will take place (Baddeley, 1987). All three stages in the information-processing model (encoding, storage and retrieval) occur in all three stages of memory processing (sensory, short-term and long-term memory). In attitude formation (according to the systematic process), it is important that information regarding the object, situation or person be stored in a reliable and permanent form.

The final stage in the information-processing model is the retrieval process, which relates to the recovering of the information as stored in the memory (e.g. sensory, short-term or long-term) (Baddeley, 1987). Thus, the degree of complexity of information received and the intention to act on the information is likely to guide which form of memory retrieval process will take effect in attitude formation. The effect of the perceptual process in attitude formation (through the information-processing model) cannot be ignored because we view things in different ways and each of us creates a unique picture or image of how we see the real world. According to Mullins and Hicks (1996), people are not passive recipients of information from the world; we analyse and judge information in terms of its perceptual connotations, provoking different behaviours.

The strong link between perception and memory processing within the larger information-processing model or system is evident (e.g. stimulus, encoding by means of screening, organising, arranging, storing logically and meaningfully and retrieval through patterns of behaviour). Furthermore, the knowledge structures within the sensory, short-term and long-term memory storage stages are associated with forming and changing of attitudes. Attitudes based on information linked to core values and beliefs, for example, could result in an attitude that serves a value-expressive function, and an attitude based on information relevant to self worth could produce an ego-defensive attitude. Thus, newly received attitude-relevant information comes into contact with previously stored attitudinal information in memory, influenced by emotions or feelings, past experiences/behaviour and cognitive structures, which either confirms existing attitudes, or changes and forms new attitudinal behavioural intentions towards an object, situation or other people (Fabrigar, MacDonald & Wegener, 2005).

The section below, focuses on the attitude elicit attitude congruent models through the balance and dissonance approaches of attitude formation and change.

2.4.3 The attitude elicit attitude congruent approaches

According to attitude elicit attitude congruency or attitude consistency theorists; a need exists for consistency although the focus of the consistency may differ. According to Keisler, Collins and Miller (1969), some theories emphasise the need for personal consistency in relation to their personality and others the maintaining of consistency between attitudes, between behaviours, and between attitudes and behaviours. Furthermore, other theories view as important the perception of the world in a consistent united manner.

A central phenomenon of all of these theories is the mere acceptance that the presence of inconsistency creates psychological tension or some degree of discomfort. In order to reduce the tension a person rearranges the psychological world to create a sense of consistency (Keisler et al., 1969). Theories that relate to the attitude elicit attitude congruency or attitude consistency approaches are the balance and dissonance theories. These two approaches are discussed next.

2.4.3.1 Balance theory

The balance theory presented by Heider (1958) may be regarded as one of the first congruity or consistency theories. The underlying hypothesis of this theory lies within the cognitive structure, which a person maintains in order to create a sense of consistency. Balanced relations may be represented schematically in memory, whereas unbalanced relations may be stored as individual bits of information. People are therefore likely to spontaneously add unmentioned features to the representation they form that are consistent with these principles, and they are also likely to later respond to these bits of information as a single unit of knowledge rather than in terms of its different components (Wyer & Albarracín, 2005). Heider (1958) argues that this sense of consistency or balanced condition is a condition whereby everything has to fit together harmoniously in order to remove the stress of inconsistency.

Balance theory consists of three elements of knowledge namely: (1) attitude toward another person: (2) the other person's attitude toward the object: and (3) one's own attitude toward the object. According to Wegener and Carlston (2005), due consideration of all three evaluations might require greater cognitive effort than thinking only about one's liking for the other person (e.g. attraction) or agreement with the other person.

According to Fishbein (1967), the balance theory is based on two fundamental principles. The first principle suggests that some cognitive systems are balanced and others not. Balanced relationships between people create a purposeful and meaningful holistic image. The inconsistency comes from agreeing with a disliked other or disagreeing with a liked other. The underlying understanding is therefore that people who are attracted to one another are supposed to have similar attitudes, whereas people that disagree with another should have different attitudes: according to balance theory, differences in attitudes between people increase whereas similar attitudes reduce.

The second principle focuses on the fact that most of the time, inconsistent relationships change to consistent relationships. According to balance theory, the inconsistency puts pressure on the system to change attitudes until the system is in balance. These changes can take on many forms, but in most situations, the affective side of people's attitudes are difficult to change in the process of moving towards consistency within the system (Fishbein, 1967).

2.4.3.2 Dissonance theory

Leon Festinger introduced the cognitive dissonance theory in the late 1950s. Cognitive dissonance refers to any incompatibility between two or more attitudes or between behaviour and attitudes (Robbins, 1996). The theory implies that people act to reduce the discomfort (dissonance) they experience when two of their thoughts (cognitions) are inconsistent. For example, when people become aware of differences or inconsistencies between their attitude and behaviour, they try to remove the discomfort or dissonance by changing their attitude towards a stable state where there is a minimum of dissonance (Foster, 2008; Robbins, 1996). The cognitive dissonance theory is similar to several other models of attitude formation and change such as balance theory (Heider, 1958) and congruity theory (Osgood & Tannenbaum, 1955), which emphasise the consistency perspective. Cognitive dissonance theory differs from the other consistency theories in that it includes the relations among all cognitive elements (e.g. knowledge about attitudes, beliefs, values, interpersonal relations, and behaviour) (Olson & Stone, 2005).

According to Robbins (1996), people cannot completely avoid dissonance. For example, a supervisor can tell his direct reports (staff reporting to him) to always keep to the speed limit (60 kilometres per hour in urban areas), or to wear their personal safety protective clothing, but although they understand the importance thereof they behave the opposite. According to Festinger 1957 (as cited in Robins, 1996, p. 185), the desire to minimise dissonance would be guided by the importance of the elements creating the inconsistency, the degree of influence the individual believes he or she has over the elements, and the rewards that may be involved in the dissonance. Hence, if the issues underlying the dissonance are of minimal importance, uncontrollable, or if the rewards are significant enough to counterbalance the inconsistency, a person will not be under severe tension to reduce the dissonance. However, a condition that involves more negative rewards (such as severe threat) may result in less attitude change (Freedman, 1965).

Section 2.2.1 focused on the meaning and nature of the construct of attitude and section 2.3.2 on the different theoretical models underlying the dual model, namely the heuristic-systematic approach in attitude formation and change. In the next section, the influence of the independent variables included in this study, namely intelligence, personality and the work wellness constructs (burnout, work engagement and sense of coherence) on attitude formation are explained.

2.4.4 INFLUENCE OF THE INDEPENDENT VARIABLES ON ATTITUDE FORMATION

According to Glendon et al. (2006), it is important to understand those very specific factors in attitude-behaviour links before attitudes could be applied as valid predictors of behaviour. Hence, the aim of this study is to investigate the influence of psychological factors predicting employees' attitude towards work place safety that may result in positive or negative safety behaviour outcomes, such as work place incidents/accident and driver accidents. The influence of background factors, including individual psychological factors are presented graphically in Figure 2.4 below.

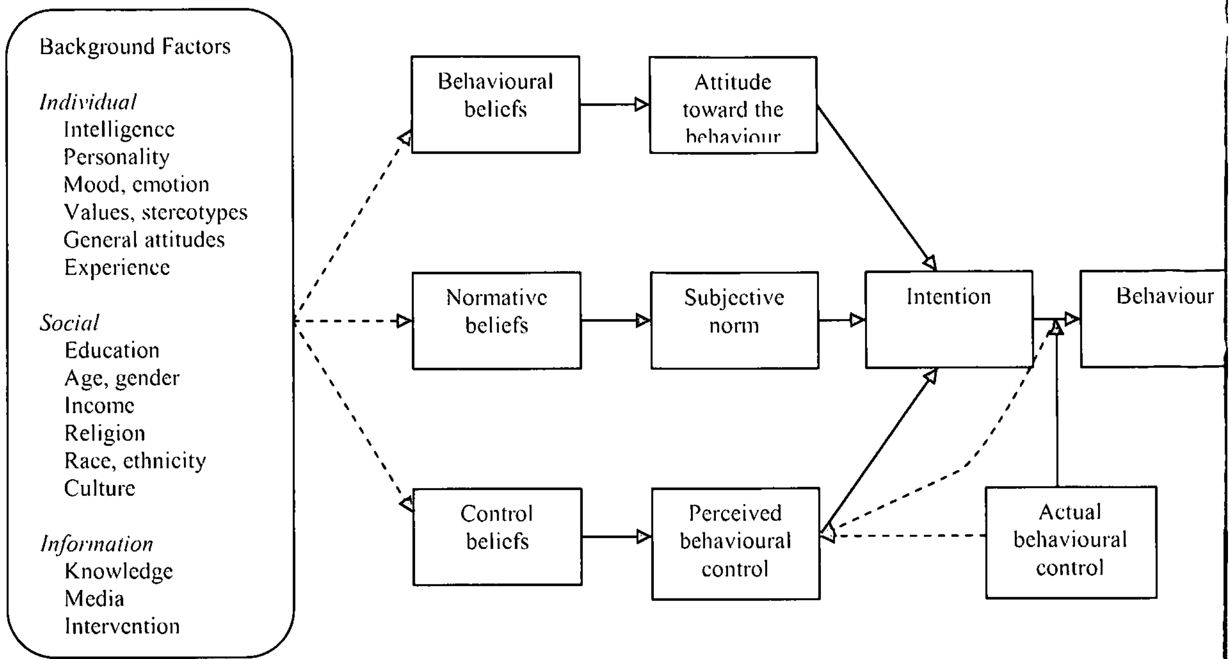


Figure 2.4 The theories of reasoned action and planned behaviour (Ajzen & Fishbein, 2005, p. 194)

The reasoned action and planned behaviour approach (Ajzen, 1985, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) deals with the factors that lead to the formation of intentions. According to this model (Figure 2.4) the behavioural, normative, and control beliefs people hold about a certain object or situation are influenced by a wide variety of individual, social, and situational factors. Therefore, differences in beliefs are found between men and woman, young and old, Black and White, above and below average intelligence, dominant and submissive, shy and outgoing, and between individuals who are self-sufficient and those who are group-orientated (Ajzen & Fishbein, 2005). In addition, the physical environment, the social environment, exposure to information, and broad dispositions such as values and prejudices also affect differences in beliefs. Therefore, behavioural, normative, and control beliefs can differ as a function of a wide range of background factors (Ajzen & Fishbein, 2005).

Therefore, based on the model (Figure 2.4) a large number of factors could potentially influence the beliefs people hold: age, gender, ethnicity, socioeconomic status, education, nationality, religious affiliation, personality, mood, emotion, general attitudes and values, intelligence, group membership, past experiences, exposure to information, social support, coping skills, and may more (Ajzen & Fishbein, 2005). Although, the influence of background factors are not part of a reasoned action approach, Petraitis, Flay, and Miller (1995) encourages the investigation of potentially relevant background factors in the understanding of the attitude-behaviour links. For example, the presence of strong emotions (e.g. affected by feelings, anger, etc.) may also help to explain why certain individual's sometimes seem to act irrationally in the sense that they fail to carry out an intended behaviour that is in their best interest. For the purposes of this study, certain psychological factors, namely intelligence, personality, burnout (e.g. emotional exhaustion and cynicism), work engagement (e.g. general attitude of vigour and dedication) which represent the physical work environment, and sense of coherence (e.g. coping skill) are investigated in order to determine its potential influence on attitude toward the behaviour, namely work place safety.

Individual differences in intelligence focused on how intelligence affects a recipient's ability to receive and succumb to messages (McGuire, 1968), because intelligent individuals have a greater ability to understand and to verify the merits of a message than relatively less intelligent people do. Therefore, intelligence can most probably increase persuasion when reception factors are important (Cooper & Dinerman, 1951). In contrast, because intelligent individuals are likely to have a greater ability to defend their attitudes, intelligence can also lead to resistance to persuasion messages (Crutchfield, 1955). In addition, highly intelligent people have a greater ability to counterargue messages, but also the need to acquire more knowledge or information on the messages, object or situation challenging an existing attitude or influencing attitude change (Briñol & Petty, 2005).

Most of the research investigating the influence of personality factors on attitude was done using the Big Five personality factors (e.g. Briñol & Petty, 2005; Gerber, Huber, Doherty, Dowling, & Ha, 2010; Goren-Bar, Graziola, Pianesi, & Zancanaro, 2006; Schoen & Schumann, 2007). For example, dominant (extraverted) and submissive (introverted) person's have been found to be more responsive to individual persuaders (Blankenship, Hnat, Hess, & Bron, 1984) and to messages (Moon, 2002). According to Moon (2002), dominant individuals changed their attitudes more in the direction of a dominant message, whereas submissive (introverted) individuals are more influenced by messages with a submissive style. Furthermore, Cacioppo, Petty, Feinstein, and Jarvis (1996) found that the need for cognition is related to openness to experience in attitude formation and change. DeBono and McDermott (1994) found that anxious (e.g. emotionally exhausted) individuals used the attractiveness of the source to decide their position in response to a persuasive message, whereas less anxious (e.g. individuals experiencing work engagement, effective coping strategies) individuals relied on the logic of the arguments contained in the message.

Furthermore, Schoen and Schumann (2007) argues that personality traits (based on the Five Factor model of Personality) indirectly affect partisan attitudes and voting behaviour in Germany in predictable ways even after controlling for sociodemographic characteristics. The researchers found that openness makes citizens more inclined to support parties endorsing social liberalism whereas low scores on conscientiousness increase the likelihood of supporting and voting for parties promoting economic or social liberalism as do high levels of agreeableness. Whereas, high levels of neuroticism appear to promote support for parties that offer shelter against material or cultural challenges. In another study, Gerber et al. (2010) also use the Five Factor model of personality to predict political attitudes (ideology). The results of their study suggest that conservatives are inclined to be hard-working, organised, close-minded, and emotionally stable. Liberals are inclined to be lazy, disorganised, open-minded, and neurotic. In investigating the relationship between personality traits and the attitudes towards adaptivity dimensions for mobile museum guides found that the personality traits relating to the notion of control (conscientiousness, neuroticism/emotional stability, locus of control) have a selective effect on the acceptance of the adaptivity dimensions. It is further observed that limited research exist on the influence of a wider range of personality characteristics (e.g. neuroticism, trusting), and situational factors (e.g. burnout, work engagement) on attitude formation.

Nevertheless, it can be concluded that the psychological factors included in this study, namely intelligence, personality, burnout, work engagement, and sense of coherence could potentially influence employees beliefs and attitudes towards work place safety in a public electricity company in South Africa.

The purpose of this study focuses on psychological factors (such as intelligence, personality, burnout, work engagement, and sense of coherence) and their influence on employees' attitudes towards work place safety (the dependent variable). Hence, the aim of the next section is to direct the construct attitude within the scope of this study, namely attitude towards work place safety.

2.5 ATTITUDE TOWARDS WORK PLACE SAFETY

A person's attitude towards safety may be described as an individual's beliefs and feelings about a specific workplace, or about task-related objects or activities (Barling & Frone, 2004; Glendon et al., 2006; Neal & Griffin, 2004). In a study done by Cox and Cox (1991) investigating safety climate and attitudes towards safety in a European gas company, they found five factors that they believed could measure attitude. These factors are: (1) personal scepticism (unconstructive belief), (2) individual responsibility (constructive belief), (3) safety of the work (evaluation), (4) effectiveness of safety arrangements (evaluation), and (5) personal immunity (unconstructive belief). The researchers found that attitudes towards safety were related either to unconstructive/constructive beliefs or to evaluations of the workplace. In relation to personal beliefs about risk and safety were immunity (e.g. the occurrence of injuries happens to other people) and scepticism (for example, if I worried about safety I would not get my job done).

According to Glendon et al. (2006), the individual's attitude towards work place injuries is likely to be influenced by previous experience, perceived likelihood of injury, and knowledge of the manner in which injuries occur. In addition, individual disposition, such as the personality dimension, safety locus of control (the extent to which an individual believes that he has control over external events in the safety arena) has been found to influence a person's attitude towards work place safety. Other factors including individual responsibility (safety protective clothing should always be worn), risk perception (extent to which processes or events are perceived as hazardous), and evaluations of the working environment (satisfaction with safety rules and procedures, and working conditions) are likely to influence safety attitudes.

In addition, Williamson, Feyer, Cairns, and Biancotti (1997) developed a measuring instrument that includes both perceptual and attitudinal questions and after conducting reliability studies found that personal motivation, positive safety practice, risk justification, fatalism, and optimism are positively related to safety attitudinal behaviour. In another study done by Mearns, Flin, Gordon, and Fleming (1998) perceptions, behaviours and attitudes towards safety on offshore oil platforms were examined, and the following attitudinal factors found, namely speaking up about safety, attitudes toward violations, supervisor commitment, attitudes towards rules and regulations, cost versus safety, and personal responsibility for safety correlated significantly with accident history.

Importantly, Mearns et al. (1998) argues that because of the great variability in attitudinal measures compared to perceptual measures, future research regarding attitudes towards safety should be clearly separated from perceptions of the safety climate. The researchers further argue that attitudes are more influenced by individual differences than by environmental factors. Hence, attitudinal measurements are a far more reliable method of measuring safety attitudes than perceptions of the work environment (e.g. safety climate) because significant correlations between attitude measures and self-reported injuries were found (Donald & Canter, 1994). These relationships can be assumed to exist because attitudes act as precursors to behaviour (e.g. more negative safety attitudes may lead to a higher amount of risk behaviour, and therefore an increase in the likelihood of injuries).

However, the strategic importance of safety climate in mediating the relationship between organisational and psychological processes and their relationship with safety cannot be ignored. Research evidence suggests that safety climate acts as an antecedent to safety-related motivation for employees and that this motivation influences both behaviour of individuals (attitude towards safety) and safety outcomes for the organisation (organisational commitment) (Neal & Griffin, 2004).

The next important issue is to understand how attitudes towards work place safety are likely to influence the occurrence of work place injuries. In the next section, the attitude-behaviour relationship is presented.

2.5.1 The attitude-behaviour relationship

To best understand the attitude-behaviour relationship one needs to turn to those theoretical models or theories that make explicit assumptions about other people's attitudes and why we think they behave as they do (e.g. risk behaviour). Some basic models that illustrate the attitude-influences-behaviour, behaviour-influences-attitudes and the mutually reinforcing and consistent approaches as explained by Glendon et al. (2006) are discussed briefly. Thereafter, more complex approaches describing the attitude-behaviour links such as the theory of planned behaviour (Ajzen, 1991; Fishbein & Ajzen, 1975), the health belief model (Becker, 1974; Becker & Rosenstock, 1987), and the protection motivation theory (Beck, 1984; Van der Velde & Van der Plight, 1991) are discussed.

2.5.1.1 Basic models describing the attitude-behaviour relationship

Glendon et al. (2006) argue that if one knows a person's attitude towards something (e.g. knowing that wearing a safety harness when working on structures above ground level is a good safety practice) then one can predict the person's behaviour towards it (as illustrated in Figure 2.5).

Influences/predicts

Attitude (e.g. "knowing that wearing a safety harness when working on structures above ground level is a good safety practice") → Behaviour (person is seen to understand that wearing a safety harness when working on structures above ground level is a good safety practice)

Figure 2.5 A simple model of the attitude-behaviour link (Glendon et al., 2006, p. 195)

Simply expressing a positive attitude about one's understanding that wearing a safety harness is important when working on structures above ground level is not sufficient to change people's behaviour in regard to the actual wearing of the safety harness. According to Fazio (1986), attitudes influence behaviour by selectively activating various thought processes stored in a person's memory. Thus, an attitude is made up of previous positive and negative experiences but it selectively influences the memory of those influences and not when deciding on a course of action. Hence, when confronted with a certain task or event, people with different attitudes (towards the wearing of a safety harness, for instance) are likely to observe different aspects of the situation as significant (e.g. that the wearing of a safety harness is crucial) or important (e.g. it is important to wear, but not crucial to the task or event). Thus, any simplistic model trying to provide a complete explanation of the attitude-behaviour link, as illustrated in Figure 2.5, needs to be treated with caution (Glendon et al., 2006).

Another simplistic model (see Figure 2.6) explained by Glendon et al.(2006) suggests that if one wishes to change people's attitude towards something (e.g. the wearing of a safety harness) the answer may be to enforce a new rule in order for people to behave in a particular manner.

$$\text{Behaviour (e.g. wearing of the safety harness because it is enforced)} \xrightarrow{\text{Influences/changes}} \text{Attitude (e.g. I'm happy to wear the safety harness)}$$

Figure 2.6 An alternative model of the attitude-behaviour link (Glendon et al., 2006, p. 196)

In the above example, behaviour is enforced through the implementation of a rule and whatever the initial attitude toward the rule, people change their attitude to be consistent with the newly required behaviour. This example reflects the underlying principle of the cognitive consistency theory. In addition, this example also demonstrates the self-perception theory (Bem, 1967) in that people form or determine what their attitudes are through observing their own behaviour.

Mutual influence/reinforcement

Attitude $\longleftrightarrow$ Behaviour

In this case, the attitude may be to the effect that "because I understand the importance of wearing a safety harness, it must make sense to do so" (attitude) – that is, attitude is influenced by relevant behaviour.

The behaviour (wearing of the safety harness) occurs because of the attitude that it makes sense to do so – that is, behaviour is reinforced by the presumed favourable attitude.

Figure 2.7 A mutual influence model of the attitude-behaviour link (Glendon et al., 2006, p. 197)

The next model (see Figure 2.7 above) brings Figures 2.5 and 2.6 together, demonstrating that attitudes influence behaviour and behaviour influences attitudes. Therefore, a change in either one is likely to effect change in the other. This mutually reinforcing model (Figure 2.7) confirms the notion of attitude-behaviour consistency. This notion of consistency, congruity, or balance underpins theories such as the cognitive dissonance theory presented by Festinger (1957) which states that people strive to align (e.g. to be consistent) their attitudes and behaviour (as illustrated in Figure 2.7) from a cognitive consistency perspective (Glendon et al., 2006). As discussed in section 2.2, attitudes are not only influenced by behaviour, but also by other factors such as cognition, emotions, beliefs, motivation and many more. Thus, if one wants to change either attitudes or behaviour and maintain consistency one needs to focus on both independently. Glendon et al. (2006) propose in their fourth model (Figure 2.8) that because of the different influences affecting both attitude and behaviour and to maintain cognitive consistency as an underlying factor, a workshop on safety harness protection, for example, may help to address relevant attitudes and behaviour towards wearing a safety harness.

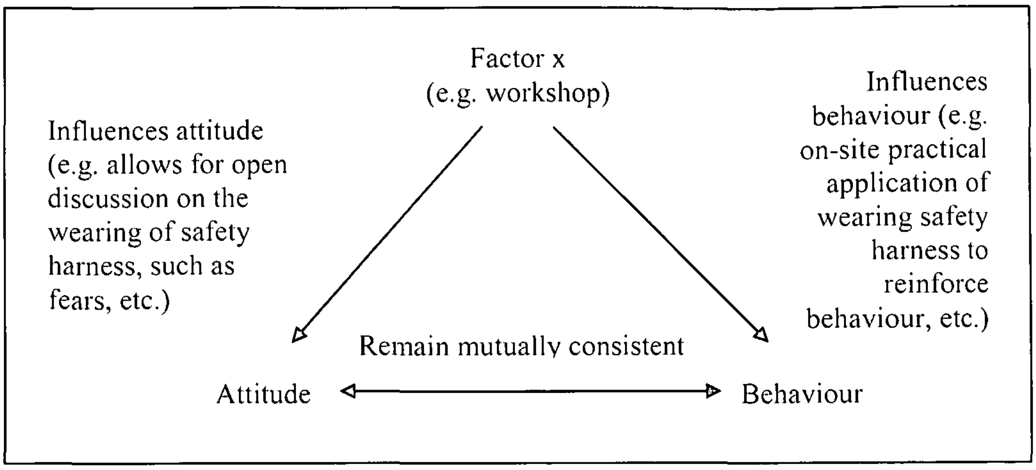


Figure 2.8 A third factor consistently influences both attitude and behaviour (Glendon et al., 2006, p. 197)

This approach shows that in order to instil change concerning health and safety, it is important to address both cognitions (attitudes, perceptions, motivation) and behaviour directly in order to move forward. According to Ajzen and Fishbein (1977), the following factors were identified in the attitude-behaviour prediction relationship, namely action, target, situation, and time frame. Their study also reveals that it is possible to predict behaviour if attitudes are known, only if the attitudes are highly specific in relation of that behaviour. Alternatively, if one wants to change behaviour through attitude change, then those attitudes that are specific to the behaviour need to be addressed. The four models (Glendon et al., 2006) discussed above are simplistic, but they help to understand the mutually consistent working of the attitude-behaviour relationship in terms of prediction of behaviour and behavioural change. An explanation of the more sophisticated models of attitude-behaviour links, such as the theory of planned behaviour (TPB), the health belief model (HBM), and protection motivation theory follows.

2.5.1.2 Complex theory-based models to attitude-behaviour links

According to Ajzen (2001), many people, including researchers and non-researchers such as line managers and safety incident investigators, are continuously intrigued by the ability of attitudes to predict behavioural intentions or observed behaviour. The more complex theoretical models (specific to the health and safety domain) concerned with the prediction of behaviour from attitudinal variables, are: 1) the theory of planned behaviour (TPB) (Fishbein & Ajzen, 1975; Ajzen, 1991) the health belief model (HBM) (Becker, 1974; Becker & Rosenstock, 1987), and 3) the protection motivation theory (Beck, 1984; Van der Velde & Van der Plight, 1991).

An explanation of the three models follows next.

2.5.1.2.1 The theory of planned behaviour (TPB)

The role of motivational factors in the attitude-behaviour interaction has been incorporated in the theory of reasoned action (TRA) and in a later adaptation of this theory, the theory of planned behaviour (TPB), developed by Fishbein and Ajzen (1975), and Ajzen (1991). The TPB model as illustrated in Figure 2.9 (as cited in Glendon et al., 2006, p. 200) proposes the existence of five pre-conditions or features before behaviour can be predicted:

- The individual's attitude to the particular behaviour
- The individual's intention to perform that behaviour
- What he or she believes are the consequences of performing that behaviour
- Social norms (socially acceptable behaviour) that govern the behaviour
- Individual control (person's evaluation of factors likely to inhibit or facilitate their performance of the behaviour)

According to Glendon et al. (2006), the TPB suggests that a person's behaviour is predicted by behavioural intention, which is further influenced by a combination of three factors: attitude towards performing the behaviour, subjective norm (the individual's perception of the normative pressure to perform the behaviour), and perceived behavioural control (the perception held by the individual of the degree to which performing the behaviour is under his or her volitional control). The next level shows the factors that determine an individual's attitude, namely the individual's beliefs about the consequences of the behaviour (both negative and positive behavioural beliefs), and the individual's evaluations of those outcomes.

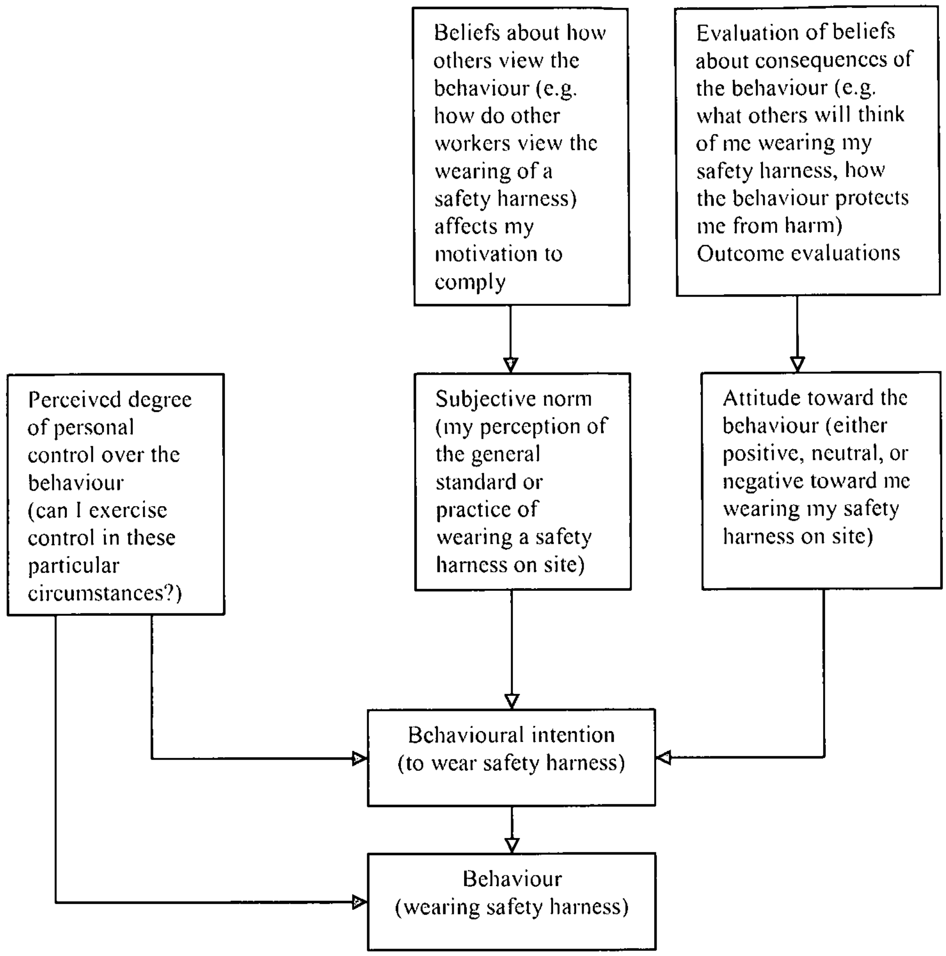


Figure 2.9 Theory of planned behaviour (Fishbein & Ajzen, 1975; Ajzen, 1991. as cited in Glendon et al., 2006, p. 200)

Furthermore, an individual's perceptions of the extent to which significant others believe he or she should engage (normative beliefs) in the behaviour and his or her motivation to comply influences an individual's perception (subjective norm). Glendon et al. (2006) show evidence of the applicability and non-applicability of the application of this theory in safety research especially in relation to driver behaviour, such as predicting driver violations, driver anti-social behaviours, predicting health behaviours, traffic psychology (e.g. Armitage & Conner, 2001; Bohner & Wanke, 2002; Elliot, Armitage & Baughan, 2003; Parker, Reason, Manstead & Stradling, 1995). The researchers highlight the contribution of other factors outside of the planned behaviour model that could influence attitude, one's intention to act and ultimately prediction of behaviour.

These additional factors are:

- environmental changes
- habitual behaviour – (is more powerful than attitudes in predicting behaviour)
- affective beliefs
- minimal influence of social norms
- safety climate

2.5.1.2.2 The health belief model (HBM)

The health belief model developed by Becker (1974), and Becker and Rosenstock (1987) propose a structured approach towards changing people's behaviour to a healthier way of living. The HBM (as cited in Glendon et al., 2006, p. 204), is described in Figure 2.10.

The model describes two important factors that influence behaviour, namely the individual considers the perceived benefits and disadvantages of taking action (e.g. wearing of a safety harness), and the person has a view of the threat that is posed (e.g. risk of serious injury) (Glendon et al., 2006). In addition, for this approach to produce any positive results to any health or safety campaign depends on the following factors:

- The perceived benefits of taking action need to be greater than the perceived obstacles or barriers.
- The target population needs to be susceptible (and to demonstrate this whenever possible) to change towards a healthier way of living or a safer way of working.
- Provision of relevant reminders for action (such as posters at strategic points, reinforcing safe working behaviours during work place meetings). This approach is likely to demonstrate that people have control over the situation and that they can take responsibility for their own health and safety.

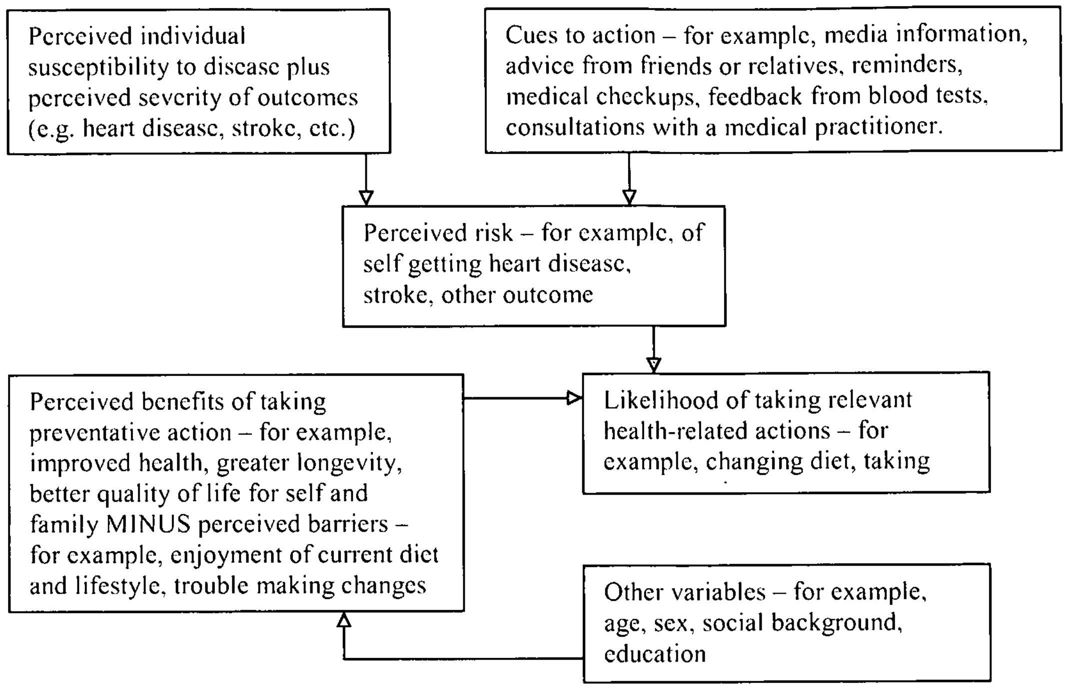


Figure 2.10 Health belief model with illustrative health example (Becker, 1974 as cited in Glendon et al., 2006, p. 204)

2.5.1.2.3 The protection motivation theory

According to the protection motivation theory (Beck, 1984; Van der Velde & Van der Plight, 1991) health behaviours can be influenced by the following factors (Glendon et al., 2006, p. 203-204):

- Perceived severity of outcomes
- Probability of outcomes
- Efficacy of behaviour
- Expectation that the individual is able to carry out the behaviour

The theory is explained in Figure 2.11, together with safety-related examples. According to Glendon et al. (2006), the first two factors focus on the individual perceived risk, and the third and fourth factors on the possible effectiveness of the planned intervention. The contribution of the protection motivation theory towards the attitude-behaviour links is that attitudes and perceptions are linked to behaviour through motivational processes.

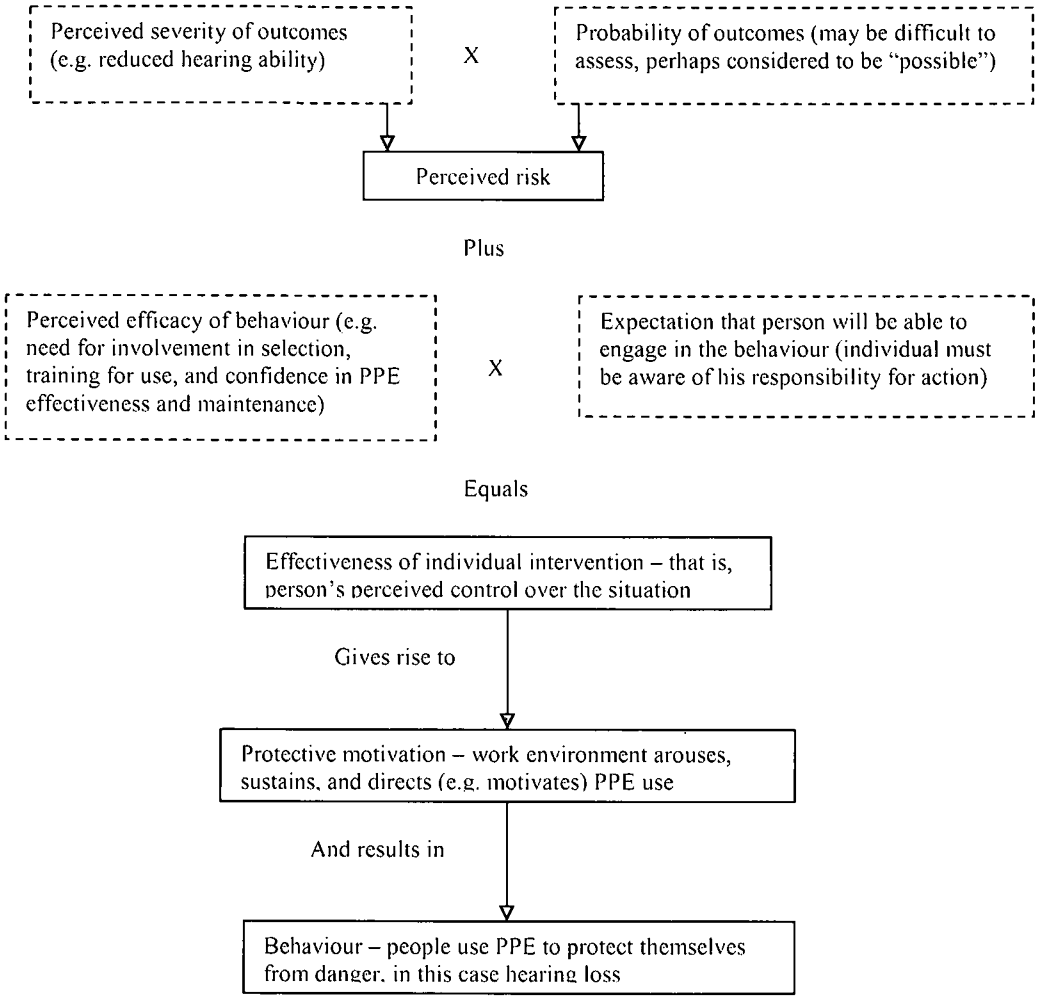


Figure 2.11 Protection motivation theory (Beck, 1984; Van der Velde & Van der Plight, 1991 as cited in Glendon et al., 2006, p. 205)

According to Glendon et al. (2006, p. 204), the four factors interact through the notion of protective motivation, which arouses, sustains, and directs activity to protect the individual from danger.

The three complex models described above are typical examples of social cognition models and explain the rationality of human behaviour. The application of these models is useful in identifying those variables that link attitudes and behaviour within the health and safety domain (and other fields). Although the practical application of these models in research settings shows some validity, these models tend to ignore non-rational and emotive aspects of human functioning as well as behaviour that is guided more by habit than by reason, especially in health-related behaviours, such as smoking, alcohol usage and exercise. Even the well-known cognitive dissonance theory has it flaws in that people are likely to continue to engage in behaviour that they know is damaging to their health, for example nicotine addiction. However, these models can assist in uncovering some of the main contributors that influence behaviour and attitudes, including other relevant factors as discussed above (Glendon et al., 2006). Finally, Conner (1992) and Schwarzer (1992) developed a list of the primary contributors influencing behaviour in respect of health, safety and risk. These factors include attitudes, perceptions, motivation, and behaviour.

The following section introduces the safety attitudinal constructs that are used to measure employees' attitude towards work place safety as in relates to this study.

2.5.2 SAFETY ATTITUDINAL CONSTRUCTS USED TO MEASURE ATTITUDE TOWARDS WORK PLACE SAFETY

In attempting to measure attitude and to implement specific interventions, an objective measure is required to measure specific attitudinal factors that is relevant to the behaviour under investigation (Glendon et al., 2006), but also relevant to the kind of operational function of the organisation. The following measures of attitude are direct measures of work place safety intensity, which have been developed over many occasions of use and which are considered to be reasonably reliable and valid (e.g. Cox & Cox, 1991; Fogarty & Shardlow, no date; Forcier et al, 2001; Reams, 2007). The main reason why employees' attitude towards safety are critical is that attitude measures have been shown to be significantly correlated with self-reported injuries, such that individuals who hold more positive attitudes are more likely to remain injury free (Donald & Canter, 1994). Specifically, in this study, the influence of psychological factors (intelligence, personality, burnout, work engagement, and sense of coherence) on attitude towards work place safety (safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) is investigated.

For the purpose of this study, the following safety attitudinal constructs, namely safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation (see Chapter 7 regarding the measurement instruments used in this study) have been selected to measure employees' attitude towards work place safety in a public electricity company in South Africa.

In this study, the primary safety attitudinal constructs (Fogarty & Shardlow, no date; Forcier et al., 2001) are defined as follows:

- Safety control: Safety control refers to the extent to which a person takes responsibility for maintaining a safe work environment. A person with a higher safety control score is more likely to accept personal responsibility for his or her own actions.
- Risk avoidance: Risk avoidance refers to a person's tendency to avoid high-risk, dangerous, or thrill-seeking behaviours. It is a good indicator of whether a person is likely to comply with company rules and regulations.
- Stress tolerance: Stress tolerance is a person's ability to cope with stress. People who have higher stress tolerance scores are generally at a lower risk of on-the-job accidents, as they are not as susceptible to distraction and fatigue.

The secondary scales (Fogarty & Shardlow, no date) are defined as follows:

- Driver attitude: Driver attitude is the extent to which a person is likely to drive safely. Higher scores on driver attitude indicate that people are more likely to follow road rules and are at lower risk of being involved in driving accidents.
- Quality orientation: Quality orientation refers to the likelihood of a person producing quality goods and services. People with higher quality orientation scores are more likely to take personal responsibility for the quality of their work, try to avoid errors and strive for continual improvement.

The safety consciousness construct combines the scores of the three primary safety attitudinal constructs, safety control, risk avoidance, and stress tolerance scales as an overall indication on an individual's work safety attitudes. In addition, it refers to the values, attitudes and beliefs that underlie the awareness of safety hazards and the ability to handle potentially dangerous situations effectively (Fogarty & Shardlow, no date; Forcier et al. 2001).

The next section provides a brief summary of those constructs discussed under each main heading.

2.6 SUMMARY

The aim of this chapter was to investigate the concepts of work place safety, attitude and attitude towards work place safety. The relevance and importance of research in the South African context to understand the predictors and correlates of safe and risk behaviours were emphasised.

The variable risk was defined as a combination of the frequency, or probability, of occurrence and the consequence of a specified undesirable or hazardous event. Thereafter, specific constructs related to risk such as hazard, adverse event, accident versus incident, near miss and loss were discussed and demonstrated by means of a practical example of an event-based risk (see Figure 2.1).

Next, at-risk behaviour was discussed in depth, emphasising that an individual's propensity to risk could be explained by the severity of the potential loss or outcome, the probability of the potential loss or the consequences of occurring and the individual's level of exposure to the risk.

Thereafter, the concepts of human factor and human error were introduced. The human factor focuses on the human system or engineering interface, while human error results from actions that in most cases are deemed to produce the desired outcome but failed or certain actions that may work but also have the potential for an adverse outcome. The different types of human error were schematically presented in Figure 2.2.

The dependent variable in this study, namely attitude towards work place safety was introduced next. Attitude can be regarded as a learned predisposition to respond in a consistently favourable or unfavourable manner towards a specific person, object or entity. The theoretical models of attitude confirmed the multi-influential role of cognition, affect and behaviour in attitude formation. The various theories regarding the forming of attitudes were explained through the dual-process model (heuristic-systematic processing approach). In addition, the theories underlying the attitude consistency or attitude elicit attitude-congruent approaches were explained. This section concluded with a brief discussion on the influence of the independent variables (intelligence, personality, burnout, work engagement, and sense of coherence) used in this study on the formation of attitudes.

Lastly, attitude towards work place safety was explained, highlighting the specific safety-related attitudinal indicators that are likely to predict or have been found to cause work place accidents or incidents. The attitude-behaviour relationship was explained by means of a more simplistic model, followed up with researched-based complex models. Both of these approaches were explained through schematic illustrations with safety specific examples. In addition, the dimensions used in this study to measure employees' attitude towards work place safety were defined.

2.7 CONCLUSION

It can be concluded that the severe influence of work place incidents/accidents remain a concern for organisations, managers, safety practitioners and the individual worker. Specifically, the affect of human error in incident/accident causation has been an area of strong interest for many researchers worldwide. In addition, employees (also managers) attitude towards work place safety have been found to be a significant precursor to behaviour in that those individuals with more negative safety attitudes lead to a higher frequency of unsafe acts. In addition, background factors such as intelligence, personality, physical environments (e.g. burnout, work engagement) and coping skills (e.g. sense of coherence) were found to influence individuals beliefs indirectly or attitude towards the behaviour directly.

Therefore, for the purpose of this study, it is critical to use a measurement instrument, which is considered to be reasonably reliable and valid (see Chapter 7) in objectively measure employees' attitude towards work place safety (dependent variable) in a public electricity company in South Africa. This aspect is also important in selecting the measurement instruments measuring intelligence, personality and the work wellness factors (burnout, work engagement, and sense of coherence) in predicting their influence on employees' attitude towards work place safety.

In the next three chapters, a literature review on the independent variables, intelligence (Chapter 3), personality (Chapter 4), and the work wellness constructs burnout, work engagement, and sense of coherence (Chapter 5) follows. In addition, the influence of each independent variable on attitude towards work place safety (safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) and work place incidents/accidents are explained.

CHAPTER 3

INTELLIGENCE

3.1 INTRODUCTION

As indicated in Chapter 1, the aim of this study is to investigate the influence of psychological factors on employee attitude towards work place safety. The construct intelligence (mental reasoning) was selected as one of the independent variables that could significantly influence employee attitude towards work place safety in a public electricity company in South Africa. In Chapter 2, it was explained that a variety of background factors, such as intelligence, could potentially influence a person's belief and/or attitude towards an object, person or situation either indirectly or directly (Ajzen & Fishbein, 2005). In addition, a number of studies (e.g. Arthur et al., 1991; Carty et al., 1999; Gottfredson, 1997, 2007; Lawton & Parker, 1998; Smith & Kirkham, 1982; Wickens, 1996) have found a significant relationship between individuals' intelligence and attitudes towards safe driving behaviours (e.g. Trimpop, Austin & Kirkcaldy, 2000) and work place incidents/accidents. Therefore, the construct intelligence and its relationship or influence on employee's attitude towards work place safety and safe driving behaviour cannot be ignored.

Therefore, the aim of this chapter is to analyse the construct intelligence focusing on the different approaches regarding the nature and meaning of intelligence. Two approaches, namely the functional and structural approaches, aim to explain the theoretical bases of intelligence. Thereafter, the construct cognition as an underlying process of intelligence is explained, as well as the relationship between intelligence and cognition. The chapter concludes with a brief summary, as well as conclusions regarding the implications of the content of the chapter for the empirical part of the study.

The different approaches regarding the nature and meaning of intelligence follow next.

3.2 DIFFERENT APPROACHES REGARDING THE NATURE AND MEANING OF INTELLIGENCE

According to Garlick (2002), scientific psychology has succeeded in educating the general public on the concept of IQ and its attempt to identify and measure differences in the phenomenon known as intelligence. It is evident from the literature that there is also a difference of opinion amongst theorists regarding how many and what kinds of different types of intelligence exist (e.g. Flanagan & Harrison, 2005; Garlick, 2002; Morgan, 1996; Myers, 2008; Neisser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg & Urbina, 1995; Sternberg, 1999).

Myers (2008) argues that there is still a great debate on the definition of intelligence. However, there is general consensus amongst scientists regarding the different levels of intelligence, and that different individuals have different capacities of intelligence (e.g. Garlick, 2002; Myers, 2008; Neisser et al., 1995; Sternberg, 1999). They further explain that individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning and to overcome challenges through different thought processes. It is evident that intelligence is likely to be the most important factor contributing to individual differences.

Neisser et al. (1995, p. 4) elaborate that although these individual differences can be significant, they are never entirely consistent: "a given person's intellectual performance will vary on different occasions, in different domains, as judged by different criteria". Therefore according to Myers (2008) the key factor still under debate is whether intelligence is a single overall ability or several specific abilities. Sternberg (2009) takes the argument further and emphasises that the focus should rather be on the collective incorporation of many intellectual abilities and their influence on human behaviour patterns, than on spending time and energy regarding the nature and constructs that constitute intelligence.

To conceptualise the nature of intelligence one needs to understand the two primary viewpoints, namely the functional and structural or hierarchical approaches as well as the psychometric, biological and cultural approaches. The functional approach focuses on the different functions or definitions of intelligence, and the structural or hierarchical approach on the structure or components of intelligence (e.g. Flanagan & Harrison, 2005; Louw, 1986). The psychometric approach has attracted the most attention with regard to research and the measuring of certain intellectual abilities (Neisser et al., 1995). With regard to the biological approach, other scientists turned to the study of the human brain (e.g. neurons) and physiology (e.g. genes, nutrition) to gain more insight about what intelligence is (e.g. Neisser et al., 1995; Sternberg, 2009). The role of one's culture, including the culture of ethnic groups, in understanding intelligence, focuses more on the role of acquiring and applying culture-specific practical skills compared to the more Western approach of academic achievement or performance in intelligence tests (e.g. Gardner, 1999a; Myers, 2008; Neisser et al., 1995; Sternberg, 2009). These different approaches are discussed separately.

3.2.1 The functional approach regarding intelligence

The functional approach focuses on the following viewpoints as they relate to individual differences in behaviour (Louw, 1986).

Firstly, intelligence may be equal to the learning ability of the individual. It refers mainly to the ability to master study material, the speed of learning, and the ability to learn from further education and experiences. Critics of this viewpoint suggest that the role of non-intellectual factors such as motivation, memory and awareness are ignored in the understanding of one's overall learning ability.

Secondly, there is the opinion that the ability to think in abstract terms is the cornerstone of intelligence. The ability to think in abstract terms refers to the ability to handle symbols in a conscious state in order to solve problems effectively, to identify relationships, to reason different principles and to formulate assumptions. Concepts such as creativity, judgement and insight have been linked to this ability. However, critics of this viewpoint suggest that it is very difficult to define creativity, judgement or insight or to measure such concepts. Hence, the direct relationship between intelligence and abstract reasoning is not well supported.

Thirdly, the ability to effectively adapt to one's environment has been described by some supporters as intelligence. This implies that the ability, with the support of conscious thought processes, to adapt one's behaviour to new situations is viewed as intelligence. Ignorance of the influence of emotional factors in adapting one's behaviour and one's ability to change one's environment have been mentioned as counter-arguments to this view point.

It is evident from the above that most researchers in the field of intelligence have attempted to define, or have struggled with defining, the phenomenon of intelligence. Since 1921 psychologists such as Lewis M. Terman (1916; 1925a), Edward L. Thorndike (1921, as cited in Wasserman & Tulsky, 2005, p. 14) and other prominent leaders in the field of intelligence, have publicly disagreed with one another over the definition of intelligence. For example, according to Wasserman and Tulsky (2005), Terman was more concerned about one's ability to think abstractly, while Thorndike stressed learning and the ability to provide good responses to questions. As a result most researchers agreed on a more integrated and comprehensible definition of this core psychological construct.

One of the first definitions of intelligence which is still widely accepted by most researchers was constructed by Stoddard (1941) and Wechsler (1939a). Stoddard (1941, as cited in Smit, 1983, p. 157) defines intelligence as "... the ability to undertake activities that are characterised by difficulty, complexity, abstractness, economy, adaptability to a goal, social value and the emergence of originals and to maintain such activities under conditions that demand concentration of energy and a resistance to emotional forces." Furthermore Wechsler (1939a, p. 3) defines intelligence as "... the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment." Global capacity refers to those characteristics that describe one's behaviour as a whole and aggregate "because it is composed of elements or abilities which, though not entirely independent, are qualitatively differentiable".

Contemporary researchers on intelligence such as Gardner (1999a) and Sternberg (1988; 1999) retained the viewpoint of early pioneers on the element adaptation. In support of this view Sternberg (1988, p. 65) defines intelligence in everyday life as "the purposive adaptation to, selection of, and shaping of real-world environments relevant to one's life and abilities". Contrary to the more traditional approaches, Gardner (1999) views a potential to process information as an important element of intelligence. Gardner (1999, p. 33) therefore explains intelligence as "a bio-psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture." Myers (2008, p. 330) supports both the elements of information processing ability and adaptation in his definition of intelligence as "mental quality consisting of the ability to learn from experience, solve problems, and use knowledge to adapt to new situations."

According to Reber and Reber (2001, p. 361), before the tests and measurement movement, the term intelligence meant the "ability to profit from experience, which implies the ability to behave adaptively, to function successfully within particular environments." They concluded that "ultimately intelligence is, conceptually, what it always been – the ability to profit from experience – and, pragmatically, what it has become – that which the intelligence tests measure." From a functional perspective it is evident that most researchers in their endeavours to define intelligence generally agree that adaptation to one's environment is likely to be the key determinant in understanding intelligence and the processes making up effective adaptation. According to Sternberg (2009) effective adaptation means one's ability to make changes in oneself in order to cope more effectively with one's environment, but also changing the environment or finding an entirely new one. He further argues that for effective adaptation to take place a number of cognitive processes, such as perception, learning, memory, reasoning, and problem-solving are involved. A fundamental aspect in a definition of intelligence is then, according to Sternberg (2009, main section, para. 3), not a "cognitive or mental process per se but rather a selective combination of these processes that is purposively directed toward effective adaptation". Hence intelligence cannot be regarded as a single ability but rather as the integration of many abilities, including other non-intellectual factors such as motivation, creativity and emotions.

As it is important to understand the functions of intelligence, an understanding of the theories or structure underlying intelligence is just as important.

3.2.2 The structural approach regarding intelligence

Most of the definitions or attempts to define the nature of intelligence have been done from a functional perspective, to explain the intellectual process, e.g. the learning process, the adaptation process or the process of abstract thinking. Despite the urge to define intelligence, some researchers have attempted to explain the structure or to identify the building blocks of intelligence.

According to Foxcroft and Roodt (2001) many different theories of intelligence have emerged over the decades, together with many different approaches to the measurement of intelligence. The writers further state that these theories have contributed significantly to our basic understanding of intelligence, but that there are still many supporters and critics who "highlight the controversial nature of dealing with and trying to understand and explain human cognitive functioning" (p. 179). As cited in the literature, there are two major schools of thought on the structure or nature of intelligence. Psychologists such as Eysenck (1982), Galton (1883), Jensen (1969) and Spearman (1927) argue that all intelligence comes from one general factor, known as *g*, whereas other psychologists such as Cattell (1987), Gardener (1983), Guilford (1981), Sternberg (1985) and Thurstone (1938) believe that there is more than one general type of intelligence or that there are different types of intelligence. However, they also differ in opinion on exactly how many different types of intelligence exist (e.g. Garlick, 2002; Neisser et al., 1995; Sternberg, 1999). The question still remains whether intelligence is a single overall ability or several specific abilities (Foxcroft & Roodt, 2001; Garlick, 2002; Myers, 2008; Morgan, 1996; Neisser et al., 1995; Sternberg, 1999).

A brief explanation of the different theories of intelligence is given next. The focus is on Spearman's second-order theory (1927), Thurstone's theory of multiple factors (1924; 1938), Guilford's structure-of-intellect theory (1956; 1967), Vernon's hierarchical factorial model (1950; 1961), and Gardner's (1983) and Sternberg's (1985) theory of multiple intelligences.

3.2.2.1 Spearman's second-order theory

The first scholar who deviated from the more functional perspective was Charles Spearman (1863-1945). He first argued the theory of a single general (*g*) factor of intelligence that could be used to explain differences in individuals (Spearman, 1904). According to Myers (2008), Spearman helped to develop *factor analysis*, a statistical procedure that identifies clusters of related items. Through his research, he identified that even when multiple factors were identified, second order factors analysis usually reflects some underlying general factor.

Spearman (1904) termed those factors which were identified to relate to a specific particular activity as specific (*s*) factors – thus, his well-known two-factor theory of intelligence which allows for both a general factor (*g*) and specific factors (*s*). In doing his research, administering different types of tests, covering different areas of cognitive ability, Spearman found that people highly developed in one intellectual ability tend to be, on average, highly developed in other, different intellectual abilities as well (e.g. Garlick, 2002; Myers, 2008; Spearman, 1904).

This view, according to Foxcroft and Roodt (2001), is derived from the fact that different measures of intellectual ability correlate positively with each other, suggesting that they measure some mutual ability or construct. In other words, if a certain person performs well in one area such as verbal reasoning, then the same person is also likely to perform well in another area, for instance numerical or spatial reasoning ability. This positive correlation between tests is known as the positive manifold (Spearman, 1904). This positive manifold is also referred to as the general intelligence factor, or *g*. Spearman concluded that the "*g*" factor is the single factor that determines the intelligence of the individual.

Thus, according to Spearman's theory, the g factor was required on all tests of mental ability and those tests with the highest g-loaded factor were then considered representative of "pure" or "raw" intelligence (Garlick, 2002). This led to the development of the so-called IQ tests as an attempt to measure this factor (Eysenck, 1982; Garlick, 2002; Jensen, 1981; Kaufman, 1990). According to Anastasi and

Urbina (1997), Spearman did realise later in his work that above his two-factor theory there might be another, intermediate class of factors, not as universal as *g* or as strictly specific as the *s* factors.

These factors that were found to be common to a group of activities but not to all were named a *group factor*. Follow-up work done by several of his students resulted in Spearman including a much broader group of factors such as mathematical, mechanical, and linguistic abilities (Anastasi & Urbina, 1997). Further studies, which contributed significantly to the work done by Spearman, were done by Cattell (1987), who suggested that Spearman's *g* could be split into two intellectual characteristics namely g_f or fluid intelligence and g_c or crystallized intelligence. However, fluid and crystallized intelligence were still observed to be correlated, suggesting that a general factor of intelligence does exist (e.g. Carroll, 1993; Garlick, 2002; Gustafsson, 1999).

Critics (e.g. Ceci, 1990; Gardner, 1983; Gould, 1978) of this view do not dispute the stability of test scores, nor the fact that they predict certain forms of achievement – especially educational achievement – rather effectively. They disagree however with the view that the concept of intelligence can be based on test scores alone: "It is to ignore many important aspects of mental ability" (Neisser et al., 1995, p. 6). Nonetheless, Spearman's research results are still widely acknowledged and deemed important due to the following reasons (Smit, 1983):

- the statistical-mathematical technique used by Spearman to investigate the structure of intelligence forms the basis of the centroid method of factor analysis;
- his research was intended to conceptualise the nature of intelligence rather than the measuring of it.

3.2.2.2 Thurstone's theory of multiple factors

Thurstone (1924, p. 162) stated that "the biological function of intelligence is to protect the organism from bodily risk and to satisfy its wants with the least possible chance of recording failure on the environment". With this hypothesis in mind, Thurstone and his fellow students argued that there are a dozen group factors which he categorised as primary mental abilities. He believed that those primary mental abilities are used by individuals in order to survive and succeed in society. Thurstone (1924; 1938) took Spearman's factor analysis one step further by rotating the factors. According to Anastasi and Urbina (1997), Thurstone was one of the leading initiators of multiple-factor theory.

Through his analysis 13 different factors were identified as opposed to Spearman's one factor, although through further analysis and support from other independent researchers, only seven primary mental abilities were extracted. These seven primary metal abilities were presented as verbal comprehension, general reasoning, word fluency, numerical facility, associative memory, spatial visualisation and perceptual speed (e.g. Anastasi & Urbina, 1997; Foxcroft & Roodt, 2001; Thurstone, 1938; Thurstone & Thurstone, 1941). Thurstone (1938) concluded that he could not find any evidence of Spearman's *g* in his factor analyses.

Thurstone (1938) believed that these abilities were quite distinct from one another and suggested that a person may have good numerical abilities but at the same time be low on memory. Through a deeper analysis of his findings Spearman (1939a; 1939b) found *g* as the core factor together with smaller group factors for verbal, spatial, number and memory abilities. Thurstone (1947) reacted to this finding by developing high-order factor statistical methods in terms of which he came to the conclusion that a high correlation exists between certain factors of these primary mental abilities, and that these correlations confirmed the existence of a general factor at a higher order level. Eysenck (1988) emphasised that in essence there are no distinct differences in the theoretical concepts of Spearman and Thurstone. Spearman started with a general factor and later on accepted the existence of group factors with specific factors, and Thurstone started with group factors and later recognised the existence of general factors.

Today, the existence of fifteen to twenty primary intellectual abilities is recognised and these include abilities such as mechanical reasoning, psycho-motor coordination, and hand-eye coordination (e.g. Cattell, 1971; French, Ekstrom & Price, 1963; Sternberg, 1999).

3.2.2.3 Guilford's structure-of-intellect theory

Guilford (1967, 1988) also rejected the existence of only one general factor and the splitting of the verbal and nonverbal factors. Through more in-depth factor-analytic research, Guilford (1967, 1988) proposed a three-dimensional model of the structure of intelligence. The revised model (Guilford, 1988) categorised intellectual abilities along three dimensions (Anastasi & Urbina, 1997, p. 314):

- Operations or intellectual processes: what the respondent does. This includes cognition, memory, recording, memory retention, divergent production (prominent in creative activity), convergent production, and evaluation.
- Contents of intellect: the nature of the materials or information on which operations are performed. These include visual, auditory, symbolic (e.g. letters, numbers), semantic (e.g. words) and behavioural (information about other person's behaviour, attitudes, needs, etc.).
- Products: the form in which information is processed by the respondent. Products are classified into units, classes, relations, systems, transformations and implications.

According to Guilford (1988), intelligence consists of 180 different factors or abilities which can be divided into six kinds of intellectual processes, five kinds of content, and six kinds of product. He further argues that at least one factor of each dimension is present in all intellectual activities. However, Nunnally (1967) argues that this model only leads to the identification of more factors or abilities, but does not indicate the possible relations between these factors or abilities. Nonetheless, Guilford's theory highlights the interdependency of intellectual abilities and the complexity of intelligence, and his theory implies that the total personality is well-grounded within intellectual behaviour (Louw, 1986; Smit, 1983).

3.2.2.4 Vernon's hierarchical factorial model

In his hierarchical factorial model, Vernon (1961) proposes a superordinate *g* factor and two lower-order factors which he named v:ed (verbal-educational ability) and k:m (mechanical-spatial ability). Furthermore he subdivided the v:ed into verbal and numerical and the k:m into space ability, manual ability, and mechanical information.

Vernon (1961) also views the general intelligence factor as a fundamental factor, arguing that 40% of all intellectual behaviours can be explained through this factor. It is through the general factor that primary group factors, secondary and specific group factors can be extracted. This model or procedure is in contrast with that of Guilford, who sought separate factors and tests for each homogeneous cell (Anastasi & Urbina, 1997).

3.2.2.5 Gardener's theory of multiple intelligences

A relatively new and different approach to those presented by Spearman, Thurstone, Guilford and other scholars is the theory of "multiple intelligences", presented by Howard Gardner (1983). In conceptualising his theory, Gardner (1983, 1999a) was of the opinion that intelligence is much more than IQ because a high IQ in the absence of the amount produced does not link to intelligence. He defines intelligence as "a biopsychological potential to process information than can be activated in a cultural setting to solve problems or create products that are of value in a culture" (Gardner, 1999a, p. 33). He further proposes that in order to understand the nature of intelligence one should not only study normal children and adults but also people with limited (including so called "savants") or exceptional abilities, people who have suffered brain damage and people from different cultures (Gardner, 1983; Myers, 2008; Neisser et al., 1996). In using the information gathered, Gardner argues that individuals do not have one general intelligence, but rather multiple, relatively independent intelligences. Gardner's theory of multiple intelligences suggests that there are a total of eight different forms of intelligence, each related to a specific portion of the human brain (Li, 1996), including the verbal and numerical aptitudes assessed by standard psychometric tests (Myers, 2008).

These eight different forms of intelligence are linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, intrapersonal (self), interpersonal (other people) and naturalist (Myers, 2008). According to Gardner (1999a; 1998) each of these eight intelligences has a specific set of mental skills, talents, or abilities that can be observed and measured. He further speculates about a ninth possible intelligence which he labelled as existential intelligence; however he is less sure about how to define and incorporate (observed and measured) existential intelligences (Gardner 1998; Myers, 2008).

According to Morgan (1996) the belief is that each of the initial seven multiple intelligences is in fact a cognitive style rather than a construct on its own. Morgan further refers to Gardner's terms such as mental skills, talents and abilities in his theory as a matter of semantics rather than new thinking on multiple constructs of intelligence and suggests that they are similar to the earlier work done by factor theorists of intelligence like Thurstone. Neisser et al. (1995, p. 6) argue that the "stability and validity of performance tests in these new domains has yet to be conclusively demonstrated". They further debate whether some of these abilities, for example bodily-kinesthetic, are indeed forms of intelligence or rather special talents.

3.2.2.6 Sternberg's triarchic theory

Sternberg (1985; 1999; 2003) supports most of the studies that have been done to investigate the construct of intelligence and he believes that the theories that preceded him were not incorrect, but rather incomplete. Sternberg further states that he agrees with Gardner's views on the existence of multiple intelligences, but he argues that intelligence should be investigated in terms of the contexts in which it occurs, taking socio-cultural factors into consideration (e.g. Foxcroft & Roodt, 2001; Li, 1996; Myers, 2008). With this conception in mind, Sternberg (1985) proposes his triarchic theory of human intelligence and success, which includes three fundamental aspects of intelligence namely analytical, creative and practical intelligences. Therefore, he defines successful intelligence as that set of mental abilities used to achieve one's goals in life, given a social-cultural context, through adaptation to, selection of, and shaping of environments (Sternberg, 1985; 1998).

Through further investigations and analysis of his studies, Sternberg (1985; 1990; 1998; 1999) argues the need for a balance between analytical or academic intelligence, creative and especially practical intelligence (Neisser et al., 1995). The two main types of intelligence that are interrelated but largely distinct are analytical and practical (not to exclude the significance of the other construct, creativity), where analytical intelligence is mostly assessed by ability tests which present well-defined problems having a single right answer, and generally predict academic performance quite well but predict career success more moderately. On the other hand, practical intelligence or problem solving tends to require the ability to identify a situation well, to be able to determine how to solve a problem, and if the situation is poorly identified, requires information seeking, having various acceptable solutions, being embedded in and requiring prior everyday experience, and requiring motivation and personal involvement (e.g. Myers, 2008; Neisser et al., 1995; Sternberg, 1990).

According to Sternberg (1999), in studying various domains in business management, managerial success depends less on academic problem-solving abilities than on astute abilities to manage oneself, one's tasks, and other people. The results of these practical scenarios or real life case studies suggests that his triarchic theory of human intelligence predicts job performance fairly well, even though it does not correlate significantly with mental ability tests scores and other selection measures (e.g. Myers, 2008; Neisser et al., 1995; Sternberg, 1999; Sternberg & Wagner, 1993; Sternberg, Wagner, Williams & Horvath, 1995). Sternberg (1998, 1999) confirmed his view on the significance of practical intelligence compared to the traditional view of academic intelligence, as the only predictor of human success, after studying the academic and practical intelligence of Brazilian street children, Kenyan children and Russian adults. Sternberg (1998, 1999) agrees with Gardener (1998) that there are individuals who are extremely talented in the fine arts, and that these people would have a high creative intelligence. According to Myers (2008), academic intelligence does not equal creativity. As in the case of other theories, Sternberg's triarchic theory of human intelligence has its critics (Neisser et al., 1995).

3.2.3 The psychometric approach regarding intelligence

James McKeen Cattell (1890), in his endeavour to measure individual differences, proposed a term called "mental test" to describe the series of tests that he used to determine the intellectual capacity of college students (Anastasi & Urbina, 1997). During this time Cattell mainly used tests that measured muscular strength, speed of movement, sensitivity to pain, keenness of vision and of hearing, weight discrimination, reaction time, memory and other variables. However, Binet and Henri

(1895) were of the opinion that these measurements are too sensory and they focused more on general, specialised abilities (Anastasi & Urbina, 1997).

From 1904 to 1911 Binet, in collaboration with Théodore Simon, devoted his research to refining his well-known Binet-Simon scale by introducing more complex tasks of verbal reasoning and thinking to measure intelligence (Anastasi & Urbina, 1997). Binet's intention with test scores was to use them as a practical tool to identify children who needed special help and not to be seen as a theory of intellect or ranking mechanism according to children's abilities (Anastasi & Urbina, 1997; Foxcroft & Roodt, 2001; Gould, 1981). The introduction of the Binet scales and the term "mental age" resulted in the development and use of psychometric instruments in areas such as predicting school achievement, selection, diagnosis, and evaluation (Neisser et al., 1995).

The Binet scale or test became somewhat outdated and was refined by more extensive and psychometrically statistical methods called the Stanford-Binet scale or test. According to Anastasi and Urbina (1997) the use of the Stanford-Binet test led to the development of the intelligent quotient (IQ), or ratio between mental age and chronological age. However, this procedure is no longer practised; "instead today they represent the test-taker's performance relative to the average performance of others the same age" (Neisser et al., 1995; Myers, 2008). According to Foxcroft and Roodt (2001, p. 178) "psychometric intelligence implies that we use mainly standardized psychological tests to measure levels of functioning on psychologically defined constructs". Thus, the definition of psychometric intelligence would be that which the specific intelligence tests measure. Tests of intelligence were designed to measure the individual's general intellectual level by means of constructs of verbal ability and, to a lesser extent, numerical and other abstract and symbolic items.

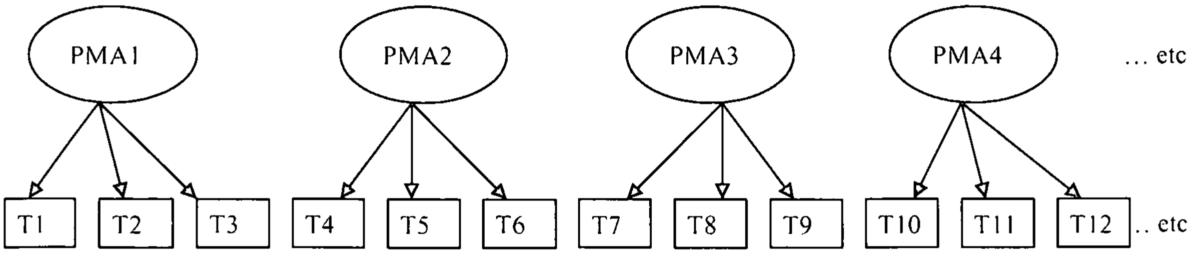


Figure 3.1 Thurston's multiple-factor (primary mental abilities or PMA's) model. Circles represent latent factors. Squares represent manifest measures (tests; T1, etc.). Single-headed path arrows designate factor loadings. (cited in Flanagan & Harrison, 2005, p. 142)

Figure 3.1 represents Thurstone's theory of multiple factors (Thurstone, 1924; 1938). Thurstone (1924; 1938) posited seven to nine primary mental abilities (represented as PMA1, PMA2, etc, in Figure 3.1) that were independent of a higher order *g* factor. Specific psychometric measurement tests have been developed to measure each underlining primary mental ability (represented as T1, T2, T3, etc, in Figure 3.1). Most modern hierarchical theories of intelligence have their roots in Thurstone's primary mental abilities theory, such as Cattell-Horn's Gf-Gc hierarchical model (see Figure 3.2) and Carroll's Schmid-Leiman's hierarchical three-stratum model (see Figure 3.4) (Horn & Noll, 1997).

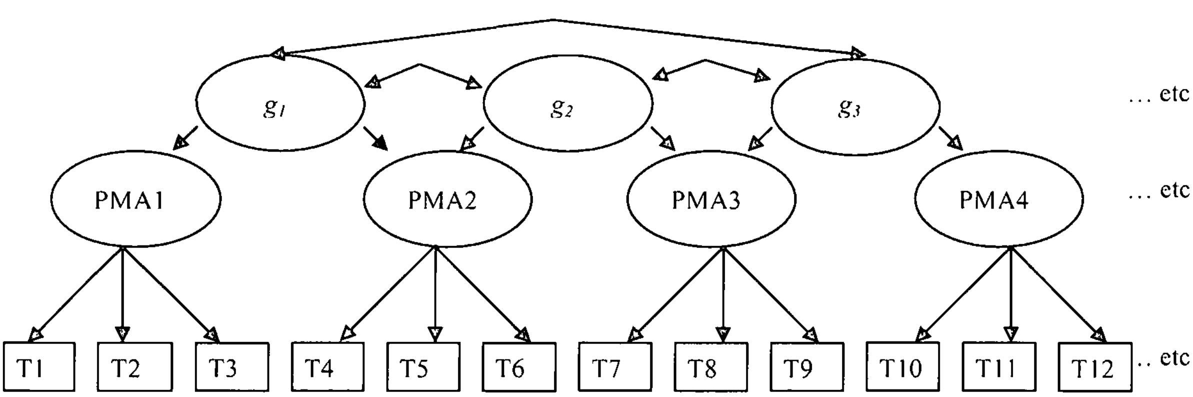


Figure 3.2 Cattell-Horn's Gf-Gc hierarchical model Circles represent latent factors. Squares represent manifest measures (tests; T1, etc.). Single-headed path arrows designate factor loadings. Double-headed arrows designate latent factor correlations. (cited in Flanagan & Harrison, 2005, p. 142)

Figure 3.2 represents The Cattell-Horn's Gf-Gc theory which has its roots in Thurstone's theory of primary mental abilities (PMA). Through factor analysis and inter-correlations of Thurstone's primary (first-order) mental abilities (PMA), a second higher-order *G* ability was extracted. Such broader abilities were labelled fluid (Gf) and crystallised (Gc) intelligence factors. This hierarchical model paved the way for the development of specific Gf-Gc psychometric measurements of intelligence (McGrew, 2005). In addition, Figure 3.2 demonstrates the inter-correlations between the first and second-order abilities and also between the different second-order Gf-Gc abilities.

As a result, psychologists have come to the conclusion that the term "intelligence tests" only refers to global intelligence or certain aspects of intelligence and does not in fact refer to certain abilities or a combination of abilities (Anastasi & Urbina, 1997). These considerations prompt the need for multiple aptitude tests measuring different abilities, and as a result, studies regarding the correlation (e.g. Spearman, 1927; Thurstone, 1938) between these different ability tests evolved (e.g. Anastasi & Urbina, 1997; Neisser et al., 1995). Through a more complex and systematic programme of factor analytic research, Raymond Cattell and John Horn proposed their Gf (fluid intelligence)-Gc (crystallized intelligence) theory of cognitive abilities (see Figure 3.2) which, according to Horn and Noll (1997), derives its roots from Thurstone's theory of primary mental abilities (see Figure 3.1) (McGrew, 2005).

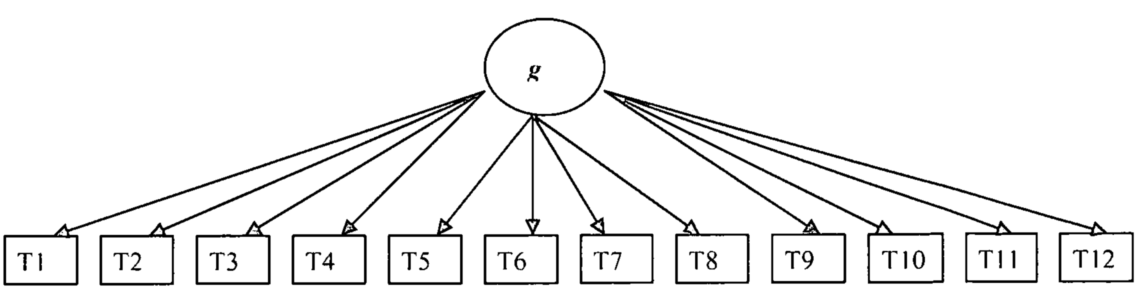


Figure 3.3 Spearman's general-factor model. Circles represent latent factors. Squares represent manifest measures (tests; T1, etc.). Single-headed path arrows designate factor loadings. (cited in Flanagan & Harrison, 2005, p. 142)

Figure 3.3 demonstrates Spearman's (1904) single general intelligence factor (*g*) with several specific (*s*) factors that could measure (T1, T2, T3, etc.) different areas of cognitive ability.

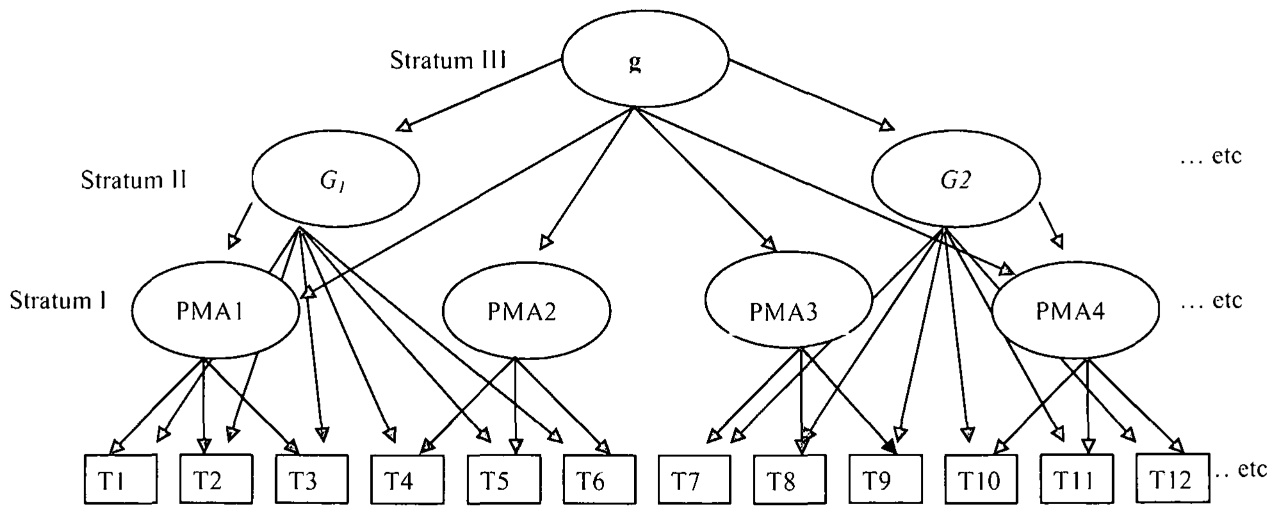


Figure 3.4 Carroll's Schmid-Leiman's hierarchical three-stratum model. Circles represent latent factors. Squares represent manifest measures (tests; T1, etc.). Single-headed path arrows designate factor loadings. Double-headed arrows designate latent factor correlations. (cited in Flanagan & Harrison, 2005, p. 142)

Figure 3.4 represents Carroll's Schmid-Leiman's hierarchical three-stratum model consisting of a general intelligence factor (*g*) on stratum III, second-order factors Gf-Gc on stratum II, and specific cognitive abilities on stratum I. In addition, Figure 3.4 shows the inter-correlations between the different factors in each stratum.

John Carroll collected 460 different datasets of research done (e.g. Spearman, Burt, Cattell, Gustaffson, Horn, Thurstone, Guilford and others) on the structure of human cognitive abilities. After an in-depth factor analysis, Carroll (1993) made public his three-stratum model (see Figure 3.4), based on Spearman's general-factor model (see Figure 3.3) and Thurstone's multiple-factor model (see Figure 3.1) of human cognitive abilities that differentiates abilities as a function of breadth. Carroll (1993, p. 62) further acknowledges particular contributions made by the Horn-Cattell Gf-Gc model (see Figure 3.2) and states that their model "appears to offer the most well-founded and reasonable approach to an acceptable theory of the structure of human cognitive ability elements". Because of similarities between Cattell-Horn's Gf-Gc theory and Carroll's three-stratum theory, researchers such as Flannagan and McGrew (1998) and Flannagen, McGrew and Ortiz (2000) suggest the creation of one single Gf-Gc taxonomy for use in the measurement and interpretation of intelligence test batteries.

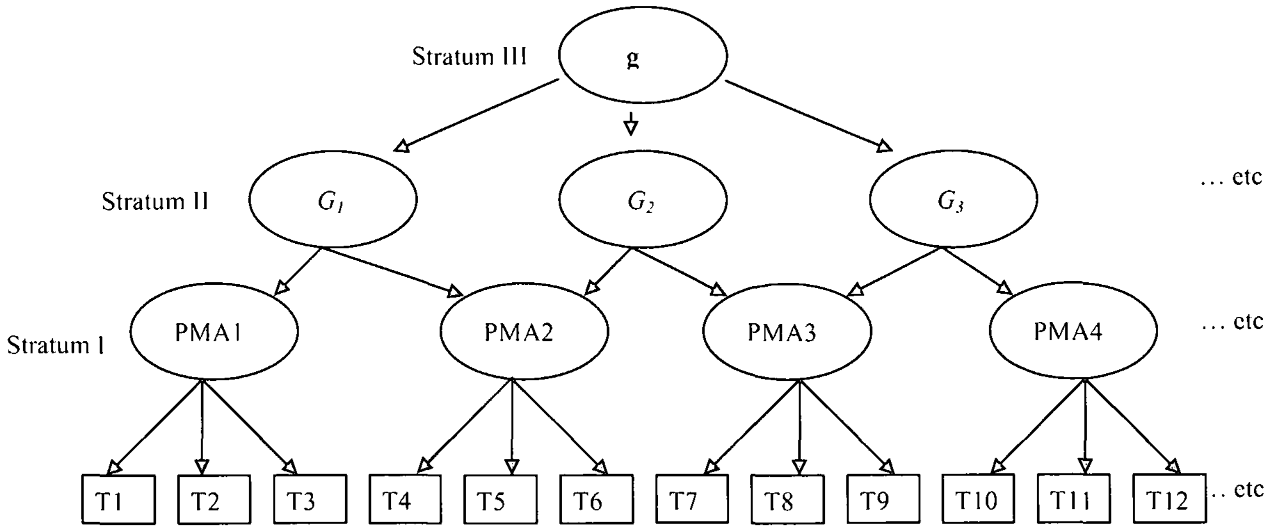


Figure 3.5 Consensus Cattell-Horn-Carroll's hierarchical three-stratum model. Circles represent latent factors. Squares represent manifest measures (tests; T1, etc.). Single-headed path arrows designate factor loadings. Double-headed arrows designate latent factor correlations. (cited in Flanagan & Harrison, 2005, p. 142)

The Cattell-Horn-Carroll theory of cognitive abilities as presented in Figure 3.5 represents a more clearer structure of human intelligence (stratum III) and the measurement of specific cognitive abilities on stratum I and II.

After discussions between Woodcock, staff members from Riverside Publishing, Cattell, Horn and Carroll, a verbal agreement was reached to officially phrase this the "Cattell-Horn-Carroll theory of cognitive abilities" (see Figure 3.5) (McGrew, 2005). This theory paved the way toward a more complete and better understanding of the structure of cognitive abilities such as the causal relations between basic information-processing abilities (e.g. processing speed and working memory) and higher-order cognitive abilities (e.g. Gf, *g*, language, reading, etc.) (McGrew, 2005).

Not only was the focus on correlation or factor analytic studies, but due to the demand in the use of psychological tests (e.g. aptitude, achievement, affective and conative characteristics, etc.), test developers and tests distributors had to meet the principles of test construction, namely standardisation, reliability, validity and cultural fairness (e.g. Anastasi & Urbina, 1997; Foxcroft & Roodt, 2001; Myers, 2008).

3.2.4 Biological and cultural approaches regarding intelligence

Current researchers on intelligence have taken a different perspective by directing their attention towards the study of the brain to gain new insights into human intellectual abilities (e.g. Gardner, 1999a; Garlick, 2002; Thompson, Cannon, Narr, van Erp, Poutanen, Huttunen, Lönnqvist, Standerskjöld-Nordenstam, Kaprio, Khaledy, Dail, Zoumalan & Toga, 2001; Myers, 2008; Neisser et al., 1995). According to Neisser et al. (1995), many domains of brain anatomy and physiology have been proposed to correlate with intelligence, such as the arborisation of cortical neurons (Ceci, 1990), cerebral glucose metabolism (Haier, 1993), evoked potentials (Caryl, 1994), nerve conduction velocity (Reed & Jensen, 1992), and sex hormones (e.g. Janowsky, Oviatt & Orwoll, 1994).

Gardner (1999a) suggests that the study of intelligence has grown beyond the boundaries of psychology and that future discoveries are likely to come from a cross-pollination of arguments in neuroscience, cellular biology, genetics and anthropology, to name but a few. He further states that the use of information processing methods and IT simulations might be another approach for gaining new insight into human intellectual abilities. Other advances in how the brain is studied in order to understand individual differences in intelligence include PET and MRI scans. Garlick (2002), on the other hand, proposes a more integrated approach, considering the findings from neuroscience and cognitive science together with those of psychometric intelligence studies.

Studies have revealed that intellectual abilities are mostly inherited and that the environment (e.g. cultural, occupational, schooling, learning interventions and family environments) also influences the individual's intellectual capabilities (Myers, 2008; Neisser et al., 1995). According to Myers (2008), just as individuals differ from one another, ethnic groups also vary in intelligence scores, but these differences are not attributed to hereditary factors (genes) as research evidence suggests that environmental (especially conditions reflecting socio-economic class) differences are the biggest contributor. However, these findings have not been widely accepted in the scientific fraternity. Likewise, the difference in specific intellectual capabilities between gender groups may be explained through evolutionary and cultural influences (Myers, 2008).

In the next section, the construct cognition as an underlying process of intelligence is explained.

3.3 COGNITION

As much as researchers endeavour to understand the construct or structure of intelligence, cognitive psychologists have taken a different approach in investigating the underlying processes of intelligent human behaviour (e.g. Carroll, 1993; Fancher, 1985; Flanagan & Harrison, 2005; Guilford, 1967; Horn & Cattell, 1966; Jensen, 1981; Thurstone, 1924; Vernon, 1961; Wechsler, 1958; Wolf, 1973). The following paragraphs are focusing on the meaning and nature of cognition, cognitive functioning or processing and the clarification of the concepts ability, aptitude and achievement. Thereafter a brief explanation of the core dimensions of cognitive abilities as well as the relationship between intelligence and cognition follows.

3.3.1 The meaning and nature of cognition

The term cognition (Latin: *cognoscere,* "get to know") refers to the "mental action or process of acquiring knowledge through thought, experience, and the senses" (Soanes & Stevenson, 2006, p. 278). Plug, Meyer, Louw and Gouws (1986) write that cognition refers to all those processes by means of which knowledge is attained from an object or matter or through awareness of the environment for example observation, identification, reasoning, evaluating, remembering, learning and thinking. Reber and Reber (2001, p. 128) refer to cognition as activities such as "thinking, conceiving and reasoning". In addition, most psychologists refer to cognition as "any class of mental behaviours with underlying characteristics of an abstract nature involving symbolising, insight, expectancy, complex rule use, imagery, belief, intentionality, problem-solving and so forth" (Reber & Reber, 2001, p. 128).

Cognition can also be viewed as the scientific term for the process of how humans gather information from their world and how they process, store and retrieve that information to display certain overt behaviours (Louw, 1986). According to Myers

(2008, p. 289) the term cognition or thinking "refers to all the mental activities associated with processing, understanding, remembering, and communicating". Cognitive and psychology scientists refer to the information processing activity as the main centre or mental event of an individual's psychological functions (e.g. Carroll, 1993; Luthans, 1995; Posner & McLeod, 1982; Sternberg, 1981). Cognitive functioning or processing is explained in more detail in paragraph 3.3.2.

Other interpretations of cognition refer to the creation of concepts: mental formations of similar groups, objects, people, organisations, and even larger associations which are referred to as "societies" (*Society of Mind*) or hierarchies of concepts and mental images of our concepts (e.g. Grill-Spector & Kanwisher, 2005; Myers, 2008; Rosch, 1978). Each of these elements within the society or mental grouping would have the opportunity to demonstrate evolving behaviour in the face of some crisis situation. Thus cognition can also be viewed as one's understanding and trying to make sense of the world (Sternberg, 2005).

According to Flanagan and Harrison (2005), the evolution in the measurement of human cognitive abilities came about as a result of the platform that psychometric theory and practice have laid in the study of individual differences in people's test scores since the 1800s. In his life-long studies to conceptualise models of intelligence, Alfred Binet's (1857-1911) work has significantly contributed to contemporary models of cognition (Wasserman & Tulsky, 2005). According to Hicks (1996), the earliest studies of cognitive behaviour were done by Kohler (1925) and Tolman (1932) while investigating animal learning.

These two theorists agreed that the process of learning is more complex than a simple stimulus-response association. In studying human learning the Swiss psychologist, Jean Piaget (1926), proposed his theory of cognitive development, suggesting four distinct stages which he called the sensory-motor period (birth to 2 years), pre-operational thought (2-7 years), concrete operations (7-11 years) and formal operations (11-15 years) of mental representation that children go through in the process of reaching an adult level of intelligence (e.g. Flanagan & Harrison, 2005; Hicks, 1996).

Although Piaget's theories had a major influence on the understanding of human intellectual development, some theorists today do not support his views. Nevertheless Piaget's theories laid the foundation for the development of other views (Sternberg, 2009). In 1957 Lee Cronbach, a leader in the psychometric testing field, criticised the lack of a universal understanding between psychologists who studied individual differences and those who studied similarities in human behaviour. His plea resulted, in part, in the development of cognitive theories of intelligence and of the underlying processes governing these theories (Sternberg, 2009).

3.3.2 Cognitive functioning or processing

According to Wasserman and Tulsky (2005), Binet's model of intelligence (*scheme of thought*) was the first evidence-based attempt at unbundling the construct cognition. His model proposed three hierarchical levels of cognition: "(1) a superordinate factor of general intelligence (which he called *judgement* or *adaptation*); (2) 4 lower order elementary cognitive processes (*comprehension, inventiveness, direction*, and *criticism*); and (3) as many as 10 first-order intellectual abilities (*memory, imagery, imagination, attention, comprehension, suggestibility, aesthetic sentiment, moral sentiment, muscular force* and *strength of will* or *persistence,* and *coordination skills and quick visual judgements*)".

Some researchers (e.g. Sternberg, 2009; Wasserman & Tulsky, 2005) label Alfred Binet as the pioneer of cognitive ability measurement and Jean Piaget as the architect of the theory called human cognitive development or intellectual development. According to Sternberg (2009), Piaget's theory of intellectual development derives from two interdependent cognitive processes, which he termed assimilation (incorporates new information into an already existing cognitive structure) and accommodation (forms a new cognitive structure into which new information can be incorporated).

Luthens (1995) describes the cognitive processes as the way in which humans process pieces of information. Furthermore, Carroll (1993, p. 10) defines a process as "any action or series of actions by means of which something is operated on to produce some result". Thus, a cognitive process is "one in which mental contents is operated on to produce some response" (Carroll, 1993, p.10). These mental contents may be interpretations of external stimuli or mental images, memory, perception, learning, rules, attention, and comparable concepts from short-term or long-term memory (Carroll, 1993; Horn & Cattell, 1966). The outcome or response can be natural or artificial, conscious or unconscious. However, according to Carroll (1993), only observable (natural and conscious) responses can be used to explain and to develop hypothetical constructs or models that explain the processes underlying human behaviour.

Any form of cognitive task executed by people could be of a complex nature (Carroll, 1993; Sternberg, 1977). According to Carroll (1993) and Sternberg (1977) these complexities can be categorised into or studied in specific processes, stages, or divisions. In trying to understand the different cognitive processes in how people process information or the process in the execution of tasks, Sternberg (1977) proposed a set of component cognitive processes in that tasks "like evaluating the correctness of the verbal analogy *red:stop::green:go*, symbolised as *A:B::C:D*", can be categorised as follows:

- Encoding (the process of translating each stimulus into an internal representation upon which further mental operations can be performed);
- Inference (the process of discovering a rule, X, that relates the A term of the analogy to the B item, and storing the rule in working memory);
- Mapping (the process of discovering a higher-order rule, Y, that relates the A term to the C term, and storing the result in working memory);
- Application (the process of generating a rule, Z, that forms an image of the correct answer and tests it against the D term of the analogy);
- Justification (the process of deciding whether the D term of the analogy is sufficiently close to the image formed by the application process to be regarded as correct); and
- Preparation-response (the control processes of preparing to solve the analogy, monitoring the solution process, and translating the solution into a response).

Sternberg (1977) went further with his experiments and developed mechanisms through mathematical modelling by means of which he could monitor the time (speed) taken by each of these thinking processes and the accuracy of the response. His research data suggest that cognitive abilities can at times be more clearly defined by clustering them with units of particular tasks. In other words the complexity or nature of the task that needs to be performed influences the specific cognitive process or stage in translating the solution or intended decision or behaviour into a response. Sternberg's (1977) studies showed that these processes are present in most tasks that are of an intellectual nature and these processes and other related processes are evident in a person's score on intelligence tests.

Carroll (1993) was determined to understand the underlying cognitive processes or steps followed in the execution of different tasks, which he describes as the "Elementary Cognitive Task (ECT): An elementary task is any one of a possibly very large number of tasks in which a person undertakes, or is assigned, a performance for which there is a specifiable class of successful or correct outcomes or end states which are to be attained through a relatively small number of mental processes or operations, and whose successful outcomes depend on the instructions given to, or the sets or plans adopted by the person" (p. 11).

What is important for a task(s) to be recognised as a cognitive task depends on the instructions given, even when "stimulus presentations and other objective events remain the same" (Carroll, 1993, p. 11). Carroll went further to develop the Dual Time Representation (DTR) chart, according to which the particular tasks are analysed, based on logical and cognitive analysis of the requirements of the task, into specific activities and then to assume which cognitive process is likely to be performed by each activity. This process can also be described based on the development of psychological tests and the different tasks that need to be performed.

The cognitive process of each task can take many forms, such as understanding, or learning to understand, the requirements of a task – the type of stimuli to be presented, what is to be done by them, what kind of responses are to be made, and (sometimes) the time allowed for performance and how the responses are to be scored or evaluated. Hence Carroll (1993) emphasises that to reflect real individual differences one needs to give detailed consideration to the types of cognitive processes and learning required by a test or task. Earlier studies suggest that information processing is executed in a serial fashion (step-by-step, one after another), while other psychologists argue the case for parallel processing; it is however difficult to distinguish between these two models of information processing (Sternberg, 2009). Through more advanced mathematical and computer modelling "parallel distributed processing" models of the mind were proposed by David E. Rumelhart and Jay L. McClelland (Sternberg, 2009). According to these models many different types of information processing are taking place within the brain at once, rather than just one at a time.

According to Carroll (1993) the cognitive processes involved in one's performance on psychological tests correlates with real life situations. Thus performance on mental ability tests is likely to correlate positively with the individual's performance in real life situations, e.g. to be successful or not, such as in education, career or employment. On the other hand some real-life situations may require more important or specific abilities than others. According to Sternberg (2009) the more familiar a person gets with the execution of a task in real life (environmental influences), the more intellectual capacity is available to deal with other more challenging daily tasks.

Luthans (1995) argues that individual differences and their unique individualisms are the result of people's cognitive processes. As discussed earlier there are many types of cognitive processes such as imagination, perception and thinking style, but the perceptual process is critical to the study of organisational behaviour between the situation and actual behaviour or individual response. Of course, this is not to say that the environment and other psychological processes such as learning, motivation and personality are less important (Luthans, 1995).

3.3.3 Cognitive ability, aptitude and achievement

Carroll (1993) emphasises the importance of knowing and understanding the concepts ability and cognitive ability, as well as other terms such as aptitude and achievement. Most people use the terms "ability", "aptitude" and "achievement" interchangeably, without giving much thought to their meaning or place when it comes to describing people's performance on tasks. Reber and Reber (2001, p. 1) define ability as the "qualities, power, competence, faculties, proficiencies, dexterities, talents, etc. that enable an individual to perform a particular feat at a specified time". Thus, the essence of the term is that the person can perform this task now, and no further training is needed. According to Carroll (1993), ability is some kind of performance or potential for performance on a given task. Robbins (1996, p. 86) defines ability as "an individual's capacity to perform the various tasks in a job". Similarly, Colman (2001, p. 1) defines ability as a "developed skill, competence, or power to do something, especially ... existing capacity to perform some function, whether physical, mental, or a combination of the two, without further education or training". Furthermore Floyd (2005, p. 204) refers to ability as a "discrete behaviour that is either performed or not". According to Robbins (1996) cognitive abilities are those needed to perform mental activities, for instance intelligence tests to determine one's general intellectual abilities. The term "task" as referred to in the above definitions means "any activity in which a person engages, given an appropriate setting, in order to achieve a specifiable class of objectives, final results, or terminal states of affairs" (Carroll, 1993, p. 8). One's ability to perform a task depends on whether one has been instructed by someone to complete the task or whether one executes it out of free will (by choice). Class of tasks refers to possible tasks that may have similar or identical characteristics. The greater the similarities, the greater the probability, that the same abilities of performance are demonstrated. Depending on the difficulty or specialisation level of the tasks e.g. musical (playing the violin) or athletic (javelin throwing), for instance, a general ability and more specialised ability may be present (Carroll, 1993). Furthermore, Carroll (1993, p. 9) argues that any task (involving mental functions) can be viewed as a cognitive task "in which correct or appropriate processing of mental information is critical to successful performance" and cognitive ability is any "ability that requires some form of cognitive tasks". In general terms it refers to one's assessment of what one can do (Carroll, 1993).

According to Reber and Reber (2001, p. 1) aptitude "is an individual's potential for performance, or the possibility of the individual being trained up to a specified level of ability". Myers (2008, p. 317) describes aptitude as the "capacity to learn" and achievement as "what has already been learned". Thus, a test of aptitude is designed to predict a person's future performance, whereas tests of competency or achievement assess one's knowledge or what a person has learned e.g. for school examinations or assessing one's knowledge after attending training. In addition, Carroll (1993, p. 16) argues that the term achievement "refer(s) to the degree of learning in some procedure intended to produce learning, such as formal or informal course of instruction, or a period of self-study of a topic, or practice of a skill" (p. 17). Achievement or performance in real-life situations is not only about cognitive ability or one's learning potential, but includes one's motivation and the opportunity to perform. Even though an individual may be willing and able, there may be obstacles that hinder performance (Robbins, 1996).

The different dimensions of cognitive ability are presented in the next section.

3.3.4 Dimensions of cognitive ability

The primary factor theory of Thurstone (1938) can be regarded as the first attempt to describe those underlying cognitive dimensions which underpin intellectual ability. Through factor analysis, he derived seven group factors or dimensions of cognitive ability, namely verbal comprehension, word fluency, numbers, spatial ability, associative memory, perceptual speed and reasoning ability (Anastasi & Urbina, 1997; Smit, 1983). Dunnette (1976) cites at least seven frequently applied dimensions from the literature which form the basis of cognitive ability. These dimensions are numerical, perceptual speed, inductive reasoning, deductive reasoning, spatial, memory and verbal comprehension.

Although some scholars believe that a high IQ may not be a predictor of job performance, there is strong evidence to suggest that cognitive ability tests which measure verbal, numerical, spatial, and perceptual abilities are valid predictors of job performance in all job levels (e.g. Coward & Sackett, 1990; Hunter, 1986; Hunter & Hunter, 1984; Schmidt, 2002; Schmidt & Hunter, 1998). According to Schmidt and Hunter (1998), reasoning means the ability to use logic to solve novel and complex problems. A brief explanation of the most frequently cited cognitive dimensions are provided below.

3.3.4.1 Numerical reasoning

Numerical ability consists of the ability to solve numerical problems using logic, the ability to classify numbers into categories or groups, the ability to perceive the relationships between pairs of numbers, the ability to understand number sequences and to extrapolate the next term in the sequence; in other words, the ability to do speedy and accurate mathematics (Robbins, 1996).

3.3.4.2 Perceptual speed

Perceptual speed is the ability to identify visual similarities and differences quickly and accurately (Anastasi & Urbina, 1997; Thurstone, 1944).

3.3.4.3 General reasoning (inductive and deductive reasoning)

According to Anastasi and Urbina (1997), Thurstone (1938, 1944) presented two factors, namely inductive and deductive reasoning. By using tests of syllogistic reasoning to measure deductive reasoning and rule identification for inductive reasoning, Thurstone suggested that inductive reasoning shows stronger evidence of non-verbal reasoning ability than does deductive reasoning. Today abstract reasoning is viewed as one of the reasoning abilities that has repeatedly demonstrated correlations with verbal and numerical abilities, forming the concept known as general reasoning ability (Heim, 1970). Hence abstract reasoning describes one's ability to identify correctly the logical relationships between abstract patterns, shapes and geometric designs: in short, the ability to use logic and assess the implications of an argument.

3.3.4.4 Spatial reasoning

Spatial reasoning or visualisation is a person's ability to manipulate and reason about shapes and spatial relationships within a three dimensional context, as well as the ability to imagine how an object would look if its position in space were changed (Robbins, 1996). In other words, how well can a person think in three dimensions?

3.3.4.5 Memory

Memory is the ability to retain and recall past experiences or information through short or long term memory. The past experiences or information could be in the form of a stimuli, events, images, ideas, words, etc.

3.3.4.6 Verbal comprehension

Verbal reasoning ability indicates one's ability to use words in a rational way, correctly identifying logical relationships between these concepts and drawing conclusions and inferences from them.

3.3.5 Relationship between intelligence and cognition

From the literature it is evident that earlier researchers such as Spearman (1923, 1927) and Thurstone (1924) were very interested in the relationship between intelligence and cognition. Both Spearman and Thurstone proved through detailed factor analysis the existence of a general factor with specific group factors, and seven primary mental factors labelled verbal comprehension, general reasoning, word fluency, numerical, memory, spatial and perceptual speed abilities.

It was only when Guilford (1967) proposed his three-dimensional model of intelligence that the concept of cognition under the dimension operations or intellectual processes came to the fore. He argued that at least one of these factors is present in all intellectual activities. As a result this finding, the interpretation may be made that according to Guilford's (1988) model cognition, memory recording, memory retention, divergent production, convergent production and evaluation are ways of intellectual functioning or sub or lower order factors of intelligence.

Other psychologists such as Vernon (1950) and predominantly Hunt (1978; 1980; Hunt, Frost & Lunneborg, 1973; Hunt, Lunneborg & Lewis, 1975), focused their research on the integration of cognitive processing with the study of intelligence. This approach, which they called the cognitive-correlates approach, was directed towards the investigation of lower order processes of intelligence, for example the amount of time taken the access lexical information in memory. However, an alternative approach was proposed by Pellegrino and Glaser (1979): this they termed the cognitive-components approach. This approach focused on higher-order components of intelligence, for example the ability and time taken to perform tasks found on standard psychometric tests of mental abilities (e.g. analogies, series completions, mental rotations, and syllogisms).

A third approach focused on developmental processes. Jean Piaget (1952, 1972) viewed intelligence as deriving from cognitive schemas, or structures that mature as a function of the interaction of the organism with the environment. In support of other researchers of intelligence, he expressed the importance of adaptation and argued that adaptation was the most important principle to intelligence. In adaptation, individuals learn from, and how to deal with, the changes in the environment. Adjustment consists of two complementary processes: assimilation and accommodation.

- Assimilation is the process of absorbing new information and fitting it into an already existing cognitive structure about what the world is like.
- Accommodation, the complementary process, involves forming a new cognitive structure in order to understand information. In other words, if no existing cognitive structure seems adequate to understand new information, a new cognitive structure must be formed through the accommodation process.

A new taxonomy of human cognitive abilities known as the Cattell-Horn-Carroll theory of cognitive abilities (see Figure 3.5) was presented as the most prominent psychometric theory of human cognitive abilities. This model demonstrates that the structure of intelligence can be investigated by analysing the interrelationship of scores on cognitive or mental ability tests. In essence the model confirms previous or earlier studies suggesting a general factor *g* (stratum III), and a serious of second-order factors on stratum II that measure specific or broader factors or abilities on stratum I. The model further confirms the existence of five broad cognitive factors or abilities namely fluid reasoning (Gf), quantitive reasoning (Gq), crystallized knowledge (Gc), short-term memory (Gsm), and visual processing (Gv) (McGrew, 2005).

Hence, according to Pretz and Sternberg (2005), intelligence is related to the efficiency of basic cognitive processes (speed of perception and focused brain activity) and metacognitive control and flexibility of the cognitive process (attention, cognitive control, flexibility of strategy, learning ability, and content-based knowledge). Further evidence needs to be revealed as to whether intelligence is the cause or the result of these differences in individual behaviour and cognitive processing (e.g. information-processing) and needs to consider the influence of socio-cultural and biological factors and non-academic achievement or intelligence.

In the next section the relationship between intelligence and attitude towards work place safety and work place incidents/accidents, including vehicle accidents, is discussed.

3.4 THE RELATIONSHIP BETWEEN INTELLIGENCE AND ATTITUDE TOWARDS WORK PLACE SAFETY AND WORK PLACE INCIDENTS/ACCIDENTS.

The influence of intelligence on attitude formation in general has been explained in Chapter 2. Limited studies could be found explaining the influence of intelligence on individual beliefs and attitude towards work place safety, specifically (see Chapter 2; paragraph 2.4.4, on p. 47-51). In contrast, a large number of studies reported the influence of intelligence, cognition or measured forms of mental reasoning on the occurrences of work place incidents/accidents, including driver accidents.

Intelligence or information-processing deals with the processes and mechanisms in the brain by means of which humans interpret their environment in order to adapt successfully to it and to satisfy personal needs. According to Glendon et al. (2006, p. 67), important intellectual processes include attention, which determines how stimuli are processed, and attribution, which affects how causality for events is ascribed. These processes affect people's attitude towards an object, person or situation which ultimately influences how people choose to act or behave. Therefore, Reason (1988) argues that task failures consist of two unique patterns: (1) planning failures (e.g. mistakes): and (2) execution failures (e.g. cognitive failures). This researcher further argues that people prone to cognitive failure may have rigid attentional focus, thereby creating a cognitive management style that is inflexible. Such a style may allow for the occurrence of cognitive breakdowns in dealing with intervening and concurrent stimuli.

According to Martin (1983), a cognitive failure can be described as a breakdown in intellectual functioning that result in a cognitively based mistake or error in task execution that a person should normally be capable of completing, with some people being more prone to experiencing cognitive failures than others (Wallace, Kass & Stanny, 2002).

In addition, Gottfredson (2008) supports the findings from the accident literature regarding causes of accidents in that the identification of hazards and avoidance of accidental (unintentional) injury are in essence cognitive tasks. This researcher argues further that current research is starting to confirm that a lower IQ increases the risk of preventable injury and death (e.g. unintentional accidents), especially when the tasks are of a complex nature. Furthermore, Gottfredson (2007) emphasises the important finding by O'Toole (1990) that IQ was the best predictor of motor vehicle fatalities in an Australian veterans' study. Other studies (e.g. Buffardi, Fleishman, Morath & McCarthy, 2000; Schmidt & Hunter, 2004) illustrate the importance of cognitive competence for preventing human error and argue strongly that all people make cognitive mistakes, but higher-*g* (IQ) individuals make relatively fewer cognitive mistakes when engaging in complex tasks, whether on mental tests or in real life. In fact, accident prevention and control requires imagining the unseen, the emerging, and the "what-if?" which is a quintessentially cognitive process (Gottfredson, 2007, pp. 406-407).

According to Kanfer and Ackerman (1989) each given task executed by individuals requires a set number of available cognitive resources. These cognitive resources can be classified as on-task, off-task, or self-regulatory activities. On-task activities include those organisational behaviours related to production, quality assurance, and safety adherence. Off-task activities include behaviours such as talking with colleagues, thinking about family, or planning the weekend. Self-regulatory activities include the evaluation of one's environment. Hence, factors such as organisational change, job insecurity, high job demands or family related problems may increase the self-regulatory activity of one's cognitive resources resulting in fewer resources available for the on-task activities of production, quality and safety, which may create potential for unintentional incidents or accidents to happen (Probst, 2004).

Most people experience off-task thoughts or behaviours at work that are not intended. For example, workers may occasionally forget important work-related procedures or rules, fail to pay attention to certain requests by work colleagues or customers, or misplace important documents unintentionally. These types of errors were termed action slips (Reason, 1977) or cognitive failures (Broadbent et al., 1982). Such errors create distractions from effective job or task execution, which can result in disastrous accidents. The cognitive process involves failures in information processing or skill, and results in reduced safety compliance, because people make slips, lapses, or mistakes.

Research (e.g. Lawton & Parker, 1998; Wickens, 1996) suggests that negative emotional states such as stress may: (1) modify the way in which individuals allocate attention to tasks (e.g. via attentional tunnelling): (2) interfere with the representation of information in working memory: and (3) change the strategies individuals use to perform tasks (e.g. by causing a shift from accuracy to speed). In support of the above findings, Gottfredson (2007) notes that even people who are fully aware of a particular danger, who are trained to deal with it and who attempt to exercise control, may experience cognitive process failures if they are distracted, fatigued, stressed, or impaired by drugs or intoxicating liquor.

According to Lawton and Parker (1998), most research on the relationship between intelligence and work place safety has been done on road accidents. Arthur et al. (1991) conducted meta-analyses on available studies, and found that selective attention and intelligence were significant predictors of vehicle accident causation including locus of control and respect for authority. However, Vickers and Villaseñor (2006) argue that these findings indicate rather a weak ($r = -.11$) relationship between intelligence and accidents. In investigating the relationship between intelligence and accidents amongst 183 575 US Navy recruits (between 1 January 1990 and 31 December 1998), Vickers and Villaseñor (2006) found no statistically significant relationship between intelligence and accident rates, even controlling for exposure to complex occupational hazards. At the occupational level, the researchers found that hazards and intelligence explained 20% of the variance in accident rates.

Carty et al. (1999) investigated the psychological predictors of work accidents and driving convictions in the transport industry and they found that those participants who performed better perceptually and who recorded higher spatial awareness tend to report fewer work-related driving accidents. Personality traits, such as neuroticism and Type A behaviour, may increase the individual's vulnerability to these kinds of cognitive failures when the individuals are exposed to stressors. This may reduce the individual's motivation to work safely or to comply with rules and procedures, as well as the individual's attention to detail, which may lead to unintentional occupational incidents or accidents. Personality traits such as extreme extraversion and sensation seeking may act via this motivational pathway (Lawton & Parker, 1998). Wallace and Vodanovich (2003) tested a moderated model examining the interaction of cognitive failure and conscientiousness. They found that cognitive failure moderated the relationship between conscientiousness, and accidents and unsafe work behaviours. This empirical study suggests that cognitive failure plays an important part in individual safety behaviour, especially when conscientiousness is low.

Hence, the study of the effects of intelligence (e.g. action slips or cognitive failure) on employee attitude towards work place safety and work place incidents/accidents, including driver accidents, is a critical area for the organisation under study, because of the unique nature of its different operations. These operations include working on electrical networks, driving long distances under poor road conditions, and adhering to formalised procedures that govern task execution in everyday situations (e.g. repairing faults on electrical networks, working processes guided by different value-chains, etc.).

A brief summary of the chapter follow next.

3.5. SUMMARY

This chapter introduced the complex psychological construct intelligence and it is evident from the literature that most researchers tried to define intelligence from their own perspective or research interest. However, the generally agreed understanding amongst scientists in this field is that adaptation to the environment is the gateway to understanding intelligence and how it functions. It is about how individual people, irrespective of their social-cultural status or biological functioning, are able to make changes in their self in order to cope more effectively with their environment, and are also able to change the environment or to select an entirely new one.

Theories of intelligence have evolved through a succession of models or structural paradigms. Spearman (1927) made the breakthrough via factor analysis, deriving his second-order theory of intelligence and highlighting the existence of a single general factor and specific factors. Thurstone (1924) disagreed with Spearman's theory and argued his own theory of multiple factors, suggesting seven primary mental abilities: this can be regarded as the birth of the theory of cognitive abilities. Guilford (1967; 1988) took Thurstone's theory one step further through more in-depth factor analysis and proposed his three-dimensional model or structure of intelligence. He named the three dimensions operations, contents and products. Although his model did not indicate the possible relationship between these factors or abilities, it did pave the way for other researchers to investigate the concept cognitive process (e.g. interdependency of intellectual abilities and the complexity of intelligence). Instead of a structural approach to intelligence, Vernon (1961) proposed his hierarchical factorial model, arguing that through the general factor primary, secondary and specific factors can be extracted.

Contemporary psychologists such as Gardner (1983) and Sternberg (1985) took different approaches towards investigating the construct intelligence. Gardner (1983) proposed his theory of multiple intelligences and argued a total of eight different intelligences, each related to a specific portion of the human brain. Sternberg (1985) argued that for one to understand intelligence fully, one must include social-cultural factors, creativity and practical experience rather than focusing too much on academic achievement.

The psychometric approach can be regarded as the most influential paradigm in understanding the structure of intelligence. These theories are based on models (e.g. the Stanford-Binet-Scale, Catell-Horn's Gf-Gc theory, Carroll's three-stratum theory) applying psychometric measuring instruments to test their theories of mental abilities.

Critics such as Sternberg (1999) argued that the psychometric approach fails to prove that a truly general ability which underpins all mental abilities actually exists. Paragraph 3.2.4 also highlights the importance of the biological (e.g. neuroscience, genetics, nerve conduction velocity) and cultural (e.g. ethnic populations, gender, environment, schooling) in the understanding of intelligence and how it influences individual's intellectual capabilities.

An in-depth explanation on the psychological construct cognition followed, highlighting that cognitive analysis refers to the study of those mental processes underlying intelligence. The information processing activity has been identified by most cognitive psychologists as the main centre or event of an individual's psychological functioning. The parallel information processing model shows that many different types of information processing are taking place within the brain at once, rather than just one at a time. Consequently an individual's cognitive processing is an important construct to the study of organisational behaviour between the situation and the actual behaviour or individual response.

In investigating cognitive processes, researchers realised the importance of knowing and understanding the concepts ability, cognitive ability, aptitude and achievement. Ability or cognitive ability refers to the individual's capacity to perform a specific task successfully and aptitude the potential for execute a task or tasks in the future after acquiring (e.g. through learning interventions) the required knowledge and skill up to specified level of ability, whereas achievement refers to the application of already learned knowledge or skills.

An explanation of the primary or frequently published dimensions of cognitive ability followed, such as numerical reasoning, perceptual speed, general reasoning (e.g. inductive and deductive reasoning), spatial visualisation, memory and verbal comprehension. The relationship between intelligence and cognition was briefly discussed. It is evident from the literature that earlier psychologists were more interested in uncovering the construct intelligence by means of factor analysis (e.g. the existence of one general factor, primary mental factors or multiple factors), while contemporary psychologists show more interest in those processes underlying intelligence or human intellectual behaviour.

Contemporary models of intelligence confirm the existence of a general factor, a series of second-order factors and specific or broader cognitive ability factors. Intelligent behaviour is likely to be dependent on an individual's cognitive ability (e.g. fluid reasoning, quantitive reasoning, crystallized knowledge, short term memory and visual processing) and cognitive process capacity (e.g. processing speed, adaptation, assimilation, accommodation), and includes other factors such as socio-cultural, biological and practical experience.

The final section of this chapter provides insight into the relationship between intelligence and attitude towards work place safety and work place incidents/accidents, including driver accidents.

3.6 CONCLUSION

It can be concluded, based on the content of this chapter, that the construct intelligence cannot be ignored in any study of human behaviour. Specifically, studies on psychometric intelligence allow for the measuring of an individual's general intelligence, and also specific cognitive abilities such as verbal, numerical, and abstract reasoning.

Especially in the study of at-risk behaviour, positive associations were reported between intelligence and vehicle accidents as well as work place incidents/accidents. A person's level of mental reasoning ability (intelligence) has the potential to influence employees' beliefs and attitude towards safe working behaviours. Therefore, it is important to include intelligence as an independent variable in this study predicting its influence on employee attitude towards work place safety in a public electricity company in South Africa. In addition, it is critical to select a reliable and valid measurement instrument in measuring employees' levels of intelligence, but more importantly its influence on employees' attitude towards work place safety, namely safety consciousness, driver attitude, and quality orientation.

In the next chapter (Chapter 4), the construct personality is presented.

CHAPTER 4

PERSONALITY

4.1 INTRODUCTION

As presented in Chapter 3, the psychological constructs intelligence and cognition have been described by most researchers as the primary factors in explaining individual differences in behaviour. Chapter 4 focuses on an important disposition, namely personality, which, together with intelligence and cognition, can be regarded as a person's entire psychological system.

The contents of this chapter include a brief discussion on the meaning and nature of personality followed by a short explanation of the nine most important approaches or theories regarding personality: these are the biological, psychodynamic, interpersonal, cognitive-behavioural, existential, phenomenological, humanistic, transpersonal and the trait approaches. Because of the significant relationship between personality and work place incidents/accidents, including vehicle accidents, the influence of personality on employee attitude towards work place safety cannot be ignored.

The chapter concludes with a brief summary, as well as conclusions regarding the implications of the content of the chapter for the empirical part of the study.

4.2 THE MEANING AND NATURE OF PERSONALITY

Similar to intelligence and cognition, the general public's understanding of the construct personality is rather misunderstood. People often refer to charm, friendliness, helpfulness, politeness, happiness and so forth as characteristics of personality. Hence personality cannot be viewed as independent parts of a person, but as an integrated whole of the human psyche (Robbins, 1996).

According to Myers (2008, p. 456), just like the construct intelligence, personality is a "concept that cannot be seen, touched, or directly measured". As many researchers have tried to define intelligence, so have researchers studying personality tried to argue their understanding of personality from different theoretical perspectives; therefore, no universally accepted definition of personality exists. However, most psychologists believe that personality reflects an individual's unique and consistent pattern of thinking, feeling, and behaviour in different contexts of their situation (Bergh, 2003; Edwards, 2008; Myers, 2008). One of the most frequently cited explanations of personality was proposed by Gordon Allport (1937, p. 48), who suggested that personality is "the dynamic organisation within the individual of those psychophysical systems that determine his unique adjustments to his environment". Luthans (1995) supports Allport's explanation of personality, highlighting that the study of personality needs to move beyond the traditional approaches (e.g. emphasis on the person only), and to include the person-situation interaction (e.g. the social learning aspect of personality). This view is also supported by Sternberg (1995), who adds that personality focuses on individual differences that drive people to behave in a certain manner, and also how these individual dispositions interact with different situations to influence behaviour.

Personality can therefore be regarded as individual dispositions demonstrating their unique and consistent pattern of thoughts, feelings and behaviour when interacting with others or different situations.

4.3 DIFFERENT APPROACHES REGARDING PERSONALITY

The construct personality is too complex to conceptualise by merely citing some basic definitions, or by considering one specific approach. It is about understanding how the different theoretical approaches to personality support or complement the primary concepts explained in paragraph 3.2, the reason being that all the major personality theories strive to achieve one primary theme and that is to understand and explain the total functioning of individuals and how this acknowledges the existence of individual dispositions (Meyer, 1986).

The following seven major approaches: the biological, psychodynamic, interpersonal, cognitive-behavioural, existential, phenomenological, humanistic, transpersonal and the trait approaches regarding personality are discussed next.

4.3.1 The biological approach

The biological approach focuses on the structures and functions of the brain and observes how the nervous system and levels of certain hormones interact with the environment to influence various aspects of people's lives such as personality, emotions and memory (Myers, 2008). Major arguments for the biological approach suggest that a person's personality is the result of heredity and environmental factors, moderated by situational conditions (Edwards, 2008; Robbins, 1996).

4.3.1.1 Essence of the biological approach and prominent exponents

Hans Eysenck (1967; 1970) may be regarded as one of the most prominent researchers on personality who believed that the factors extraversion-introversion and emotional stability-instability are genetically influenced and are the core determinants that explain individual differences in human behaviour (Costa & McCrae, 1992a). According to Eysenck (1967; 1970), inhibition theory, the temperament factor and neuroticism correspond with the level of activity in the brain's limbic system which regulates emotional responses. He stated that the introversion-extraversion factors are related to activity in the behavioural inhibition system (e.g. the nerve pathways in the septum and hippocampus, which are part of the limbic system) suggesting that the behavioural inhibition system is more active amongst introverts than in extraverts (e.g. Gray, 1972; Johnson, Wiebe, Gold, Andreasen, Hichwa, Watkins & Ponto, 1999). According to Olson (2005), brain-activity scans of extraverts also revealed that they seek stimulation because their normal brain arousal is relatively low compared to that of introverts.

4.3.1.2 Evaluating the biological approach

According to Edwards (2008), studies regarding the biological approach to personality have revealed that a relationship exists between broad traits of temperament and the manner in which the physiological system (e.g. the nervous system) operates. Furthermore the physiological characteristics related to temperament are at least partially genetically determined and when certain biological systems are damaged or malfunctioning, it can have serious implications on normal personality functioning.

There is consensus amongst scientists that biological factors (e.g. heredity, one's genes) do play an important role in the forming of people's personalities, but that the environment also plays a substantive role in shaping our personalities (Edwards, 2008; Heston, 1970; Lewontin, Rose & Kamin, 1984; Myers, 2008; Robbins, 1996). Further support for the interdependency of biological factors such as heredity (e.g. genetic make-up) and environmental factors influencing one's personality was provided by investigating identical and fraternal twins, and adopted children (e.g. Barlow & Durand, 1995; Bouchard Jr & McGue, 1990; Bouchard Jr, Lykken, McGue, Segal & Tellegen, 1990; Heston, 1970; Kendall & Hammen, 1995; Tienari, 1991).

4.3.2 The psychodynamic approach

The psychodynamic paradigm is rooted in the psychobiological approach to personality and focuses specifically on the dynamic and biologically-orientated processes, especially those that take place in the unconscious mind (Edwards, 2008; Myers, 2008; Sternberg, 1995). These theories are based on the view that the structure of personality is mainly unconscious and that people are most of the time unaware of the reason why they behave in a certain manner and as a result display certain desires to gain a better understanding of the reasons for their behaviours (Bergh, 2003).

The major contributor to this theory was Sigmund Freud, who emphasised his psychosexual theory of the structure of personality, derived from the psychoanalytic theory of Carl Jung. Whereas Freud's arguments focused on the sexual drives and motives, Jung's approach de-emphasised the sex motive (Bergh, 2003; Edwards, 2008; Myers, 2008; Sternberg, 1995). Prominent researchers who followed Freud and Jung are referred to as neo-Freudians (e.g. Alfred Adler, Karen Horney) (Edwards, 2008, Myers, 2008).

4.3.2.1 Essence of the psychodynamic approach

According to Edwards (2008) and Myers (2008) the essence of the psychoanalytic perspective concentrates on the mind and the unconscious; and is based on the belief that childhood experiences greatly influence the development of later personality traits and psychological problems. This perspective stresses the influence of unconscious fears and desires on behaviour. Freud (1949) emphasises the importance of early-childhood development and the constant interplay among an individual's motives, drives, needs and conflicts as played out by the Id (which consists of the self-preservation and sexual instinct), the Ego (which is the psychological structure we apply to adapt to day-to-day real life situations) and the Superego (e.g. acts as our moral guide and contains the conscience). Neo-Freudian researchers such as Alfred Adler and Karen Horney support Freud's theory of childhood experiences, but dismiss the sexual drives, arguing that childhood social tensions are very important for personality development (Myers, 2008).

Another important aspect of the psychodynamic paradigm is Freud's perception that people keep conflict and emotional pain out of the conscious mind via defence mechanisms, which according to Freud (1940), are also unconscious. In essence the different types of defence mechanisms people often use to protect the ego from anxiety are: (1) repression, (2) denial, (3) regression, (4) rationalisation, (5) intellectualisation, (6) projection, (7) displacement, (8) reaction formation, (9) compensation and (10) sublimation (Bergh, 2003; Freud, 1949; Edwards, 2008; Myers, 2008; Sternberg, 1995).

4.3.2.2 Evaluating the psychodynamic approach

Contemporary developmental psychologists believe that people's development is not fixed in childhood, but that it is a lifelong process, and that dreams disguise and fulfil wishes (Myers, 2008). Further research could not find any evidence for Freud's arguments that defence mechanisms protect the ego against sexual and aggressive impulses and that psychological disorders are the result of suppressed sexuality. However Freud's concept of repression is still used to explain hypnotic phenomena, and include concepts such as prolonged stress which enhances memory causing flashbacks (e.g. Cheit, 1998; Myers, 2008; Schacter, 1996). In support of Freud's defence mechanism theory, recent research done by Baumeister, Dale and Sommer (1998) found the existence of similar and other defence strategies (such as false consensus, instinctual energy and reaction formation), although less motivated by seething impulses and more driven to protect our self-image.

According to Edwards (2008) the validity of Freud's theory has to be questioned because of a lack of scientific evidence, as most of his theories are based on observations or case studies of patients with serious problems. Nevertheless the psychodynamic approach made us aware of the unconscious and the irrational, our self-protective defences, the importance of people's sexuality, and the interdependency and at times the strain between our biological impulses and our social awareness (Edwards, 2008; Myers, 2008).

4.3.3 The interpersonal approach

Researchers of the psychodynamic paradigm paved the way for other important personality theories including the interpersonal approach (Edwards, 2008). The interpersonal approach regarding personality is based on the view that humans interact with one another on a daily basis and that most of our personality characteristics are presented during these interactions (Edwards, 2008).

4.3.3.1 Essence of the interpersonal approach

Important concepts according to Horowitz (1988) and Johnson (1985) are displayed between individuals such as: (1) interpersonal needs: (2) interpersonal emotions: (3) interpersonal behaviours: and (4) interpersonal schemas. Sullivan (1950) describes the interplay between the four concepts as the *me-you* pattern and highlight important patterns such as selective attention, distortion, passive aggressiveness, and characteristics of personality that emerge during one-on-one or group interaction.

Another interpersonal approach that was developed from the psychodynamic perspective is the object relations theory of Melanie Klein (Edwards, 2008). This approach investigates how interpersonal schemas develop in the growing stages of the child and the term object refers to those people who are important in the child's life, especially its parents. In essence if the child's experiences with its parents, predominantly its mother, do not move to the stage of mature independence, interpersonal conflict is likely to occur which can only be resolved through psychotherapy (Edwards, 2008).

According to Edwards (2008), Eric Berne presented his analogy of games people play (transactional analysis) and refers to the parent ego state, the adult ego state and the child ego state. Interactions between people vary between the three different stages or schemas, which are often viewed as the psychological games people play. This approach supports the view of Melanie Klein in that if adults do not grow beyond the child ego state it may result in destructive relationships (Edwards, 2008).

4.3.3.2 Evaluating the interpersonal approach

According to Edwards (2008) people do interact with one another, especially with those closest to us, and during these interactions most of our personality characteristics come to the fore in forms that either builds effective interpersonal relations or that are destructive in nature. Because this approach focuses mainly on interpersonal relationships, the contribution of this theory as part of the personality domain is of great significance. However, critics of this theory dispute the scientific nature of this approach, because it was developed through informal cases studies by psychotherapists.

Only Melanie Klein took up the challenge to conduct further research on the object relations theory, by conducting detailed observational studies. As a result her theory received much support from other researchers (Mahler, 1979; Noshpitz & King, 1991). Other critics of the interpersonal approach argue that this view does not explain all areas of personality (Edwards, 2008).

4.3.4 The cognitive-behavioural approach

The behaviouristic paradigm dominated the field of psychology for many years and supporters dismissed the role of thoughts, images, dreams and consciousness. The more radical behaviourists totally ignored the function of the mind in influencing human behaviour and were more concerned about studying the relationship between stimuli and responses. Major contributors to the behaviourism paradigm (e.g. Watson, Pavlov, Thorndike and Skinner) tested their theories on animals, ignoring the application of their findings to humans. Scientists opposed to the behaviouristic approach investigated how the brain receives and processes information, and how individuals use this information to behave in a certain manner. This new theory led to the creation of the cognitive-behavioural paradigm (Edwards, 2008; Myers, 2008).

4.3.4.1 Essence of the cognitive-behavioural approach

The essence of the cognitive-behavioural approach explains not only how people learn behaviours through conditioning or by observing others and modelling their behaviour after that of others, but also how people think about their situations affecting their behavioural patterns (Edwards, 2008; Myers, 2008). Researchers who made significant contributions in this field are Albert Bandura (1974; 1986; 2001; Bandura & Walters, 1963), whose social-cognitive perspective highlighted the importance of self-efficacy (e.g. determining how we feel and how we act) and reciprocal determination (e.g. the interacting influences between personality and environmental factors) and Rotter (1966; 1982), with his sense of personal control theory (e.g. external and internal locus of control).

According to Edwards (2008, p. 579), Alfred Adler combined his psychoanalytic views with the cognitive approach which led to his theory of apperceptive schemas, explained as "organised patterns of thinking which represent important aspects of the world" and "acting within it so that the guiding ideals can be achieved". Beck (1976) took this one step further by developing cognitive-behavioural approaches (e.g. rational emotive behaviour therapy) to challenge the individual's cognitive distortions (e.g. early maladaptive schemas and self-fulfilling prophecies) and to guide them in changing their thinking and altering behaviour (Edwards, 2008; Corey, 2001).

4.3.4.2 Evaluating the cognitive-behavioural approach

Edwards (2008) highlights the important contributions of the social conditioning and learning theories in explaining behaviour, but these theories failed to recognise the important contribution of cognitive factors. Furthermore Bandura and Rotter succeed in incorporating both cognitive and behavioural factors in their approaches, although critics of their views argue the lack of a comprehensive outlook of personality (e.g. the ignoring of unconscious factors). However Adler's theory did incorporate both the psychodynamic perspective and cognitive factors. A positive aspect of the cognitive-behavioural approach is that it managed to incorporate all the different theoretical behavioural and cognitive factors of personality, which assisted researchers such as Aaron Beck to develop cognitive behavioural therapy in assisting individuals to confront irrational thoughts and beliefs and to gain a better understanding of their world (Edwards, 2008). As with the other approaches discussed (see 4.3.1, 4.3.2 and 4.3.3), the cognitive-behavioural approach does not offer a complete understanding of the construct personality.

4.3.5 The existential, phenomenological and humanistic approaches

According to Wertz (1994) the existential, phenomenological and humanistic approaches to psychology evolved after researchers in psychology questioned the radical mechanistic view of the natural science approach (e.g. behaviouristic and cognitive science) and the orthodox view of the psychodynamic approach. Prominent exponents of the so-called third force of psychology, namely the existential approach, were Victor Frankl (1905-1997), the existential phenomenological approach of Rollo May (1909-1994), and the humanistic approach of Carl Rogers (1902-1987) and Abraham Maslow (1908-1970) (Edwards, 2008).

A new way of thinking emerged from a natural science perspective to a human science approach whereby the life of a human being is valued and respected.

4.3.5.1 Essence of the existential, phenomenological and humanistic approaches

According to Corey (2001), Victor Frankl had already started to develop his existential approach to clinical psychotherapy before his years of horrible experiences in the Nazi death camps. Frankl (1963, cited in Corey, 2001 p. 141) believed that "love is the highest goal to which humans can aspire and that our salvation is through love". He further stated that people have choices in every situation: even in terrible situations humans could preserve a "vestige of spiritual freedom and independence of mind". A fundamental aspect of the existential approach according to Frankl (1963) is that the core of being human lies in people's search for meaning and purpose; and that human beings possesses the capacity to consciously shape their own destiny.

Rollo May paved the way for translating key concepts of the existential approach into psychotherapeutic practice in the United States (Corey, 2001). According to May (1958) it takes courage to "be", and to make the choices people have to make to shape the way they live their lives. Furthermore May (1958, 1983) believed that people experience continuous conflict within and the desire to grow toward maturity and freedom, but that they also realise that the growing process is often painful. Another existential therapist, James Bugental (1987), proposed the phenomenological method in psychotherapy according to which the therapist allows people to share their personal experiences of life and challenges them to question negative answers or bad choices to begin living authentically (Edwards, 2008; Corey, 2001).

Maslow (1970) proposed his hierarchy of needs, suggesting that if our physiological needs have been, we then become concerned with personal safety; once this need has been fulfilled, we then search for love, to be loved, and to love ourselves. With our love needs satisfied, people search for self-esteem and once achieving self-esteem, people ultimately strive for self-actualisation. In this way, people are "motivated to develop their personal strengths, interests and abilities" to their full potential (Edwards, 2008 p. 586; Myers, 2008 p. 432).

Another humanistic psychologist, Carl Rogers, presented his person-centred approach. In support of Maslow's thinking, Rogers (1980) believed that people are basically good and are gifted with self-actualising capabilities. Rogers further believed that for human beings to become fully self-actualised, the following three conditions need to be present: (1) genuineness, (2) acceptance and (3) empathy. Both Maslow and Rogers argued strongly that one's self-concept is a fundamental feature of personality, and that when people experience their self-concept as positive, they tend to behave and perceive the world positively. If their experience is negative, then people tend to feel unhappy and dissatisfied (Edwards, 2008; Corey, 2001; Myers, 2008).

4.3.5.2 Evaluating the existential, phenomenological and humanistic approaches

According to Edwards (2008) the three approaches contributed significantly to our understanding of the construct personality. Through the existential approach psychotherapists were able to gain a better understanding of how anxiety and courage of ordinary people confronted with unforeseen and strenuous circumstances affect their human existence. The phenomenological method provided a framework for therapists to explore the life experiences of people towards self-actualisation. Humanistic psychologists succeeded in educating people on the concepts of self-motivation, self-image, self-respect and self-concept (Myers, 2008). Critics of the third force paradigm argue that the focus on individualism may lead to self-indulgence, selfishness and shrinking of moral standards (Campbell & Specht, 1985; Wallach & Wallach, 1983), but Crandall (1984 as cited in Myers, 2008 p. 434) argues "that it is those who focus beyond themselves who are most likely to experience social support, to enjoy life, and to cope effectively with stress". Maddi (1980) argues that the existential approach does not provide a comprehensive theory of personality. Just like the psychodynamic paradigm, the three approaches and concepts such as personal growth or self-actualisation are based on informal case studies and cannot be measured or tested by other methods (Edwards, 2008). Another argument against the humanistic approach is that it ignores the reality of the human potential to be evil or harmful towards fellow human beings, animals and our planet (Myers, 2008).

4.3.6 The transpersonal approach

Edwards (2008, p. 589) writes that the approaches regarding personality discussed in paragraphs 4.3.1, 4.3.2, 4.3.3, 4.3.4 and 4.3.5 are derived from "inherited biological differences that are modified through learning from life experiences". Hence, supporters of the transpersonal approach believe that one needs to include a spiritual element to explain the total human psyche. The theories of Carl Jung as well as new theories beyond Maslow's humanistic approach are discussed.

4.3.6.1 Essence of the transpersonal approach

According to Corey (2001, p. 81), Carl Jung made "monumental contributions to our deep understanding of human personality". Jung (1961) channelled most of his energy to focusing on the unconscious mind, which also played an important part in the development of his theory of personality. Whereas Freud's theory of the unconscious focused on sexuality, Jung's theory included a spiritual approach. He focuses on humans finding meaning in life as opposed to being driven by psychological and biological forces.

Furthermore Jung (1961) believes that people can grow beyond their past and that humans have the capacity to constantly develop, growing and moving toward a more fulfilled and balanced level of self-actualisation. Jung referred to this process as achieving individuation, the "harmonious integration of the conscious and unconscious aspects of personality" (Corey, p. 82). Another important aspect of Jung's theory is the concept of the collective unconscious, which he describes as the deepest layer of connecting with the past (e.g. ancestral experiences) and through dreams people reflect on both the unconscious and collective unconscious.

According to Jung (1961) the contents of the collective unconscious act as archetypes consisting of the persona (e.g. mask or public face), the animus and the anima that represent both the biological and psychological elements of masculinity and femininity (Corey, 2001; Edwards, 2008). The self archetype drives people to new experiences and self-awareness. Later in his career Maslow (1971) also supported the transpersonal approach in order to fully understand personality (Edwards, 2001). Maslow (1971) argued that there are two kinds of self-actualising people, namely the non-trancenders (e.g. self-actualising in the humanistic sense) and transcenders (experiencing regularly peak experiences and living beyond their own needs and values).

4.3.6.2 Evaluating the transpersonal approach

The transpersonal approach tries to bridge the gap between science and the spiritual aspects of human existence, and supporters of the transpersonal approach argue that if we fail in closing the gap we will never be able the completely understand the complex nature of personality (Edwards, 2008). Critics of this view argue that this approach is based on semantics and that is too speculative to be rigorously researched by scientific methods. The validity of concepts such as the collective unconscious, archetypes, non-transcenders and transcenders, and people's experiences through dreams are questioned and cannot be included in theories of human personality (Edwards, 2008). Nevertheless Edwards (2008) is of the opinion that the transpersonal approach is relevant for South African psychology in that it may bridge the gap between psychology and the beliefs and practices of African traditional healers.

4.3.7 The trait approach of personality

Theorists of the trait approach to personality are more concerned to understand what personality is like, rather than to study its underlying psychological nature compared to approaches such as the biological, psychodynamic and humanistic/existential (Fontana, 2000). Most trait theorists describe personality traits as those behavioural characteristics that people display in most situations. Furthermore traits can also be explained as those broad, long-lasting and enduring characteristics that can be observed over time (Bergh, 2003; Edwards, 2008; Myers, 2008). An example of a personality trait would be describing a person as trusting, assertive, creative or spontaneous. A personality type is a style of personality defined by the person telling us more about their own perceptions and stereotypes by means of self-reporting questionnaires or 360 degree evaluations (Edwards, 2008; Myers, 2008).

Major contributors to the trait theories of personality were Gordon Allport, Raymond Cattell and Hans Eyseneck, as well as the Five Factor paradigms (Edwards, 2008, Myers, 2008; Robbins, 1996). Although their approaches and methods vary, they share a basic belief that personality can be understood and people's behaviour can be explained and described by the use of traits.

4.3.7.1 Essence of the trait approach

The essence of the trait approach is mostly concerned with measuring and describing people's psychological characteristics (Arnold, Cooper, & Robinson, 1995). Through complex statistical analysis (e.g. factor analysis), traits theorists develop self-reporting questionnaires to compare people's unique characteristics against a certain norm or population group. These results are then used to explain an individual's current behaviour and to make certain assumptions of possible future behaviour such as career decisions, job performance or personal development (Myers, 2008; Luthans, 1995; Robbins, 1996). The "more consistent the characteristic and the more frequently it occurs in different situations, the more important that trait is in describing the individual" (Robbins, 1996, p. 92).

The different theories regarding the trait approach of personality are presented next.

4.3.7.2 Allport's theory

Gordon Allport (1897-1967) is often referred to as the founder of personality trait theory. According to Myers (2008), Gordon Allport started his career as a psychology student who interviewed Freud in Vienna. Allport (1937, 1963) realised how preoccupied Freud was with the theory of psychoanalysis, specifically trying to analyse Allport during the interview. He realised that there was more to personality than trying to over analyse people's thoughts, feelings and behaviour (Myers, 2008; Sternberg, 1995).

This experience motivated Allport to start describing personality in terms of fundamental traits or identifiable behaviour patterns by going through a dictionary and noting every term he could find that described a personality trait. Furthermore he tried to combine nomothetic (e.g. viewing personality as consistent, largely inherited and resistant to change) and idiographic (e.g. concerned with the uniqueness of individuals and the development of the self-concept) perspectives which he termed the morphogenic approach. After compiling a list of 4,500 different traits, he organised them into three different trait categories (Allport & Odbert, 1936; Bergh, 2003; Carver & Scheier, 2000; Funder, 2001):

- Cardinal traits: refers to traits that are likely to dominate or are unique to each individual's whole personality. These traits are thought to be quite rare.
- Central traits: refers to traits that represent most of our personality characteristics. Examples of these traits are kindness, honesty or friendliness.
- Secondary traits: refers to traits that are only present under certain conditions and circumstances. An example of a secondary trait would be getting nervous before attending a job interview.

A key aspect of his theory is based on the individuality and uniqueness of a person. He believed that people use these consistent personality characteristics or traits to adapt to different environmental and situational demands (Bergh, 2003). Furthermore he viewed personality as dynamic in that it develops, grows and changes as the individual matures and learns.

4.3.7.3 Cattell's theory

Cattell (1943) supported the views of Allport in that people's behaviour can be described by many words and that this was likely to become an important element of explaining personality. According to Heffner (2002), Raymond B. Cattell viewed language as a useful source of information about personality, and following Allport's method, Cattell applied a lexical approach to construct his original taxonomy of trait names. In search of the basic descriptions of personality, Cattell (1943) reduced the number of main personality traits from Allport's initial list of over 4,000 down to 171, mostly by eliminating vague terms and combining similar characteristics. He also supplemented this list with terms found in the psychological literature (e.g. sanguine, cycloththyme-schizothyme, and somatotonic) (Bergh, 2003; Heffner, 2002).

Next, Cattell rated a large sample of individuals for these 171 different traits. In addition, he made use of quantitative, objective techniques known as factor analyses (although he made use of a different factor analytic measure than Eysenck) and other traditional statistical procedures in order to gain a better understanding of the basic dimensions of personality (Hicks, 1996). Cattell (1943) identified three main sources of data collection that he used as a basis for the construction of his theory of personality. Cattell respectively termed these sources of data as:

- L-data or life record data. Ratings by observers which Cattell regarded as the best source but which he also recognised as particularly difficult to make; great skill and much time are needed to make accurate ratings. His research began by identifying all the words in the English language that describe behaviour (trait elements), including more technical terms from Psychology and Psychiatry, and after removing the synonyms (repeated terms), a sample of students was studied for sixth months by trained observers who rated each participant on all of the trait elements. Data found were factor-analysed and 15 first order or source traits were found.
- Q-data or self-rating questionnaire. Scores from *Personality questionnaires.* Based on the original 15 source traits, a large number of questionnaire items were compiled and given to a large number of participants. When their scores were factor-analysed, 16 source traits emerged (12 of the original 15 plus four new ones). These were used to construct the 16PF (personality factors) questionnaire.
- T-data or test data: *Objective tests.* These are tests designed specifically to measure personality. The test involves the completion of a questionnaire and observation. The purpose of these tests is not revealed to the participants and a number of factors are measured such as reaction time, body sway and body language. Research into this type of data produced 21 factors altogether, some of which correspond with those produced using Q data.

By combining the evidence gathered from these three data collection methods with the results of the extensive factor analytic studies, Cattell and his colleagues were able to map out the basic, or primary, personality factors that were needed to explain the complete sphere of human personality. In addition, Cattell identified two main types of personality traits, namely surface traits or observed syndromes of behaviour, and source traits. He referred to source traits as those deep structure personality traits that can only be identified through factor analysis. This led to the development of the Sixteen Personality Factor Questionnaire (16PF) (Cattell, Eber, & Tatsuoka, 1970), with four extra factors that were said to be specific to the questionnaire domain (Cattell, 1947).

4.3.7.3.1 The 16 personality factor questionnaire (16PF)

According to Cattell, Eber and Tatsuoka (1970), the method of factor analysis of personality traits (as distinct from abilities) were not a familiar or well recognised approach during the early days of the 16 PF. The Sixteen Personality Factor Questionnaire (16PF) was one of the first tests in which many years of factoring of ratings and questionnaire data were collected, in order to define the dimensions to be measured, before a single source-trait was constructed. During this period, it was important for Cattell (1947, 1961) to confirm the theoretical viability of the concepts and at the same time to lay the foundation for the accumulation of psychological understanding, criterion prediction, and continuous increase in the validation of these factors (e.g. across age, gender and cultural differences). Cattell (1961) argues very strongly that the Sixteen Personality Factor Questionnaire (16PF) aims to measure the total human personality domain and not just single personality traits.

The traits that are measured by the 16PF are listed in Table 4.1. The characteristic expressions of all the traits are bipolar, that is, at the one pole there is a low amount or score (sten score of 1-3) of the trait and the other pole there is a high amount or score (sten score 8-10) (Foxcroft & Roodt, 2001; Smit, 1983). Another method of interpretation used by interpreting responses are the inclusion of the symbol – (minus), with the trait or factor, which also refers to a low amount of the trait and the symbol + (plus) a high amount of the trait (Cattell, Eber & Tatsuoka, 1970). A brief explanation of the primary and secondary factors as measured by the Sixteen Personality Factor Questionnaire (16PF) are presented next.

4.3.7.3.1.1 Factor A: The warm-cool social orientation

Factor A measures emotional orientation towards other people, and low scores are usually recorded by respondents who require a minimum of interpersonal contact whereas high scores represent people who show great interest in people and enjoy interpersonal contact (Cattell, 1989). In addition, Factor A makes the largest contribution to the assessment of personality of all the factors in the 16PF.

4.3.7.3.1.2 Factor B: The ability to discern relationships

This factor does not measure intelligence compared to other ability tests, but rather it involves the capacity to perform, related to a given standard. The scale is made up of verbal and numerical items and measures aspects of fluid intelligence. Low B scores are likely to suggest that the respondent is unable to handle abstract problems, while high scores suggest insightfulness, fast-learning and intellectual adaptability (Cattell, 1989; Smit, 1983).

Table 4.1 Personality factors measured by the 16PF

Factor	**Low score (sten score: 1 to 3 (-)**	**High score (sten score: 8 to 10 (+)**
Primary factors		
A: The warm-cool social orientation	Reserved	Warm-hearted
B: Reasoning	Concrete	Abstract
C: Adaptation to the environment	Affected by feelings	Emotionally stable
E: Control and deference in human relations	Submissive	Dominant
F: The exuberant and sombre orientations	Sober	Enthusiastic
G: The content and action of moral values	Disregards rules	Conscientious
H: Boldness and timidity in human temperament	Shy	Adventurous
I: Feeling versus thinking – contrasting modes of evaluating experience	Tough-minded	Sensitive
L: Alienation versus identification in social orientations	Trusting	Suspicious
M: Intuiting and sensing as contrasting perceptual modes	Practical	Imaginative
N: Self-presentation in social situations	Forthright	Astute
O: Guilt-proneness and untroubled adequacy	Self-assured	Apprehensive
Q1: Orientation towards change	Conservative	Experimenting
Q2: Self-sufficiency versus group dependency	Group dependency	Self-sufficiency
Q3: Investment in maintaining a socially approved self-image	Low self-sentiment integration	High strength of self-sentiment
Q4: Tense and relaxed temperaments	Relaxed	Tense

Table 4.1 Personality factors measured by the 16PF (continued)

Factor	Low score (sten score: 1 to 3 (-)	High score (sten score: 8 to 10 (+)
Second order factors		
EX: Extraversion	Introversion	Extraversion
AX: Anxiety	Low anxiety	High anxiety
TM: Tough-Mindedness	Emotionality	Tough poise
IN: Independence	Accommodating	Independent
SC: Self-control	Low control	High control

4.3.7.3.1.3 Factor C: Adaptation to the environment

The underlying construct which is being measured is a person's ego strength. Generally, low scores usually identify individuals who to some degree lack patience, perseverance, and self control. High scores usually identify emotionally stable individuals who act only after adequate deliberation and then proceed with patient perseverance. Such persons tend to be realistic, restrained and constant in attitudes and interest and usually tend to be calm and even tempered (Cattell, 1989; Smit, 1983).

4.3.7.3.1.4 Factor E: The control and defence in human relations

Factor E measures the amount of control people either submit to or exercise over others in their interpersonal relationships. According to Cattell (1989), Factor E is one of the factors where the mean is of high importance, as both ends of the poles (submissive versus dominance) can be disruptive to interpersonal relationships. Furthermore, she explains that most people think of dominance as being assertive, but dominance refers to a wish to obtain a higher status, in order to overpower and direct others to goals not of their choosing, whereas assertiveness refers to the flexibility possessed by an individual to protect one's boundaries and extensions of self, time, possession, priorities, etc., from invasion, without intruding on the rights of others (Cattell, 1989).

4.3.7.3.1.5 Factor F: The exuberant and sombre orientations

This factor measures the degree to which the natural exuberance of childhood experiences persists into adulthood. A high F+ pole represents high spiritedness, energetic, change seeking, and exhibitionism, while subduedness, caution, and self-effacement are represented by its F- pole. Although this factor may cause confusion with factor A as an outgoingness/withdrawal continuum of social behaviour, Factor A measures interest in people, while Factor F measures interest in self (Cattell, 1989).

4.3.7.3.1.6 Factor G: The content and action of moral values

This factor can be regarded as one of the most valued constructs because of its predictive power with academic and work-related achievement of any trait after intelligence (Cattell & Butcher, 1968; Rothman & Flowers, 1970). Krug (1980) and Karson and O'Dell (1976) referred to this factor as conformity, focusing on its alignment with conventional moral standards. Cattell (1989) supports the views of her father, Raymond Cattell, in stating that this factor relates to the Freudian construct, namely the superego. Furthermore, this factor measures an internalised set of rules which has both content and action. Its content is made up of cultural mainstream values. With only ideational content, the superego would remain passive. The superego achieves action state when it has to restrain self-satisfying impulses, or put duty before personal benefit. It acts as an overseer, dispensing disapproval whenever its rules are broken and approval when its rules are adhered to. Although this factor does not measure guilt, it is the normal response to the superego's disapproval (Cattell, 1989).

Conscientiousness, which is the other superego action, leads and guides behaviour. Respondents reporting high scores on this factor are likely to be conscientious individuals who readily accept and reliably discharge responsibility. These individuals are generally self-exacting in character and often seem to be directed by an overpowering sense of duty, whereas individuals with low scores show tendencies of disregarding rules, neglecting responsibility and a lack of acceptance of group moral standards. According to Krug (1980), superego inflexibility can even threaten physical health by contributing to stress. High G+ scores may find it hard to modify their self-imposed rules and so work hard, drive themselves to meet deadlines, get little sleep, and allow little time for rest and relaxation. Importantly, Cattell (1989) warns that this factor measures those ideals and moral principles endorsed by the majority of people in contemporary American and northern European culture, and because it represents the ideal virtues of our culture, the scale items for Factor G are likely to be susceptible to motivational distortion.

4.3.7.3.1.7 Factor H: Boldness and timidity in human temperament

According to Cattell (1973) Factor H comes close to being the most influential and determining factor in the total temperament domain, as demonstrated by its physiological associations with EKG patterns. Persons scoring highly on this factor under-react to external dangers and stressors and are risk takers and adventurers who enjoy excitement. By contrast, those people with low scores overreact to any form of perceived threat. As a result, they prefer to stay with whatever is certain, predictable, and safe (Cattell, 1989). An important interpretation was made by Cattell, Eber and Tatuoka (1970) in that H+ and B- and F+ as well as H+ and C- scores show tendencies towards accident-proneness. These individuals are likely to be overly optimistic about the probability of success or they take on dangerous tasks without realistically assessing the probable consequences.

4.3.7.3.1.8 Factor I: Feeling versus thinking–contrasting modes of evaluating experience

The factor according to Cattell (1989) refers to Jung's feeling and thinking dichotomy. Factor I essentially measures or taps into the habitual tendency to respond to events, ideas and experiences, either with feeling or with thinking. Individuals scoring high on Factor I generally make evaluations based on subjective impressions and emotional reactions. As a result, these individuals produce judgments based on personal values, aesthetics, taste, and approach/avoidance tendencies. Low Factor I individuals, on the other hand, tend to be objective, often to the point of discounting or being unaware of what they are feeing. They are inclined to be more considerate of verifications, probability, and accuracy in arriving at their judgements (Cattell, 1989).

4.3.7.3.1.9 Factor L: Allienation versus identification in social orientations

According to Cattell's (1989) clinical research this factor's highest pole is very closely tied to disturbed interpersonal relationships. This factor measures the degree to which one feels identified with others, not only one's immediate family and close friends, but with the human race generally. Persons scoring high on this factor are largely missing feeling, since their sense of personal boundaries is so tightly drawn that they feel separate from other people. In contrast, low scores are usually recorded by cheerful individuals who tend to be friendly and helpful and concerned about the welfare of others. Furthermore, L- behaviour promotes good human relations and team spirit (Cattell, 1989).

4.3.7.3.1.10 Factor M: Intuiting and sensing as contrasting perceptual modes

This factor bears a strong resemblance to one of the bipolar dimensions in Jung's type theory of human temperament. Low M scores usually identify practical, logical individuals who tend to be proper, conventional and factual. They possess a high regard for order, morals and conventions. Generally, they pay strict attention to practical matters and avoid eccentricities of behaviour that might set them apart from their colleagues. Consistent alertness, caution and practical concern all contribute to low frequency of accidents. High factor M scores reflect more distinctively individualistic persons who are self-motivated and imaginatively creative. They tend to be unconventional in many matters and their individuality may generate rejection by more practical and less creative colleagues. Their apparent "absent-mindedness" is likely to be an objectively observable feature of their creative thinking (Cattell, 1989; Smit, 1983).

4.3.7.3.1.11 Factor N: Self-presentation in social situations

According to Cattell (1989) this factor represents the social mask that people use in order to cover whatever about themselves they wish to hide, and to portray, instead, an image designed to raise the kind of responses they desire from others. Respondents scoring high on this factor are inclined to keep their social masks firmly in place with most people and in most situations. Normally, they use their masks manipulatively or are very careful what they disclose towards others. By contrast, those respondents who score low on this factor are inclined to make little effort to hide their reactions. They demonstrate true transparency, although according to Cattell (1989) they may lack certain social skills and etiquette, and may be too naïve at times. In addition, Spangenberg (1967, as cited in Smit, 1983) found that low Factor N scores significantly correlate with accident proneness.

4.3.7.3.1.12 Factor O: Guilt proneness and untroubled adequacy

This factor measures feelings that people have about themselves in regard to their self-worth. Sometimes these feelings arise out of current self-judgements, but they can also goes back to earlier, even preverbal times (Cattell, 1989). Because of the difficulty experienced by Cattell (1973) to define this factor in the entire 16PF contingent, he later settled on guilt proneness. However, he emphasised that the core of this factor is not actual guilt feelings, which are only its subjective manifestations, but rather an underlying emotional self-attitude.

High O+ scores usually identify self-deprecating individuals who tend to brood and worry excessively. These persons tend to be emotionally very sensitive, to become easily discouraged and are inclined to harbour troublesome feelings of inferiority and inadequacy in meeting even the routine demands of daily life. Low O-scores, on the other hand, are usually obtained by individuals who feel emotionally secure and who routinely display confidence in coping. Such individuals tend to be free of significant feelings of inadequacy and inferiority. They tend to be cheerful and free of undue care and worry (Cattell, 1989; Smit, 1983).

4.3.7.3.1.13 Factor Q_1: Orientation towards change

This factor was originally discovered by Thurstone and Chavel through test questionnaire data collected since 1929 (Cattell, 1973). Since then, this factor has been confirmed by Guiford and Eysenck as well as by Cattell and his co-workers, in more than eight separate data analyses (Cattell, 1989). As with the other three Q-labelled primary 16 PF factors (Q_2, Q_3 and Q_4), Q_1 appears only in questionnaire data (the Q stands for questionnaire) and not in the ratings of observers. According to Cattell, Eber and Tatsuoka (1970), the core of this factor involves a psychological orientation towards change. Hence, Cattell (1989, p. 238) defines change as a "perceptual readjustment, towards a corresponding temporal phenomenon, that is mediated by emotions and motives on the part of the organism".

Persons who scored low on this factor are likely to show reluctance to leave their present and past attachments behind, preferring to stay with the familiar, and showing little interest in future innovations. In contrast, those persons high on Factor Q_1 are likely to be future-orientated and to show interest in the new and unfamiliar. They also tend to be less emotionally attached to their past than most people would be (Cattell, 1989).

4.3.7.3.1.14 Factor Q_2: Self-sufficiency (reliance on self) versus group dependency (reliance on others)

Although the lower pole of this factor is generally referred to as group dependency, Cattell (1989) prefers to name it simply dependency, because the behaviour it denotes can be directed towards a single person as well as towards a group. According to Macoby and Masters (1970) the term dependency is manifested in ways such as getting attention, seeking praise and approval, resisting separation, and asking for help. Furthermore, these behaviours express the desire to maintain contact or closeness with others.

Low scores on this factor usually identify individuals who value or require consultation with peers before making decisions and initiating action. They tend to go along with the group and they seek social approval. They are receptive to suggestions and usually avoid unconventional behaviour. High Q_2 scores usually identify decisive and resourceful individuals. They do not seek the agreement of colleagues and do not require group support in making decisions or in taking action. These are highly independent-minded individuals who are not suggestible and are not influenced greatly by public opinion. Furthermore, they are in the habit of going their own way and may tend to be reclusive, considering most social activities to be wasteful or time consuming (Cattell, 1989; Smit, 1983). However, Cattell (1989) warns that just as an extreme Q_2- (dependency) score may suggest a developmental failure, a high Q_2+ (self-sufficiency) score is not usually desirable either.

4.3.7.3.1.15 Factor Q_3: Investment in maintaining a socially approved self-image

This factor taps what Smith (1978, p. 33.) describes as "the uniquely human capacity to observe ourselves as objects in whose social and internal image we are emotionally invested, causing us to evaluate our behaviour with forethought and afterthought and conduct ourselves accordingly". Cattell (1973) labels this trait the self-sentiment and it contains two major elements namely (1) the self-concept and (2) the evaluator.

According to Cattell (1989) the self-concept is similar to what Erickson described as sense of identity. The concept originated from the recognition that one's attachments, values, and beliefs tend to endure over time. Hence, the innate human drive to reduce cognitive dissonance in regard to one's own behaviour, which leads to the shaping and organising of different self-perceptions into a coherent unity. This unity then comes to be experienced as "I" (Cattell, 1989). In addition, Rogers (1957, 1961) divided the conscious self-concept into two parts, namely the wished-for self-concept (e.g. the socially approved concept or image one would like to have) and the perceived self-concept (e.g. the views one actually has of oneself and how one is seen by others).

The evaluator (second self-sentiment component) is, according to Cattell (1989), without content; it contains no values or standards. It is a measuring stick that estimates the degree of comparison between the wished-for and the perceived self-concepts. Hence, low scores are usually recorded by those individuals who demonstrate little regard for social demands. They tend to lack social awareness and tact. High scores are usually recorded by individuals who consistently maintain a disciplined control over their behaviour. They tend to guard themselves against impulsive actions and resist temptations of the moment (Cattell, 1989; Smit, 1983).

4.3.7.3.1.16 Factor Q_4: Tense and relaxed temperaments

According to Cattell (1989) this factor measures the unpleasant sensations that accompany automatic arousal, mostly identified by most people as nervous tension or simply tension. High scores on Q_4+ represent an excess of these sensations, and low scores on Factor Q_4- represent the absence thereof. As the 16PF measures enduring characteristics the Q4+ indicates tension as a trait; therefore, the respondent is characteristically tense, volatile, and easily upset. However, it is possible that the Q4+ score could also indicate that the tension is a state, which means that the respondent is reacting to some transitory situation, and his or her score will later eventually return to its former level. According to Cattell (1989) this factor at either extreme may be achieved by motivational distortion suggesting that the items measuring this factor make distortion fairly easy. Hence she recommends that extreme high and low scores need to be verified with the client during the feedback or follow-up interview process.

4.3.7.3.2 The second-order factors: the underlying organisers of temperament

Through factor analysis of the correlations between the 16 primary factors, a number of second-order factors were identified by Cattell (1961). Only the five largest factors were included in the 16PF. These are: extraversion, anxiety, tough poise, independence, and control. These second-order factors provide the interpreter with a quick overall insight into the questionnaire-takers style. Specifically, they indicate whether the individual is, on the whole, outgoing or reserved, anxious or comfortable, primarily emotional and intuitive or unemotional, dependent or independent, and high or low on self-control (Cattell, 1989).

A brief explanation of the five second-orders are explained next.

4.3.7.3.2.1 Extraversion versus introversion

According to Cattell (1989) the factor extraversion versus introversion can be regarded as the largest second-order factor. It also relates significantly to Jung's construct as well as to Freud's subject/object polarities. According to Cattell (1989), research has indicated that most people come to prefer one of these modes in terms of their level of expressiveness and tendencies toward being either outwardly or inwardly focused. The primary factor poles contributing to extraversion and introversion are: Extraversion, Q_2- (dependency), H+ (adventurous), F+ (Enthusiastic) and A+ (warm-hearted), and Introversion Q_2+ (self-sufficiency), H- (shy), F- (sober serious), and A- (reserved) (Cattell, 1989).

4.3.7.3.2.2 High anxiety versus low anxiety

According to Cattell (1989) people do not only differ in the intensity of the discomfort they experience when presented with an external threat, they also differ in the internal harmful stimuli that they draw towards themselves, for example, in the form of tension and worry. The following six primary factors that measure the high pole of anxiety are O+ (being overwhelmed by worry, apprehension and guilt), Q4+ (physical tension), C- (being easily upset and having poor tolerance for frustration), Q3- (self-image problems), L+ (alienation and mistrust), and H- (feeling oversensitive to environmental stimuli) (Cattell, 1998; Cattell & Scheier, 1961; Rickels & Cattell, 1965). Furthermore, Cattell (1989) proposes that anxiety can be a trait and also a state. Although it is not possible to identify which of these conditions are reflected in a person's second-order anxiety score, a person's individual scores on the primary factors are likely to give some direction. When C- (lower ego strength) and Q3- (low self-sentiment) scores are prominent contributors, then it may reflect the trait anxiety, as ego strength and self-sentiment are unlikely to vary in response to changes in mood. An anxiety-provoking situation may indicate a passing reaction or state. An extremely low score on the anxiety factor may indicate lack of motivation for difficult tasks, as is generally shown in research relating anxiety to achievement (Cattell, 1989).

4.3.7.3.2.3 Tough poise versus emotionality

According to Cattell (1989) the practical value in this factor allows the test interpreter to understand how the respondent reacts to external stimuli or their problem solving approach. Research done by Hundleby, Pawlik and Cattell (1965) confirms that this factor is a stable personality characteristic rather than a passing state. Individuals who are more feeling or emotionally dependent normally score high on Factor I+ (tender-minded), M+ (absent-minded), A+ (warm-hearted), Q1+ (experimenting) and F- (sober-serious) for males, and for females Factor I+, M+, E- (humble), F-, L- (trusting) and A+. Scores on the lower end of the pole, however, suggest that people are more inclined towards approaching problems in the here and now, through objective thinking processes. Research suggests that males tend towards a conservative way of thinking and females may have a more defensive or aggressive approach (Cattell, 1989).

4.3.7.3.2.4 Independence versus agreeableness

Low scores on this pole suggest that respondents are likely to be self-determined with regard to their own thoughts and actions, where as respondents high in agreeableness suggest a temperamental willingness to submit to social control out of the need for interpersonal support, to be more group-orientated, more tolerant and happy to compromise (Cattell, 1989; Smit, 1983). The primary factors that measure the factor independence for men are E+ (dominance), H+ (venturesome), Q1+ (experimenting), L+ (suspicious), O- (self-assured), N- (forthright), G- (weaker ego strength) and Q2+

(self-sufficiency), and for woman E+, Q1+, H+, G-, Q2+ additional as for men M+ (imaginative) (Cattell, 1989).

4.3.7.3.2.5 High control versus low control

The practical value of this factor to the test interpreter is that it gives insight into how successfully the respondent is able to both inhibit impulses and persist in directing his or her behaviour along socially desirable lines (Cattell, 1989). The high control factor arises from a combination of high scores on Factor G (superego strength) and Factor Q3 (self-sentiment strength). This means that respondents are likely to base their morals and personal standards on conventional values. They generally show interest in keeping a respectable public image, persistence, steadiness, strong will-power, and conscientiousness. According to Cattell (1989, p. 320) a low control score is slightly more difficult to interpret, because of a lack of socialisation into the respondent's cultural values and beliefs. "Thus, a low-scoring respondent may or may not be without moral restraint, and may be either concerned or unconcerned about personal standards." He or she may just be open-minded to different cultures. a G- score does not necessarily indicate poor superego development, and it may be achieved by individuals who have strong but unconventional morals. On the other hand, Q3- scores normally suggest social identity problems, but may also mean that this can be achieved by individuals who are not self-centred. However, if the respondent profile also indicates C+ (ego strength) and/or F- (sober seriousness), then it may be that the individual acts rather than reacts, and exercises caution in most situations (Cattell, 1989).

4.3.7.4 The five-factor model of personality

Researchers such as Costa and McCrae (1987), Goldberg (1990) and Norman (1963, 1967) also found evidence of the same five-factor structure as proposed by Cattell (1945) and Tupes and Christal (1961). Goldberg (1990) then referred to these factors as the "Big Five" factors of personality, distinguishing them from the primary, or core, personality factors that were originally identified by Cattell. The five-factor model of personality presents a structure of personality that is best described by five global domains or factors that characterise individual differences.

According to Digman (1990), these five domains are generally referred to as Extraversion, Neuroticism, Openness to Experience, Agreeableness, and Conscientiousness. In addition, the five-factor model is not based on any single theory of personality, and factor analysis of other personality instruments have revealed similar structures to that of the Big Five (Digman, 1990; McCrae & Costa, 1989; McCrae, Costa & Piedmont, 1993; Trull, Useda, Costa & McCrae, 1995). The practical value of this model to the test interpreter is that it allows the domain of personality to be represented widely and systematically (Briggs, 1992), and provides a practical solution to the question of personality structure (Digman, 1990). McCrae and John (1992) suggest three advantages of using the five-factor model of personality namely: (1) it integrates a wide array of personality constructs, allowing researchers across different fields of study to communicate easily: (2) it is comprehensive, providing a means of studying relations between personality and other phenomena: and (3) it is efficient, as it offers at least a global description of personality. Furthermore, there is a large amount of research evidence that suggests that the model can be applied with success in different cultures (e.g. Borkenau & Ostendorf, 1990; Trull & Deary, 1997; Tsaousis, 1999).

The 5-factor model, together with the six facet scales for each factor, is commonly measured by the NEO Personality Inventory (NEO PI-R) develop by McCrae and Costa (2003). The test thus provides a broad description of personality, as well as a more in-depth analysis of the traits that make up the factors. Discussions regarding each of these factors follow next.

4.3.7.4.1 Neuroticism

According to Digman (1990) this factor is also known as Neuroticism versus Emotional Stability. The term Neuroticism was described by Freud as "neuroses", emphasising its relationship with psychopathology, but the five-factor model prefers to conceptualise its traits in terms of normal personality. In describing Neuroticism researchers normally refer to this factor as the tendency to experience negative effects such as sadness, anger, fear, distrust, embarrassment and guilt. When interpreting high scores on Neuroticism, individuals tend to be prone to irrational thoughts, are less able to control their impulses, and cope poorly with stress and pressure situations.

Individuals scoring low on this factor however are likely to be emotionally stable: calm, even-tempered and generally unflustered (Costa & McCrae, 1992a; Taylor & De Bruin, 2006).

Researchers such as Watson and Clark (1984) prefer the term "Negative Affectivity" to "Neuroticism", and refer to Negative Affectivity as a mood-dispositional dimension. Individuals that score high in Negative Affectivity are likely to have a negative view of self, and may experience a wide range of negative mood states such as nervousness, distress, tension and worry. Another characteristic of Negative Affectivity is how people feel about themselves and their world. Individual experiences of poor self-esteem related to Negative Affectivity seem to be linked with the tendency to ponder over mistakes and disappointments, while also having a high sensitivity to the minor mistakes and frustrations of daily life.

According to Costa and McCraw (1992a) the Neuroticism factor is measured on six facets, namely Anxiety, Angry Hostility, Depression, Self-Consciousness, Impulsiveness, and Vulnerability. *Anxiety* refers to the extent to which a person is fearful, prone to worry, and nervous. *Angry Hostility* relates to the tendency to be easily upset, to experience anger and bitterness, and to be emotionally volatile. *Depression* represents the person's proneness to feelings such as guilt, sadness, loneliness, and having a more pessimistic outlook on life. *Self-Consciousness* measures the degree to which a person is uncomfortable around others, mostly in social settings, or is easily embarrassed. *Impulsiveness* represents an individual's ability to control cravings and urges, and to resist temptation. *Vulnerability* specifies a person's susceptibility to stress – one's ability to cope effectively in stressful situations.

It is evident from research done by Costa and McCraw (1992a) that Neuroticism is a strong indicator of a person's affective tendencies. For the interpreter of the NEO-PI-R personality inventory, high scores suggests that individuals are likely to be influenced or controlled by their emotions, whereas low scores suggest that individuals are likely to exercise strong emotional control and management of cognitive irrationalities.

4.3.7.4.2 Extraversion

According to Watson and Clark (1997), most researchers refer to the factor Extraversion as an individual's preferred way of handling his or her environment. Here, environment relates to whether a person enjoys being around other people, likes excitement and stimulation as is cheerful in character. Extraversion is also referred to as Positive Emotionality and consists of six facets, four of which are central to the construct, and two of which are secondary. In addition, each one of the six facets is then divided into two sub-traits, which make up the lowest level of the hierarchy. The four primary facets are: Affiliation, Positive Affectivity, Energy, and Ascendance. Affiliation refers to the sociability aspect of Extraversion, and represents Warmth (warm and friendly feelings towards others) and Gregariousness (being motivated towards frequent social interaction). *Positive Affectivity* represents the tendency to feel happy, cheerful and optimistic about the future, and to be easily excited and enthusiastic about activities and events in life. *Energy* highlights two characteristics namely liveliness and activity. Liveliness reflects individual differences in levels of energy, and activity reflects living a full, busy life. *Ascendance* reflects individual differences in assertiveness and social visibility and is characterised by Exhibitionism (the degree to which a person is dramatic and entertaining) and Dominance (the degree to which a person enjoys controlling or influencing others) (Costa & McCrae, 1992a; Watson & Clark, 1997).

The secondary facets are: Venturesomeness and Ambition. *Venturesomeness* relates to the need for Change (e.g. requiring a great deal of variety, adventurousness) and Excitement Seeking (e.g. seeking out intense, stimulating environments). The two characteristics that underpin the facet *Ambition* are Achievement (e.g. the thrill of meeting challenges and mastering complex tasks) and Endurance (e.g. working long hours in order to achieve one's goals).

The interpretation of scores high in Extraversion suggests that the individual is likely to enjoy being around people, preferably in large social gatherings, as well as being assertive, active and talkative. They also tend to prefer stimulation and excitement, and people experience them as cheerful and optimistic. Although introverts tend to spend more time on their own, are reserved and independent and prefer to work at their own pace, they are not necessarily unhappy, shy, pessimistic or slow. Hence, introverted individuals are not the polar opposite of extroverts (Costa & McCrae, 1992a; Taylor & De Bruin, 2006).

4.3.7.4.3 Openness to experience

According to Costa and McCrae (1992a), individuals scoring high in Openness are inquisitive about their world, live their lives to the fullest, and engage in novel ideas and unconventional values. Individuals scoring low on Openness can be described as predictable, old-fashioned and are less inclined to challenge the status quo. Furthermore, their interest in and curiosity about the world are likely to be narrow and less intense. McCrae and John (1992) argue strongly that the factor Openness to Experience is a dimension of personality and not an intellectual ability, suggesting that individuals who score high on this factor do not necessarily have an equivalent or similar high level of intelligence.

The six facets that make up the factor Openness to Experience in the NEO PI-R are: Fantasy, Aesthetics, Feelings, Actions, Ideas, and Values (Costa & McCrae, 1992a). The facet *Fantasy* refers to the degree to which a person has an active, wide imagination; such a person may tend to be absentminded or a day-dreamer. High scores on *Aesthetics* suggest an extraordinary appreciation for art, music, poetry and beauty, without necessarily having artistic talent. Openness to *Feelings* measures the degree to which individuals experience and evaluate their emotions as an important part of their life. Individuals scoring high on Openness to *Actions* suggest a high desire to experience as many new things as possible – be it food, travel to places, or activities. Openness to *Ideas* refers to those individuals displaying a high need for intellectual curiosity and debate. Lastly, the facet *Values* refers to the extent to which an individual is willing to re-examine social, political and religious values, and prepared to challenge them (Costa & McCrae, 1992a; Taylor & De Bruin, 2006).

4.3.7.4.4 Agreeableness

According to McCrae and Costa (1989) Agreeableness refers to a person's capacity for sympathy, trust, altruism and cooperation. In support of their definition, Taylor and De Bruin (2006) define agreeableness as the degree to which an individual is able to interact with other people, and to show concern and empathy. When interpreting high scores on Agreeableness, individuals are likely to be considerate towards others, sincere, selfless, eager to assist, and to have a basic belief that others are as helpful in return. Individuals with low scores may be sceptical, manipulative, tough-minded, have a competitive nature, and be self-centred (Costa & McCrae, 1992a; Taylor & De Bruin, 2006). The six facets that measure Agreeableness according to the NEO PI-R are: Trust, Straightforwardness, Altruism, Compliance, Modesty, and Tender-mindedness (Costa & McCrae, 1992a). *Trust* refers to the degree to which people believe that others are genuinely open and honest, and see no need to question their motives. *Straightforwardness* measures an individual's level of forthrightness and authenticity. *Altruism* refers to a person's willingness and kindness to help others. The facet *Compliance* may be related to the degree to which a person defers to others, to forgive, and to contain aggression. *Modesty* relates to an individual tendency to be humble and self-effacing. *Tender-mindedness* relates to a person's attitudes of sympathy and concern for others (Costa & McCrae, 1992a; Taylor & De Bruin, 2006).

4.3.7.4.5 Conscientiousness

According to Costa and McCrae (1992a) the factor conscientiousness refers to an individual's ability to demonstrate self-control or self-discipline in the planning, organising, and execution of tasks. Digman (1990) uses conscientiousness to describe individuals who are dependable, hardworking, achievement-orientated, and persevering. In support of these definitions, Taylor and De Bruin (2006) describe conscientiousness as the degree of effectiveness and efficiency with which an individual plans, organises and executes tasks.

Individuals scoring high on conscientiousness are likely to be goal-orientated, strong-willed, and determined. Furthermore, they tend to be dependable, hardworking, achievement-orientated, and persevering. Individuals scoring low may be more relaxed and easy-going regarding the achieving of their goals and may tend to be more disorderly. They prefer to work according to their own schedule, and feel restricted by routine and repetitive tasks. The six facets that are measured by the NEO

PI-R are: Competence, Order, Dutifulness, Achievement Striving, Self-Discipline, and Deliberation (Costa & McCrae, 1992a). Competence refers to the respondent's level of personal efficacy, ability and emotional resiliency. Order refers to an individual's capacity to organise his or her lifestyle or to an individual who prefers a more structured orientation to life such as doing things in a systematic way.

Such individuals are comfortable with routine and repetitive work. The facet Dutifulness refers to an individual's ethical principles and moral obligations, and to how strongly an individual is likely to be guided by them. Achievement Striving refers to an individual's drive and willpower to meet his or her goals. Self Discipline has to do with an individual's capacity to follow through on tasks until completion, even when at times things do not work out as planned. Deliberation focuses on an individual's problem-solving approach in that the pros and cons are carefully considered before embarking on any decision. According to Costa and McCrae (1992) the facets Competence and Self-Discipline correlate negatively with Neuroticism, suggesting that emotionally unstable persons are less likely to be able to effectively complete tasks.

Researchers such as Barrick and Mount (1991), Judge, Higgins, Thoreson and Barrick (1999), and LePine, Colquitt and Erez (2000) have found that conscientiousness is positively related to performance on a variety of jobs. They argue that this factor measures those individual characteristics that demonstrate hardworking, persistence, responsibility, carefulness, personal mastering and ability to plan. Conscientiousness has been found to correlate positively with job satisfaction (Judge et al., 1999).

Arthur and Graziano (1996) found that individuals who rated themselves high on conscientiousness (based on the Five-Factor Model) were involved in fewer driving accidents. Celler et al. (2001) comment that based on previous studies, the factors conscientiousness, neuroticism, extraversion and agreeableness may be more related to accident behaviour in the workplace. The researchers confirm a significant correlation between conscientiousness and the reported total of "at fault" and "not-at-fault" accidents and to a lesser degree with agreeableness.

4.3.7.5 Evaluating the trait approach

Edwards (2008) highlights the major criticisms of the trait approach:

- The trait theory is too simplistic and it does not take into consideration other complex psychological processes of other personality paradigms.
- There is no consensus amongst trait theorists with regard to the number of personality traits forming the basis of their personality theory. Eysenck proposed three factors, Costa and McCrae five, and Cattell sixteen.
- A major concern of the trait perspective is that it tends to ignore the influence of environmental and social factors and regard personality as consistent, largely inherited and unchangeable (Hicks, 1996). According to Myers (2008) research on the lifespan of people has revealed that personality does change from infancy, although as people grow older their interests and career choices may change but their personalities stabilise.
- Mischel (1973, 1984, 2004) questions the consistency of specific behaviours in different situations and through studies of college students' conscientiousness, he argues that people do not behave with predictable consistency. Hence this inconsistency in behaviours questions the predictive validity of personality measurements. Other researchers such as Deary and Matthews (1993) and Hogan (1998) disagree with Mischel's views in that they argue that individuals' average behaviour characteristics such as happiness or outgoingness are predictive in many situations. However, the trait approach regarding personality lies in distinguishing qualities or characteristics of a person. Furthermore, traits are a readiness to think or act in a similar fashion in response to a variety of different stimuli or situations (Bergh, 2003; Robbins, 1996).

For the purpose of this study, the emphasis is on the trait theory approach and its influence on employee attitude towards work place safety. The trait theory of personality has been predominantly used in the investigation of the influence of personality or prediction thereof on work place incidents/accidents including vehicle accidents (e.g. Arthur, Jr & Graziano, 1996; Celler et al., 2001; Hansen, 1989; Jones & Wuebker, 1985; Lawton & Parker, 1998).

The influence of personality on attitude towards work place safety and work place incidents/accidents including vehicle accidents is discussed in the next section.

4.4 THE INFLUENCE OF PERSONALITY ON ATTITUDE TOWARDS WORK PLACE SAFETY AND WORK PLACE INCIDENTS/ACCIDENTS

In Chapter 2 (paragraph 2.4.4. p. 47-51) references were made to the potential influence of a variety of background factors, including personality, on an individual's beliefs and attitude towards an object, person or situation (Ajzen & Fishbein, 2005). For example, dominant (extraverted) and submissive (introverted) individuals have been found to be more responsive to individual persuaders (Blankenship et al., 1984; Moon, 2002). Specifically, the Five Factor Model of personality has been shown to influence people's political inclination (Gerber et al., 2010) and voting behaviour (Schoen & Schumann, 2007). In safety behaviour research, Jones and Wuebker (1985, 1993) and Wuebker (1986) found that locus of control may influence a person's attitude towards injuries to the extent to which an individual believes that he/she has control over external events. Yagil (2001) found in his study that sensation seeking and external locus of control are positively related to employee attitude towards work place safety. Furthermore, Henning et al. (2009) have reported that agreeableness, prevention focus, and fatalism contribute significantly to a stronger attitude towards work place safety. Mearns et al. (1998) also argues that attitudes are influenced by individual differences which include personality. It was noted that limited research exists on the influence of personality characteristics on an individual's attitude. However, a larger number of publications exist on the relationship between attitude and work place incidents/accidents, including vehicle accidents.

The study of individual differences in the propensity to experience accidents (referred to as accident-proneness) has been an important research agenda for many researchers (e.g. Groeger & Brown, 1989; Jonah, 1986; McKenna, 1983; Yagil, 1998). From the literature it appears that a number of personality constructs and measurements (e.g. locus of control, emotional stability, Type A personality, conscientiousness) have been used in the study of attitude towards work place safety, driver attitude and work place incidents (e.g. Arthur et al., 1991; Arthur, Jr & Graziano, 1996; Celler et al., 2001; Yagil, 2001).

The "freedom from accidents" profile developed by Cattell et al. (1970) has formed the basis of empirical studies on prediction of accident involvement in a number of industries. The developers used the Cattell 16 Personality Factor Questionnaire (16PF), and Cattell suggested that individuals high on factor M (abstractness) have less self-control and may not externally evaluate their driving behaviours. Other important factors such as factor C (low ego strength), measure the degree to which individuals feel a lack of control over their life and lack of foresight to make right choices. Russel and Karol (1994) found that factor E (high dominance) and F (high liveliness) could play a role in supporting greater risk, aggression and impatience in dealing with certain situations.

The Big Five Personality traits (e.g. Costa & McCrae, 1987; McCrae & Costa, 1999) have been used most often in studies to examine the relationship between personality and work place accidents, including vehicle accidents. Most recently, Clarke and Robertson (2008) performed a meta-analysis of the relationship between the Big Five traits and work place accidents. The researchers found that, except for openness, the Big Five traits were strongly related with accidents. In particular, those with high levels of openness and neuroticism, and those with low levels of agreeableness and conscientiousness, were strongly related with work place accidents. In other studies using the Big Five traits, Arthur and Graziano (1996) found that individuals who rated themselves high on conscientiousness were involved in fewer driving accidents.

In addition, Type A behaviour, sensation seeking, and extremely high levels of extraversion were found to correlate positively with risk taking or accident involvement (e.g. Beirness & Simpson, 1988; Cooper & Sutherland, 1987; Dahlback, 1991; Hansen, 1989; Shaw & Sichel, 1971; Sutherland & Cooper, 1991). According to Frone (1998), individuals with Type A behaviour are more likely to be involved in accidents because of an elevated sense of haste and time urgency. Another personality trait, locus of control, has received extensive attention in accident causation research (Neal & Griffen, 2004). Arthur et al. (1991) found that a regard for authority and locus of control exhibits moderate correlations with measures of vehicle accidents.

Thus, accident proneness or injury proneness cannot be regarded as an enduring or single personality trait that attaches to an individual, but more as a combination of factors and circumstances (e.g. intelligence, attitude, stress, etc.) (e.g. Glendon et al., 2006; Verschuur & Hurts, 2008). Celler et al. (2001) conclude that personality inventories could be very useful for assisting in the selection of individuals who are most likely to behave safely in the work place. Personality factors cannot be ignored because of problems of measurement and their vague relation with behaviour, because several studies have shown the existence of multiple relationships between personality and aspects of job performance that are relevant to safety and risk behaviour (e.g. Clarke & Robertson, 2008; Glendon et al., 2006).

It is clear from the above review that personality cannot be excluded from any study of human behaviour and its relationship with variables such as attitude towards work place safety and work place incidents/accidents, including vehicle accidents. In addition, personality traits such as extraversion, neuroticism, conscientiousness, sensation-seeking, locus of control, and Type A behaviour have consistently been found to show positive correlations with at-risk behaviour. Thus, the risk associated with working with electricity and driving long distances can therefore not be excluded from human error-related incidents and accidents.

Thus, the aim of this study is to investigate whether the personality characteristics mentioned in this section could predict a significant amount of influence on employee attitude towards work place safety in a public electricity company in South Africa. Therefore, the inclusion of personality as a predictor (independent) variable in this study is of major importance.

A brief summary of this chapter follows next.

4.5 SUMMARY

Intelligence and personality can be regarded as the most researched and theorised constructs by scientists or psychologists to understand and explain individual differences in human behaviour. In their endeavours to understand the construct personality, most researchers agree that personality can be described as individual dispositions demonstrating their unique and consistent pattern of thoughts, feelings and behaviour, and their interaction with other people and the world. The different approaches or personality theories are concerned with observing individual characteristics, understanding how these different characteristics came about, and how they are affecting the individual's quality of life. Seven major personality theories, the biological, psychodynamic, interpersonal, cognitive-behavioural, existential, phenomenological, humanistic, transpersonal, and the trait approach were discussed.

The biological approach regarding personality indicates that genetic make-up, heredity and the environment play an important role in the development of human personality. Aspects such as intelligence, introversion-extroversion, and neuroticism are areas found to be related to the biological approach. The psychodynamic theory strongly supports the view of the role of the unconscious mind as well as childhood experiences in the development of human personality. The way people use certain defence mechanisms to protect the ego from certain threats are still supported by many psychologists.

The interpersonal approach highlights the importance of how people portray their personality style or preference when interacting with others. These displayed behavioural characteristics can either build or destroy effective interpersonal relations. The behaviouristic paradigm dominated the field of psychology and supporters of this paradigm dismiss the psychodynamic approach and specifically the function of the mind in influencing human behaviour. Researchers such as Adler, Bandura, Rotter and Beck (e.g. Edwards, 2008; Myers, 2008) contributed significantly towards the development of the cognitive-behavioural approach regarding personality. A positive aspect of the cognitive-behavioural approach is assisting clients to confront irrational thoughts and feelings towards achieving behavioural change goals.

The existential, phenomenological and humanistic approaches disregard the scientific approach to personality, and rather emphasise the importance of people's search for meaning and purpose, suggesting that human beings possess the capacity to consciously shape their own destiny. A fundamental belief of the humanistic approach is that when people experience their self-concept as positive, they tend to behave and perceive the world positively. Next, the transpersonal approach according to Jung posits that humans can grow beyond their past and that individuals have the capacity to constantly develop, grow and move toward a more fulfilled and balanced level of self-actualisation.

The trait approach of personality, which, unlike the other eight personality theories (the biological, psychodynamic, interpersonal, cognitive-behavioural, existential, phenomenological, humanistic and transpersonal approaches), was more concerned with describing personality or traits by means of words. Through complex factors and other statistical analyses Cattell and others identified two main types of personality traits, namely surface and source traits. This led to the development of personality questionnaires such as the Sixteen Personality Factor Questionnaire (16PF) and later the Five-Factor Model of personality measured by the NEO Personality Inventory (NEO PI-R).

Of all the mentioned personality approaches or theories derived from personal experiences, case studies or patient-client records, the trait theorists paved the way for the actual measuring of personality or behavioural attributes. This is evident in most studies investigating the influence of personality on attitudes and work place incidents/accidents including vehicle accidents.

4.6 CONCLUSION

It can be concluded that personality, especially the trait approach to personality, plays an important role in any form of behavioural research. Furthermore, various personality characteristics have been associated with the individual's attitude towards safety, but more specifically with workplace incidents/accidents and vehicle accidents. Therefore it is of the utmost importance for this study that a measuring instrument be selected that is reliable and valid in measuring personality, and which also has the potential to predict a positive or negative influence on employees' attitudes towards work place safety in a public electricity company in South Africa.

In the next chapter (Chapter 5), the construct work wellness is explained.

CHAPTER 5

WORK WELLNESS

5.1 INTRODUCTION

The previous two chapters focused on intelligence and personality as stable individual dispositions or unique individual characteristics that drive behaviour. This chapter focuses on work wellness as an important temporary state that is likely to influence employee attitude towards work place safety and work place incidents/accidents. Especially, stress tolerance (one of the safety attitudinal scales used in this study) appears to be related to a number of work behaviours that have implications for employee's attitude towards work place safety and the occurrences of work place incidents/accidents, including vehicle accidents. Thus, both trait factors (intelligence and personality) and state factors (employee work wellness) are likely to be important psychological variables contributing to or influencing the employee's ability to execute tasks safely at work. Therefore, the inclusion of the construct work wellness in this study as a significant predictor of influencing employee's attitude towards work place safety in a public electricity company in South Africa.

The meaning and nature of work wellness and the different approaches specific to this study is explained. Thereafter, two models of wellness at work, namely a taxonomy of wellness at work developed by Schaufeli and Bakker (2001), and the comprehensive burnout and work engagement model (COBE) developed by Schaufeli and Bakker (2004) are presented. In addition, two approaches of work wellness, the pathogenic and salutogenic/fortogenic paradigms are introduced. The construct burnout is discussed under the pathogenic paradigm whereas work engagement and sense of coherence falls under the salutogenic/fortogenic paradigm. Thereafter, the relationship between the work wellness constructs (burnout, work engagement, and sense of coherence) and attitude towards work place safety and work place incidents/accidents are explained.

In conclusion, a brief summary of the chapter follows, as well as conclusions regarding the implications of the content of the chapter for the empirical part of the study.

5.2 THE MEANING AND NATURE OF WORK WELLNESS

According to Pelletier (1996), wellness is an active process of becoming aware of and making choices toward a more successful existence. This researcher further argues that wellness is a state of emotional, occupational, mental, physical, social and spiritual well-being that enables people to reach and maintain their full potential. Hornby (2006, p. 1672) defines wellness as a "state of being healthy". The author further explains that the term healthy means to experience good health and not likely to become ill or sick. According to Emmet (1991), people's basic understanding of the meaning of health is the absence of disease.

The World Health Organisation (WHO) defines health as a state of complete physical, mental, and social well-being and not simply the absence of disease or illness (World Health Organisation, 1998, as cited in Danna & Griffin, 1999, p. 361). In addition, Bircher (2005, pp. 335-341) defines health as "a dynamic state of well-being characterized by a physical and mental potential, which satisfies the demands of life commensurate with age, culture, and personal responsibility", while Saracchi (1997, pp. 1409-1410) defines health as "a condition of well being, free of disease or infirmity, and a basic and universal human right". In support of Bircher's view, Hornby (2006, p. 690) defines health as a "condition of a person's body or mind or a "state of being physically and mentally healthy". In addition, Hornby (2006, p. 1672) explains that well-being refers to general health and happiness which includes emotional, physical and psychological well-being. Expanding on the World Health Organisation's definition of health and the general public understanding of well-being, the concept of wellness may be defined as an active process of becoming aware of and making conscious choices toward a more holistic approach towards life. It reflects how people feel about various aspects of their lives.

When defined as the absence of disease, health is likely to be measured and assessed objectively. For example, a physical examination and the results of laboratory testing enable a physician to determine that a patient is free of disease and therefore healthy. In comparison, well-being and psychological strength are subjective qualities and are more difficult to measure. In most cases, the determination of well-being and psychological strength depends on self-assessment and self-report (Edlin, Golanty & Brown, 2000). Furthermore, it is not necessarily essential that individuals satisfy the traditional definition of good health to rate themselves highly in terms of wellness. For example, many people with chronic diseases (such as ongoing or long-term conditions such as diabetes, heart disease or asthma) or disabilities report high levels of satisfaction on each of the six dimensions of wellness (e.g. emotional wellness, intellectual wellness, occupational wellness, physical wellness, social wellness and spiritual wellness). Similarly, people in good health may not necessarily give themselves high scores in all six aspects of wellness (Edlin, Golanty & Brown, 2000).

The next question that comes to mind is how the concepts wellness, health and well-being can be conceptualised within an organisational context. Research on these concepts (e.g. Antonovsky, 1979; Cooper & Cartwright, 1994; Rothmann, Jackson & Kruger, 2003; Schaufeli, 2003; Strümpfer, 1990) was directed towards a pathogenic paradigm, e.g. an orientation as to why people become ill, and a more contemporary view namely the salutogenic/fortogenic paradigm, e.g. towards positive health and wellness at work. A discussion on these two wellness paradigms follows.

5.2.1 Paradigms of work wellness

An individual's experiences at work, be they physical, emotional, mental, or social in nature, are likely to affect the employee in the work place. These experiences can be either negative or positive, and the employee does not leave them at work at the end of a working day or shift: they spill over into non-work domains (Conrad, 1988a).

Furthermore, according to Schaufeli and Bakker (2001) and Turner, Barling and Zacharatos (2002), work could contribute to illness as well as to health. Hence, a person's work and personal life are not separate domains, but are interrelated and intertwined. In support of this statement, Cooper and Cartwright (1994) argue that work-related stress combined with the stress from everyday life could lead to negative physical and emotional outcomes because of the physical strain, as well as to mental demands affecting the human body and mind.

The concern for employee health and wellness is receiving a more focused approach from management because of the growing awareness of other elements in the work place that pose risks for employees. These elements include health and safety practices (Patterson, 1997; Rothmann, 2006), work place ergonomics (Hoke, 1997), increases in work place aggression (Neuman & Baron, 1997; O'Leary-Kelly, Griffin & Glew, 1996), sexual harassment (Martell & Sullivan, 1994) and other forms of dysfunctional behaviour (Griffen, O'Leary-Kelly & Collins, 1998). In addition, the working relationship between managers and their subordinates has been implicated in health and work wellness research (e.g. Blanchard, 1993; Cooper & Cartwright, 1994; Hornstein, 1996) and in the display of Type A behavioural tendencies in supervisors and managers (Ganster, Schaubroeck, Sime & Mayes, 1990).

The consequences for employee health and wellness can affect both employees and organisations in negative ways. Employees may for example become less productive, their decision-making abilities may be influenced, there may be increases in absenteeism from work and work place incidents, and medical or health insurance costs may escalate (Danna & Griffin, 1999). Furthermore, family and marital problems (Maslach & Jackson, 1986), dysfunctional leadership behaviours (DuBrin, 1990), negative job attitudes, poor organisational commitment, intention to resign, a sense of failure, fatigue, and impaired organisational behaviour (Schaufeli, 2003; Schaufeli & Enzmann, 1998; Storm & Rothmann, 2003a) have been reported. In addition, Sparks, Faragher and Cooper (2001) report that perception of job insecurity, work hours, control at work, and managerial style could also have an impact on employee wellness at work. On the positive side, Cavanaugh, Boswell, Roehling, and Boudreau (2000) find that work demands perceived as a challenge have positive outcomes for employee wellness at work.

Traditionally, research in the field of Occupational Health Psychology focused on the pathogenic paradigm, e.g. an orientation towards the abnormal, with the fundamental question being "Why do people fall ill?" (Strümpfer, 1990). Contemporary research in Occupational Health Psychology, however, has turned researchers' energy towards positive psychology, e.g. "what can go right?" (Ryan & Deci, 2000; Seligman & Csikszentmihalyi, 2000; Strümpfer, 2002). The tendency to focus mainly on negative implications did not escape researchers within the industrial and organisational psychology domain. Negative aspects that have been cited in the literature are burnout, stress, violations of psychological contracts, job insecurity and organisational downsizing (Turner, Barling & Zacharatos, 2002). Positive concepts such as job satisfaction, organisational commitment, organisational citizenship behaviour and intrinsic motivation, on the other hand, are receiving more attention within the industrial and organisation psychology field (Schaufeli & Bakker, 2001).

The concept of positive health and the enhancement of psychological wellness were termed salutogenesis (Antonovsky, 1979) and fortigenesis (Strümpfer, 1995; Wissing & Van Eeden, 1997). In the context of work wellness, the functioning of the two wellness paradigms, pathogenic and salutogenic/fortigenic, are explained in more depth.

5.2.1.1 Pathogenic paradigm

The pathogenic paradigm focuses mainly on those factors that explain why people become ill (e.g. anger, stress, depression, anxiety and many others) and attempt to come up with remedies for treating and preventing diseases or dysfunctional behaviours. Studies investigating the concept of work wellness directed their attention towards the understanding (e.g. causes, symptoms and effects) of work place stress (e.g. Cooper & Cartwright, 1994; Cooper & Marshall, 1978; Ganster & Schaubroeck, 1991; Karasek & Theorell, 1990; Rothmann, Jackson & Kruger, 2003; Selye, 1956; Sutherland & Cooper, 1990). Quick, Horn, and Quick (1986) and Sutherland and Cooper (1990), for example, found that work place stress can cause behavioural, medical, and psychological problems. The immediate and most overt signs of stress reveal themselves through behavioural changes and include: (1) greater alcohol and drug abuse: (2) increased cigarette smoking: (3) accident proneness: and (4) violence. The psychological effects include: (1) family problems: (2) sleep disorders: (3) sexual dysfunctions: and (4) depression. This downward spiral tends to influence employees' health status and ends up in the hastening of the appearance of diseases and worsening the impact of illness.

The manner in which individuals respond (e.g. adapt to or cope with) to these stressors also received a great deal of attention (e.g. Friedman & Rosenman, 1974; Matheny, Aycock, Pugh, Curlette & Silvia-Cannella, 1986; Rice, 1992; Selye, 1956;, Storm & Rothmann, 2003a; Wiese, Rothmann & Storm, 2003). Rice (1992), for example, introduced coping strategies by drawing a distinction between preventative or passive and combative or active coping styles. Passive or preventative coping strategies include: (1) avoiding the stressor altogether: (2) adjusting demand levels against the individual's resources: (3) altering stress-inducing behaviour patterns: and (4) developing coping resources (e.g. better nutrition and more exercise, building self-esteem and self-confidence, changing beliefs and attitudes about stressors, etc.).

Active coping strategies, on the other hand, include: (1) self-monitoring of stress levels: (2) effective planning of resources: (3) dealing with your stressors actively: (4) stress tolerance: and (5) lowering arousal (e.g. relaxation techniques). In addition, Rice (1992) argues that avoidance or withdrawal and escape through self-medication are ineffective coping methods, which can increase the negative effects of stress. Furthermore, the effect of prolonged induced stress and an individual's inability to cope effectively with stressors has received much attention from researchers (e.g. Levert, Lucas & Ortlepp, 2000; Maslach & Jackson, 1981; Rothmann, 2004; Selye, 1983).

According to Selye (1983), once an individual fails to continue resisting the stressor, his or her coping resources become depleted and he or she enters a stage of exhaustion or collapse, which is generally referred to as distress – the unpleasant or unhealthy form of stress. Likewise, Maslach and Jackson (1981) argue that employees could experience burnout because of regular and ongoing exposure to stressful conditions at work. This phenomenon, namely burnout, is explained in more detail in section 5.3.1.

Spielberger and Vagg (1999) argue that in order to conceptualise job stress one needs to do a proper evaluation of the specific aspects of one's job that produce job strain. Such stressors include work overload (Corrigan, Holmes, Luchins, Buican, Basit & Parks, 1994; Landsbergis, 1988), poor collegial support (Golembiewski & Munzenrider, 1988), role conflict and role ambiguity (Miller, Ellis, Zook & Lyles, 1990), and lack of participation in decision-making. Organisational factors that have been cited as contributing to employee experiences of burnout are leadership behaviour and supervisory support (e.g. Beehr & Gupta, 1987; Dolbier, Sonderstrom & Steinhardt, 2001; Parry, 1998; Spannenberg, 2004), job design (e.g. Schabracq, 2003; Turner, Barling & Zacharatos, 2002); skills variety, task identity, task significance, autonomy, job performance feedback, interpersonal relations (e.g. Hackman & Oldham, 1980; Mullins, 1999), and job demands and job resources (e.g. Demerouti, Bakker, Nachreiner & Schaufeli, 2001b; Jones & Fletcher, 1996; Maslach, Jackson & Leiter, 1996).

5.2.1.2 Salutogenic paradigm

The traditional approach of work place research focused on the negative aspects of those factors contributing to an unhealthy work place. Modern research on employee work wellness, however, focuses on the positive aspects of health and wellness, namely the salutogenic (Latin salus = health, Greek genesis = origin) and fortigenic (Latin fortis = strong) perspectives (e.g. Antonovsky, 1979; Schaufeli & Bakker, 2001; Seligman & Csikszentmihalyi, 2000; Snyder & Lopez, 2002; Strümpher, 1995; Rayn & Deci, 2000). Seligman and Csikszentmihalyi (2000) and Sheldon and King (2001) (as cited in Breed, Cilliers and Visser, 2006, p. 74), define positive psychology as the "scientific study of ordinary, positive, subjective human strengths, virtues, experiences and functioning". The construct salutogenic thinking explains the extent to which an individual is able to cope with stressful circumstances which facilitates more optimal performance, whereas fortigenes focuses on the nature, manifestations and different ways to enhance psychological wellness (Aspinwall & Staudinger, 2003; Strümpher, 1995; Wissing & Van Eeden, 1997).

From a positive psychology perspective researchers such as Antonovsky (1979), Schaufeli and Bakker (2001), Seligman and Csikszentmihalyi (2000), Snyder and Lopez (2002), Strümpher (1995), and Rayn and Deci (2000) identify new psychology constructs emphasising personality growth, wellness and optimal psychological functioning. Some of these behavioural constructs include self-actualisation, sense of coherence, hardiness, potency, self-efficacy, learned resourcefulness, internal locus of control, resilience, emotional intelligence, work engagement and many more.

These constructs are likely to focus more on positive concepts or outcomes such as job satisfaction, organisational commitment, job involvement, empowerment, organisational change, organisational citizenship behaviour and intrinsic motivation (e.g. Breed, Cilliers & Visser, 2006; Cilliers & Kossuth, 2002; 2004; Lochner, 2000; Rothmann, 2003; Strümpfer, 1998). Wissing and Van Eeden (1997) identify a general psychological wellness factor, describing it as a combination of specific qualities, such as a sense of coherence, satisfaction with life, affect balance, and a general attitude of optimism or positive life orientation. A core characteristic of general wellness includes having an interest in the world and the motivation to perform activities on a behavioural level. They tend to experience the demands of life to be challenges rather than insurmountable problems.

Breed et al. (2006, pp. 74-87) investigated the possibility of a salutogenic factor by including the six salutogenic strengths (as suggested by Strümpfer, 1990), sense of coherence, hardiness, learned resourcefulness, potency, internal locus of control, and self-efficacy, in a single study. The researchers found no evidence of a factor structure for these six salutogenic constructs between White and Other population groups. However, their research indicated a mutual salutogenic functioning behaviour amongst the two population groups, namely an optimistic view of life and the experience of life situations as meaningful. They concluded that the construct salutogenic functioning manifests differently between the different cultural and language groups in South Africa. Although the six constructs showed acceptable internal consistency reliability, the researchers proposed that more research is needed to understand the inconsistent relationship between the theoretical basis of these constructs and its operationalisation, also amongst diverse population groups.

It is clear from the above that wellness can be explained or approached from two opposite paradigms, namely the traditional pathogenic paradigm, e.g. an orientation towards the abnormal, with the essential view on why people fall ill (Strümpher, 1990) and the more humanistic, positive psychology orientation, the fortigenic paradigm, e.g. focusing on the origins, nature, manifestations, and ways to promote psychological wellness (e.g. Maslach, Schaufeli & Leiter, 2001; Seligman & Csikszentmihalyi, 2000; Strümpher, 1995; Wissing & Van Eeden, 1997). Researchers such as Schaufeli and Bakker (2001) take these two paradigms one step further by incorporating them into a model of wellness at work. Hence, for the purpose of this study, the focus is on a model of wellness at work developed by Schaufeli and Bakker (2001), which incorporates burnout as a pathogenic construct, work engagement as a salutogenic construct (Maslach, Schaufeli & Leiter, 2001), and sense of coherence as a mediating fortogenic construct (Rothmann, 2003; Rothmann, 2006; Van Der Linde & Coetzer, 2004).

5.3 A MODEL OF WELLNESS AT WORK

Schaufeli and Bakker (2001, 2004) argue that burnout and engagement are indicators of employee wellness. After in-depth analysis of the two wellness constructs, the researchers proposed a model according to which the primary burnout and engagement scales were combined into a taxonomy of well-being at work. In a South African context, the proposed model was supported by researchers such as Rothmann (2006) and Rothmann and Joubert (2007), who argue that burnout and engagement can be integrated as one model explaining employee work wellness.

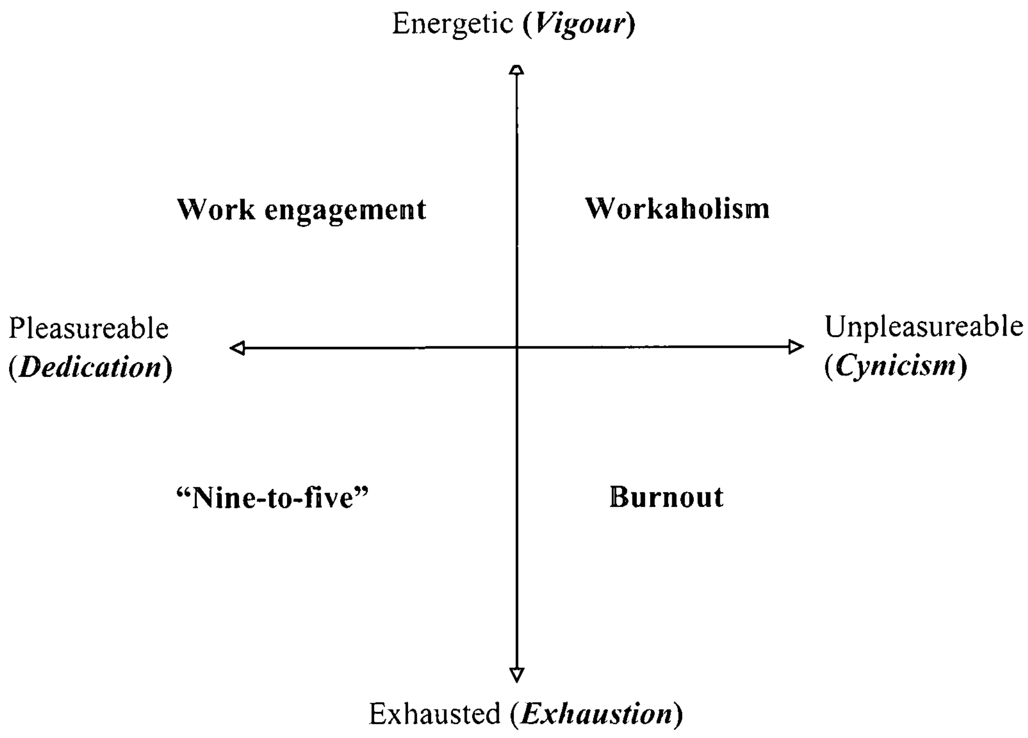


Figure 5.1 A taxonomy of wellness at work (as cited in Rothmann, 2003, p. 17)

Schaufeli and Bakker (2001) developed a model of wellness at work, which makes it possible to focus on burnout and work engagement. The model is illustrated in Figure 5.1. The researchers argue that four types of wellness at work can be identified between two axes. According to Schaufeli and Bakker (2001), the horizontal axis represents the extent of pleasure at work (e.g. pleasure versus unpleasurable), while the vertical axis represents the mobilisation of energy. This model makes it possible to distinguish between work engagement and burnout, and also between workaholism and a type of work known as "nine-to-five".

According to Schaufeli (2003) and Schaufeli and Bakker (2004), burnout and work engagement are indicators of the wellness of people in the work place and may therefore be combined in a model of wellness at work. The researchers refined their model by labelling the horizontal axis *identification with work* (varying from dedication to cynicism) and the vertical axis *mobilisation of energy* (varying from vigour to exhaustion). The concepts burnout and work engagement are seen as independent states that are negatively, but not perfectly, related (Demerouti, Bakker, De Jonge, Janssen & Schaufeli, 2001b; Schaufeli & Bakker, 2004; Schaufeli, Salanova, González-Romá & Bakker, 2002b).

In addition, González-Romá, Schaufeli, Bakker and Lloret (2006) find that the core burnout (exhaustion and cynicism) and work engagement (vigour and dedication) dimensions can be regarded as opposites of each other along two distinct bipolar dimensions labelled energy (e.g. mobilisation or activation of energy) and identification (extent of pleasure at work). The positioning of these dimensions on the model (see Figure 5.1) proposes that the activation dimension is connected by exhaustion and vigour and the pleasure dimension is connected by cynicism and dedication (Schaufeli & Bakker, 2001).

According to Schaufeli and Bakker (2001), individuals who score highly on the energy (vigour) and motivation/pleasureable (dedication) axis experience work engagement, and those scoring highly on the exhaustion and unpleasurable (cynicism) axis experience burnout. Individuals who score highly on the energetic (vigour) and highly on the unpleasurable (cynicism) axis experience workaholism or over-commitment; those scoring highly on exhaustion and on the motivation/pleasureable (dedication) axis experience a type of work phenomenon called "nine-to-five" or job distraction.

Briefly, workaholism refers to a characteristic of people who choose to spend most of their time on work activities; they are excessively hard workers. It implies that the employee is experiencing high levels of energy, but that he/she does not necessarily experience work as pleasurable and meaningful. On the other hand, "nine-to-five" employees identify themselves strongly with their work, but feel emotionally drained (low energy levels) because of high job demands and a lack of job resources. Hence, a person's work wellness profile can be determined via all four quadrants.

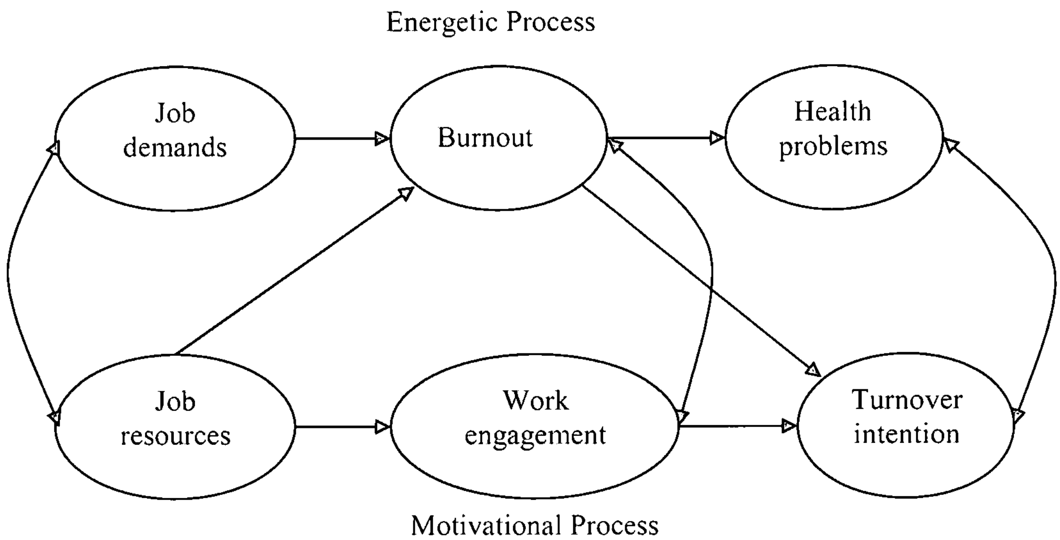


Figure 5.2 The Comprehensive Burnout and Engagement (COBE) model (as cited in Schaufeli & Bakker, 2004, p. 297)

More recently, the Job Demand-Resources (JD-R) model developed by Demerouti, Bakker, Nachreiner and Schaufeli (2001b) and the Comprehensive Burnout and Engagement (COBE) model (see Figure 5.2) by Schaufeli and Bakker (2004) are extensively used in research highlighting those indicators causing burnout and work engagement as well as the result or consequences of both of these constructs (burnout and work engagement). According to the JD-R model, job demands (e.g. physical demands, time pressure, shift work, role ambiguity, role conflict, stressful events and heavy workload), are associated with exhaustion. Job resources (e.g. supervisory and collegial social support, job empowerment opportunities in the form of increased control and autonomy, participation in decision-making and recognition) are associated with work engagement (e.g. Demerouti et al., 2001b; Levert et al., 2000; Rothmann, 2002).

According to Schaufeli and Bakker (2004) the COBE model proposes two psychological processes, namely an energetic and a motivational process. The energetic process refers to wearing out, suggesting that high job demands exhaust the employee's energy. The motivational process refers to a state of mental withdrawal, suggesting that because of a lack of resources the employee struggles to effectively deal with his/her job demands. The energetic process connects job demands with health problems via burnout. The motivational process connects job resources via engagement with organisational outcomes. In addition, job resources are likely to act either in an intrinsic motivational role (enhancing employee's growth, learning and development), or in an extrinsic motivational role (committed to achieving work goals).

However, research done by Maslach, Schaufeli and Leiter (2001) has found that the absence of job resources demonstrates strong correlation between lack of social support, predominant lack of supervisory support compared to collegial support, and burnout. The researchers also found correlations between lack of feedback and all three dimensions of burnout as well as lack of autonomy and burnout. It seems that employees who receive no or little support from their manager or supervisor and who enjoy little participation in decision-making seem to experience higher levels of burnout (Maslach et al., 2001; Rothmann & Joubert, 2007; Schaufeli & Bakker, 2004).

Hence, for the purpose of this study the focus is on the processes that contextualise burnout (exhaustion and cynicism), work engagement (vigour and dedication), and sense of coherence as determinants of employee work wellness (Schaufeli & Bakker, 2004; Rothmann et al. (2005).

5.3.1 Burnout

Burnout is a metaphor that is commonly used to describe a state or process of mental exhaustion (Schaufeli & Enzmann, 1998). The concept of burnout was popularised by

Freudenberger (1989) within psychoanalysis and by Maslach (1982a; 1982b) and Pines, Aronson and Kafry (1981) from a social psychology and empirical framework (Farber, 1983). According to Schaufeli and Enzmann (1998), burnout can be defined as a persistent, negative, work-related state of mind (or syndrome) developing over time in so-called "normal" individuals, characterised by an array of physical, psychological and attitudinal symptoms, primarily exhaustion, and accompanied by distress, a sense of reduced effectiveness, decreased motivation and the development of dysfunctional personal and societal attitudes and behaviours at work.

This psychological condition develops gradually and may remain unnoticed for a long time by the individual involved. Stress in itself is not to be confused with burnout (Maslach, 1982a; Pines et al., 1981; Schaufeli & Enzmann, 1998). Burnout can be regarded as a particular type of prolonged job stress, the final step in a progression of unsuccessful attempts to cope with a variety of negative stress conditions. Burnout also differs from depression (Maslach & Jackson, 1984), which refers to the individual's symptoms across all life situations, and is regarded as job-related (Cilliers, 2002). Burnout is a process initiated by extremely intensive and long-term stress and tension in the working environment (Schaufeli & Buunk, 1992).

Burnout is a syndrome that consists of three essential dimensions (e.g. Maslach, 1982a; Maslach & Jackson, 1986; Maslach, Jackson & Leiter, 1996):

- **Exhaustion**: this refers to the depletion or draining of emotional resources and feelings of being overextended. It is accompanied by distress, a sense of reduced effectiveness, decreased motivation, and the development of dysfunctional attitudes and behaviours at work.
- **Cynicism (or depersonalisation)**: this refers to the mental distancing or interpersonal dimensions of burnout and results in a negative, callous or excessively detached response to various aspects of the job. Here, the concept focuses on the crisis in one's relationship with work in general and not necessarily as a crisis in one's relationship with people at work.
- **Reduced professional efficacy (or personal accomplishment)**: this refers to the belief that one is no longer effective in fulfilling one's job responsibilities.

In a study done by Green, Walkey and Taylor (1991), the researchers argue that exhaustion and cynicism can be regarded as the core elements of burnout, because of the relatively low correlation between these two concepts (exhaustion and cynicism) and professional efficacy. In support of their argument, Lee and Ashforth (1996) and Schaufeli and Bakker (2001) also find strong evidence of a two-factor structure of burnout consisting of exhaustion and cynicism. Furthermore, Schaufeli et al. (2002) and Schaufeli and Bakker (2004) discovered that professional efficacy correlates positively with the work engagement variables vigour, dedication and absorption, suggesting that professional efficacy loads on the "wrong" factor and does not relate to the essence of the burnout syndrome. The consequences of burnout are potentially serious for employees and for the customers (internal and external) with whom they interact. Maslach and Jackson (1986) state that burnout could lead to deterioration in the quality of service that is provided by employees. It appears to be a factor in job turnover, absenteeism, and low morale. Furthermore, it correlates with various self-reported indices of personal dysfunction, increased use of alcohol and drugs, and marital and family problems (Maslach & Jackson, 1986).

Organisational factors that contribute to burnout are stress because of work overload (Corrigan et al., 1994; Landsbergis, 1988), poor collegial support (Golembiewski & Munzenrider, 1988), role conflict and role ambiguity (Miller, Ellis, Zook & Lyles, 1990) and lack of feedback (participation in decision-making and autonomy). According to Schaufeli and Enzmann (1998), work-related attitudes and high (unrealistic) expectations are also related to burnout.

5.3.2 Work engagement

After a great deal of criticism received against research in the psychology field for directing most of the energy towards studying mental illness, contemporary researchers in psychology are starting to investigate those factors that enhance mental "wellness." in an attempt to gain a better understanding of the meaning and experiences of working (Turner, Barling & Zacharatos, 2002). From a positive psychology perspective, work engagement is defined as a positive, fulfilling, affective-motivational state of work-related well-being, suggesting that engaged employees experience high levels of energy, are enthusiastic about their work, and are often mentally focused in their job, not realising that time flies (Macey & Schneider, 2008; May, Gilson & Harter, 2004; Schaufeli & Bakker, 2004).

Work engagement can also be regarded as the antidote to job burnout. According to Maslach and Leiter (1997), work engagement is characterised by energy, involvement and efficacy, which are considered the direct opposites of the three burnout concepts, namely exhaustion, cynicism and reduced professional efficacy respectively. Therefore, they also measure work engagement by the opposite pattern of scores on the three Maslach Burnout Inventory (MBI) dimensions – low scores on exhaustion and cynicism, and high scores on efficacy are indicative for engagement.

Schaufeli et al. (2002) partly agree with Maslach and Leiter's (1997) explanation, but take a different perspective and propose that work engagement needs to be defined and operationalised in its own right. They further argue that burnout and work engagement are opposite concepts that should be measured independently with different instruments. Furthermore, they propose that burnout and work engagement may be considered two prototypes of employee wellness that are part of a more comprehensive taxonomy (see Figure 5.1) constituted by the two independent dimensions of pleasure and activation (Schaufeli & Bakker, 2001). Activation ranges from exhaustion to vigour, while identification ranges from cynicism to dedication. According to this framework, burnout is characterised by a combination of exhaustion (low activation/energy) and cynicism (low identification/pleasure), whereas engagement is characterised by vigour (high activation/energy) and dedication (high identification/pleasure).

Work engagement refers to a more persistent and pervasive affective-cognitive state that is not focused on any particular object, event, individual or behaviour. Work engagement consists of the following dimensions (Schaufeli et al., 2002):

- **Vigour** is characterised by high levels of energy and mental resilience while working, including the willingness to invest effort in one's work, not being easily fatigued, and persistence even in the face of difficulties.

- **Dedication** is characterised by deriving a sense of significance from one's work, by feeling enthusiastic and proud about one's job, and by feeling inspired and challenged by it.
- **Absorption** is characterised by being totally and happily immersed in one's work and having difficulties detaching oneself from it. Time passes quickly and one forgets everything else that is around.

Work engagement is also distinct from other established constructs in organisational psychology, such as organisational commitment, workaholism, job satisfaction or job involvement (Maslach, Schaufeli & Leiter, 2001). *Organisational commitment* refers to an employee's allegiance to the organisation that provides employment. The focus is on the organisation, where work engagement focuses on the work itself. *Workaholism* refers to those people who choose to spend most of their time on work activities; they are excessively hard workers. Furthermore, these types of workers are reluctant to disengage themselves from their work and they persistently and frequently think about work when they are not at work.

In contrast to workaholics, engaged workers lack the typical compulsive drive. Engaged workers experience work as fun and they work hard because they like it (Schaufeli et al., 2001; Schaufeli, Taris & Bakker, 2006; Scott, Moore & Miceli, 1997). *Job satisfaction* is the extent to which work is a source of need fulfilment and contentment, or a means of freeing employees from hassles or things causing dissatisfaction; it does not encompass the person's relationship with the work itself. *Job involvement* is similar to the involvement aspect of engagement with work, but does not include the energy and effectiveness dimensions (Maslach et al., 2001).

Lastly, work engagement (especially absorption) comes close to what has been called "flow", a term used by Csikszentmihalyi (1990) that represents a state of optimal experience that is characterised by focused attention, a clear mind and body unison, effortless concentration, complete control, loss of self-consciousness, distortion of time and intrinsic enjoyment. However, flow is a more complex concept that includes many aspects and refers to rather particular, short-term "peak" experiences instead of a more pervasive and persistent state of mind, as is the case with work engagement

(Schaufeli & Bakker, 2004).

Upon further investigation of the energetic and identification/activation process (see Figure 5.1), Shaufeli and Bakker (2004) find that out of the three work engagement constructs, vigour, dedication and absorption, as well as the professional efficacy scale of the burnout factor, vigour and dedication correlate significantly with one another compared to correlations with absorption and professional efficacy. Furthermore, vigour and dedication are logically related to burnout, namely vigour (exhaustion) and dedication (cynicism). It appears that absorption and professional efficacy are less related than the other dimensions, but both dimensions could also be viewed as elements of work engagement (Schaufeli & Bakker, 2001; 2004).

Factors that are likely to increase employee's work engagement are career development, identification with the organisation and a rewarding work environment (Roberts & Davenport, 2002). From a fortigenic paradigm (Strümpfer, 1995), certain psychological strengths have been cited in the literature to enhance work engagement. These strengths include a sense of coherence (Antonovsky, 1987), self-efficacy (Bandura, 1977), an internal locus of control (Rotter, 1966), optimism (Carver & Scheier, 2002) and life satisfaction (Diener, Lucas & Oishi, 2002).

Other constructs from a positive psychology perspective that may have a moderating/mediating effect on occupational stress, burnout and work engagement are: resilience (Masten & Reed, 2002), flow (Nakamura & Csikszentmihalyi, 2002), positive affectivity (Watson, 2002), coping strategies (Stanton, Parsa & Austenfeld, 2002), and emotional intelligence (Salovey, Mayer & Caruso, 2002). However, Rothmann (2003) argues that more research is needed to understand the effects of these constructs in the work situation and also the outcome of interventions directed at building psychological strengths.

According to the COBE model of Schaufeli and Bakker (2004), job resources such as supervisory and collegial support, job empowerment opportunities, participation in decision-making, job security and recognition are likely to increase individual's levels of work motivation. Likewise, the concept sense of coherence (Antonovsky, 1979) has been widely researched and found to correlate significantly with distress (e.g.

burnout) and eustress (work engagement) (e.g. Rothmann, 2006; Rothmann, Jackson & Kruger, 2003; Rothmann, Steyn & Mostert, 2005; Van Der Linde & Coetzer, 2004). Hence, for the purpose of this study the construct sense of coherence is included alongside job resources as a personal resource in the motivational process enhancing one's experiences of work engagement.

5.3.3 Sense of coherence

In 1979, the medical sociologist Aaron Antonovsky wrote that despite being bombarded by multiple stressors in everyday living and undergoing severe traumatic experiences, there are individuals who are coping quite well and staying healthy. Salutogenesis is a concept shaped by Antonovsky (1979) to emphasise the focus on health rather than on disease (e.g. pathogenesis) (Heim, 1994). Sense of coherence was introduced as a key concept of psychological strength (e.g. salutogenesis) (Antonovsky, 1979). Sense of coherence is defined as "a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that one's internal and external environments are predictable and that there is a high probability that things will work out as well as can reasonably be expected" (Antonovsky, 1987, p. 132).

Hence, a person's sense of coherence is likely to be an important component for one's health and well-being (Antonovsky, 1987, 1993; Bengtsson-Tops & Hansson, 2001; Strang & Strang, 2001). Each person's sense of coherence, or sense of well-being, requires certain inherent prerequisites for coping successfully, which are represented by the concepts; comprehensibility, manageability and meaningfulness (Antonovsky, 1987).

- **Comprehensibility:** refers to the extent to which a person finds or structures his or her world to be understandable, meaningful, orderly and consistent instead of chaotic, random and unpredictable. The person perceives their world as comprehensible and making sense on a cognitive level.
- **Manageability:** refers to the extent to which people experience events in life as situations that are endurable or manageable and can even be seen as new challenges. Individuals feel they have the resources to meet the demands, or feel that they know where to go to get help.

- **Meaningfulness:** refers to the extent to which one feels that life makes sense on an emotional and not just on a cognitive level, and that life's demands are worthy of commitment. It is, essentially, seeing coping as desirable.

To optimise the chances of successful coping with a stressor, one must believe that: (1) one understands the problem: (2) that one has at one's disposal the resources which are needed: and (3) one must wish to cope with the problem. The health of a person depends on their ability to cope, as well as on the support or resources they can turn to for help. The resources a person draws on in times of need act as a buffering or mediating mechanisms minimising the negative impact of stressors and thus preventing breakdown (Antonovsky, 1983).

These resources can be internal such as self-esteem and the cognitive ability to learn to cope with feelings of inferiority, for example, or they can be external, such as the local environment and cultural influences. These internal and external resources are sometimes interchangeable and a person accumulates them through life experiences from childhood onwards. The stronger the sense of coherence a person has the better ability they have to employ cognitive, affective and instrumental strategies which are likely to improve coping and thus well-being.

Although sense of coherence has been defined as a relatively stable dispositional orientation (Antonovsky, 1987), it is possible that job stress could impact on the employee's sense of coherence. According to Antonovsky (1987), it is essential to understand that a strong sense of coherence is not a particular coping style, and that the stressors life poses are many and varied. To adopt one pattern of coping consistently is precisely to fail to respond to the nature of the stressor and hence to decrease the chances of successful coping. What the person with a strong sense of coherence does is to select the particular coping strategy that seems most appropriate to deal with the stressor being confronted.

The availability of a wide repertoire of coping strategies, then, and flexibility in choice at any give time, is crucial (Antonovsky, 1987; Feldt, 1997). However, a strong sense of coherence might help employees to understand stressors, and to regard them as manageable and meaningful. Therefore, a sense of coherence acts as a moderator between the effects of job stress on exhaustion. Also, sense of coherence is expected to contribute to professional efficacy of employees (Basson & Rothmann, 2002; Levert, Lucas & Ortlepp, 2000; Rothmann, Jackson & Kruger, 2003; Steyn, Rothmann & Mostert, 2004). International and local research has confirmed that sense of coherence acts as a mediator between negative characteristics of emotional exhaustion and psychosomatic symptoms (e.g. Feldt, 1997; Rothmann, Jackson & Kruger, 2003; Strümpher, 1995), emotional job strain and burnout (Söderfeldt, Söderfeldt, Ohlson, Theorell & Jones, 2000), conflicts at work and stress symptoms (Albertsen, Nielsen & Borg, 2001), and job autonomy and competence (Toppinen-Tanner & Kalimo, 2003). In addition, Hoover (1983) and Wyller, Holmen, Laake and Laake (1998) find that sense of coherence is positively related with adaptation to illness, suggesting a strong association with wellness.

Other behavioural constructs that correlate with sense of coherence within the field of work are job satisfaction (Strümpfer, 1998), self esteem, life satisfaction, extroversion, independence, conscientiousness, agreeableness, powerlessness, and social support (Basson & Rothmann, 2001; Boyle, Grap, Younger & Thornby, 1991). In addition, Field, Kinnunen & Mauno (2000) find a positive relationship between sense of coherence and organisational commitment. In support of their finding, researchers such as Cilliers and Kossuth (2002; 2004) and Motshele (2001) find a positive relationship between sense of coherence and job involvement, organisational commitment, empowerment and organisational change.

In a South African study, Rothmann (2006) finds that sense of coherence acts as a personal resource (e.g. resilience factor) between job resources and work engagement, suggesting that high scores on work engagement usually result from having resources (e.g. personal and/or job resources, such as sense of coherence, social support, growth opportunities and advancement opportunities) to succeed in one's job.

An explanation on the relationship between work wellness (burnout, work engagement and sense of coherence) and attitude towards work place safety and work place incidents/accidents, including vehicle accidents follow next.

5.4 THE RELATIONSHIP BETWEEN WORK WELLNESS AND ATTITUDE TOWARDS WORK PLACE SAFETY AND WORK PLACE INCIDENTS/ACCIDENTS

Loughlin and Frone (2004) argue that emotional and physical health is two factors that may affect the safety of employees at work. Therefore, individual work wellness includes factors such as psychological stress on the one extreme, and on the other, psychological growth. Hence, these factors could be regarded as important components of health, safety and welfare, and it is therefore a cardinal and ethical responsibility of management to protect this aspect of workers' work wellness. Employee work wellness factors such as stress, negative life experiences and depression have been suggested to have a strong influence on attitude (e.g. DeBono & McDermott, 1994) and the occurrence of negative outcomes such as work place incidents/accidents and driver accidents (e.g. Hofmann & Stetzer, 1996; Rundmo, 1992b, 1995; Sutherland & Cooper, 1991).

In the next sections, a discussion will follow on the relationship between burnout, work engagement, sense of coherence and attitude towards work place safety and work place incidents/accidents including driver accidents.

5.4.1 The relationship between burnout and attitude towards work place safety and work place incidents/accidents including driver accidents

There is considerable evidence to show that beyond a certain threshold, individuals under stress perform less than optimally and stress can therefore adversely affect productivity, quality and safety. Thus, stress is experienced as a result of interactions between individual variables (e.g. personality, coping style, attitudes, and expectations) and environmental factors (e.g. organisational culture and rate of change) (Glendon et al., 2006). Hence, according to McGrath (1976), stress can be conceptualised as a sequence of events in which a perceived imbalance has occurred between demand and response capability, where consequences of not meeting demands are perceived as important.

According to Chappelow (1989), over-arousal (e.g. being overloaded through having to cope with a large number of stimuli at once), particularly where there is a lower than average tolerance for stress, was found to be related to incident causes. In a study conducted by Rundmo (1992b), examining the relationship between perceptions of risk and other aspects of safety on offshore oil platforms, it was found that risk perception and work stress were positively correlated with injuries and human errors at the individual level of analysis. Amongst other factors, employee perceptions of safety and contingency measures were found to be important predictors of perceived risk and work stress. According to Frone (1998), exposure to physical hazards, high work demands, and boredom in the work place are related to an increase in risk of being injured at work among adolescents.

Furthermore, there is considerable evidence to show that job stress influences the degree of burnout experienced (e.g. Burke, 1997; Mills & Huebner, 1998; Schaufeli & Enzmann, 1998; Steyn et al., 2004). According to Schaufeli and Enzmann (1998), organisational stressors can be divided into two groups, namely job demands and lack of job resources. Burnout can be considered as a particular kind of prolonged job stress (Brill, 1984), or the result of chronic, ongoing stress. According to Schaufeli (2003) exhaustion and cynicism represent the core of burnout. For the purpose of this study the focus is on the two core components of burnout, namely exhaustion and cynicism, and their influence on employee's attitude towards work place safety.

Studies done by Rundmo (1997), Carty et al. (1998) and Morrow and Crum (1998) amongst others have found strong associations between levels of stress and safety climate and safety behaviour. In addition, individuals who reported higher levels of stress also reported higher incidences of work place incidents and vehicle accidents. Hence, it can be argued that because of the strong association between (1) job stress and burnout, and (2) stress and negative safety outcomes, the undesirable effect of burnout on attitude towards work place safety could result in unintentional work place incidents/accidents, including driver accidents.

Burnout employees may be prone to at-risk behaviours because of an increase in job demands and a lack of resources to effectively meet their expected job performance (Schaufeli & Bakker, 2004; Rothmann & Joubert, 2007). In a study done by Steyn et al. (2004) on 38 engineers, 86 technicians and 91 electricians in a public electricity company in South Africa, it was found that stress because of job demands, lack of support, supervision and transformation, as well as a weak sense of coherence, predicted exhaustion. The scales exhaustion and avoidance coping predicted cynicism (e.g. negative attitude towards work, etc.). It can be argued that employees who experience high levels of burnout are likely to develop negative attitudes towards the organisation, management and their work environment, which may negatively influence their safety awareness ability, in turn causing work place accidents.

Thus, based on the above research findings, the variable burnout is likely to be an important predictor to be included in this study, influencing employee attitude towards work place safety in a public electricity company in South Africa.

The relationship between work engagement and attitude towards work place safety and work place incidents/accidents is presented next.

5.4.2 The relationship between work engagement and attitude towards work place safety and work place incidents/accidents.

According to Rothmann and Joubert (2007) empirical studies have discovered that some individuals do not develop burnout, regardless of high job demands and long working hours. As revealed by Nelson and Simmons (2003) and Schaufeli and Bakker (2004), engaged employees seem to find pleasure in working hard and dealing with job demands. Schutte, Toppinen, Kalimo and Schaufeli (2000) define work engagement as an energetic state in which the employee is dedicated to excellent performance at work and is confident of his or her effectiveness. Maslach and Leiter (1997) consider job engagement to be the positive antidote of burnout and they describe it as "energy, involvement, and efficacy" which are the direct opposite of the three burnout dimensions.

Demerouti et al. (2001) argue that a positive attitude towards work and the organisation, such as job satisfaction, organisational commitment, and low turnover intention is likely to be a direct consequence of work engagement. In support of the researchers' argument, Wagner and Harter (2006) suggest that organisations where employees feel a strong emotional bond (e.g. worker engagement) to the organisation have reduced absenteeism, fewer accidents, and increased productivity, and, in turn, are more profitable. From a transformational safety culture perspective, Broadbent

(2007) argues that when employees are not engaged, and feel little psycho-behavioural connection to the organisation and its larger goals, the outcome is noticeable in an increase in worker injury rates, higher turnover and absenteeism, and many other associated forms of behaviour, affecting the financial performance of the organisation over time. Therefore, if work engagement mediates the relationship between job resources and turnover intention (e.g. Schaufeli & Bakker, 2004), and job insecurity (e.g. Probst, 2004) influences safety behaviour, then it can be argued that a negative association is likely to exist between disengaged employees and their overall attitude towards work place safety, adversely affecting both the quality and breadth of their focus and attention of the tasks that need to be performed. This negative association could consequently influence employee attitude towards work place safety, resulting in at-risk safety behaviour (e.g. not completing a task according to standards).

No studies could be found on the effect of work engagement on a person's beliefs or attitude towards an object, person, or situation. However, in a recent study, Hansez and Chmiel (2010) report that job resources (e.g. management or supervisor commitment to safety training and development, etc.) can influence job or work engagement positively, resulting in an enhanced focus on taking responsibility for one's own and colleagues' safety, avoidance of risk or hazardous situations and ability to manage work pressure effectively. Thus, the inclusion of the work engagement construct in this study as a predictor in influencing employee attitude towards work place safety is significant.

The relationship between sense of coherence and attitude towards work place safety and work place incidents/accidents follows next.

5.4.3 The relationship between sense of coherence and attitude towards work place safety and work place incidents/accidents

The construct sense of coherence has been discussed in depth in section 5.3.3. The essence of sense of coherence relates to the confidence in one's ability to predict one's internal and external environments and the probability that things will work out as well as reasonably expected. A strong sense of coherence is also related to general well-being (Feldt, 1997) and emotional stability (Mlonzi & Strümpfer, 1998).

In theory, this would mean that individuals with high levels of burnout would be expected to demonstrate weaker levels of sense of coherence. Specifically, the manageability component of sense of coherence has been proven to be related to the exhaustion component of burnout (Rothmann & Malan, 2003). Although sense of coherence has been defined as a relatively stable dispositional orientation (Antonovsky, 1987), it is possible that job stress could impact on employee's sense of coherence. However, a strong sense of coherence might help employees to understand stressors, and to regard them as comprehensible, manageable and meaningful. Therefore, a strong sense of coherence might moderate the effects of job stressors on exhaustion (Rothmann, Jackson & Kruger, 2003). In support of these findings, a causal sequence was found between sense of coherence, job stress and exhaustion (Steyn et al., 2004). Thus, a strong sense of coherence could be regarded as an individual resource in minimising the effect of job stress on exhaustion.

Empirical evidence (e.g. Antonovsky, 1993; Rothmann et al., 2003; Feldt et al., 2007) supports the association between sense of coherence and stress, burnout and certain personality traits and because stress and work wellness have been implicated as predictors of negative safety outcomes (Carty et al., 1998) one can suggest that a lower sense of coherence may influence one's ability to be safety conscious. To date, no studies could be found in this area which can support the possible role (e.g. mediating or moderating role) of SOC and its influence on a person attitude as well as the association with work place incidents/accidents. However, Broadbent (2007) proposes that in maximising individual resiliency as part of the organisational safety culture, leaders would be able to better involve and engage employees on work place safety behaviours. The more employees experience the commitment of management towards work place safety as positive, and combine this with a strong belief that management cares for their wellness, a positive attitude towards work is likely to develop. In addition, the positive attitude affect could increase their confidence in their ability to predict their internal and external environments (e.g. be more safety conscious, show positive driver behaviour, high standard of work quality and service) and could strengthen the manageability and meaningfulness aspects of their sense of coherence.

Therefore, based on the above, the work wellness constructs, burnout, work engagement, and sense of coherence is an important variable to be included in this study in predicting their influence on employee attitude towards work place safety.

A brief summary of the chapter and final conclusions follow next.

5.5 SUMMARY

This chapter introduced the topic work wellness by highlighting the importance of employee wellness to the organisation and the consequence if organisations fail to include employee wellness as a strategic focus area. The concepts health and well-being were defined, followed by an in-depth explanation on the variable work wellness. The discussion focused on the traditional pathogenic paradigm, e.g. an orientation towards ill-health, followed by a more contemporary perspective, focusing on positive psychology, especially the salutogenic (e.g. origin of health) and fortigenic (e.g. nature, manifestations and ways to enhance psychological strengths).

Thereafter, Schaufeli and Bakker's (2001) model of wellness at work was explained. Their model (see Figure 5.1) clearly distinguishes between two dimensions that can be used to classify four types of wellness at work. An extended version of the JD-R model, the Comprehensive Burnout and Engagement (COBE) model (see Figure 5.2), developed by Schaufeli and Bakker (2004) was explained. The chapter focused on two important types of wellness at work, namely burnout and work engagement. Burnout was defined as a metaphor that is generally used to describe a state or process of mental exhaustion, and engagement as an energetic state in which the employee is dedicated to excellent performance at work and is confident in his or her ability to be effective. The factors that cause burnout (e.g. job demands) and work engagement (e.g. job resources) as well as the positive (organisational commitment, turnover intention) or negative (e.g. ill health or health problems) outcomes for employees and the organisation were discussed. The construct sense of coherence was explained as a psychological strength that is likely to strengthen one's experience of work engagement and meaning in life, but also as a buffer in minimising the effect of burnout experience.

Lastly, the relationship between the wellness constructs (burnout, work engagement, and sense of coherence), and attitude towards work place safety and work place incidents/accidents was discussed.

5.6 CONCLUSION

Based on the theoretical concepts of the work wellness constructs (burnout, work engagement, and sense of coherence) and their association with either negative of positive work related behaviours, it can be concluded that the three work wellness variables have the potential to influence employee attitude towards work place safety and in turn to minimise the occurrence of work place incidents/accidents, including driver accidents by participants in this study.

In addition, it is critical to select a measurement instrument that is reliable and valid in measuring employee levels of work wellness (burnout, work engagement, and sense of coherence) and its influence on employee attitude towards work place safety in a public electricity company in South Africa.

In the next chapter, the proposed model of psychological factors influencing attitude towards work place safety are presented.

CHAPTER 6

PROPOSED MODEL OF PSYCHOLOGICAL FACTORS INFLUENCING ATTITUDE TOWARDS WORK PLACE SAFETY

6.1 INTRODUCTION

As highlighted in Chapter 1, the aim of this study is firstly to explore the individual psychological constructs (from the literature) which are likely to influence employee's attitude towards work place safety; secondly to develop a theoretical model of the psychological factors that are likely to influence employee's attitude towards work place safety; and thirdly to evaluate the predictive significance (e.g. path coefficients) of the theoretical model (inner model) (see Figure 6.1).

Most of the research on safety behaviour argues a direct relationship between individual psychological variables and negative work place safety outcomes such as incidents/accidents and vehicle accidents. Although a person's attitude has been implicated to influence the occurrence of work place incidents/accidents, including vehicle accidents, little research has been done relating to psychological factors to attitude towards work place safety. Most of the research focuses on employee's attitude and perception within the context of determining the safety culture within an organisation (e.g. Cox & Cox, 1991). Thus, much time and effort have been devoted to attempts to measure attitudes and to develop theories that will explain how attitudes may be changed and how they can account for behaviour. For this purpose, a theoretical model of psychological factors and its influence on attitude towards work place safety are proposed.

In conclusion, a brief summary of the chapter will follow, as well as conclusions regarding the implications of the proposed path relationships between the different variables of the theoretical model as they relate to the overall objective of the study.

The proposed theoretical model depicting the possible path relationships between the independent variables (e.g. intelligence, personality, burnout, work engagement and sense of coherence) and the dependent variable, namely attitude towards work place safety (e.g. safety control, risk avoidance, stress tolerance as the primary constructs of safety consciousness, and driver attitude and quality orientation as the secondary scales) as presented graphically in Figure 6.1 are discussed next.

6.2 THE PROPOSED MODEL OF PSYCHOLOGICAL FACTORS INFLUENCING ATTITUDE TOWARDS WORK PLACE SAFETY

Understanding an employee's mental and emotional ability to perform the essential functions of his/her job when the employee's conduct, behaviour and circumstances necessitate safe working practices to safeguard the lives of the public, co-workers and the worker him/herself was the key indicator for selecting the constructs to be included in the theoretical model. Based on the above, the employee's current mental and emotional traits (e.g. personality) and/or states (e.g. employee work wellness) could play a role in influencing the cognitive, affective, and conative components of attitude (see Chapter 2), specifically attitude towards work place safety.

The possible predictors (independent variables) that have been identified to influence employee attitude towards work place safety (dependent variable) are intelligence, personality, burnout, work engagement, and sense of coherence. The work place safety attitudinal factors identified to measure employee's attitude towards work place safety in this study are safety control (cognitive component of attitude), risk avoidance (conative component of attitude) and stress tolerance (affective component of attitude). Two relevant secondary attitudinal constructs were also included, namely driver attitude and quality orientation. The development of the model and sequence of variables (independent and dependent variables) depicting the direction or path of influencing attitude towards work place safety is discussed in the next section.

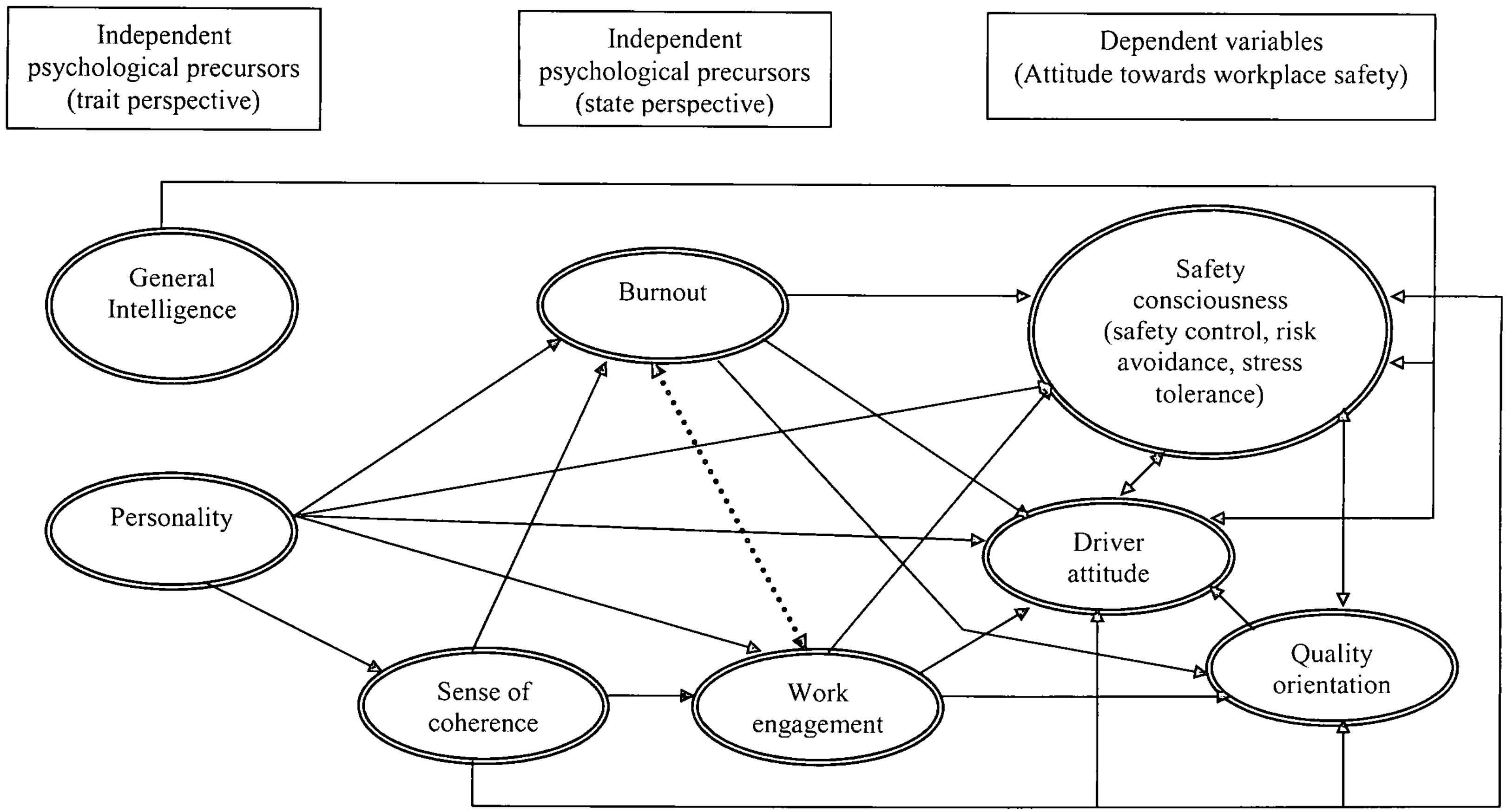


Figure 6.1 The proposed theoretical model of psychological factors influencing attitude towards work place safety

6.2.1 Development of the theoretical model

In this section the proposed research model depicting the variables influencing attitude towards work place safety as outlined in Figure 6.1 is discussed. A summary of the previous empirical evidence found in the literature supporting the path relationships as outlined in the theoretical model (see Figure 6.1) are presented in annexure A.

The model is divided into three segments, namely the independent psychological variables or precursors on the left-hand side and centre, and on the right-hand side the dependent variable. The independent psychological variables or precursors are further divided into a trait perspective on the left-hand side (e.g. individual disposition – more or less permanent nature), namely intelligence and personality. In the centre, from a state perspective (e.g. more or less temporary nature) the independent variable represents burnout, work engagement and sense of coherence.

The reason for the inclusion of the three wellness constructs is to understand the relationship between three psychological perspectives towards work wellness at work, namely the pathogenic paradigm (e.g. Strümpfer, 1990), positive psychology (e.g. Schaufeli et al., 2002a), and the salutogenic paradigm (Antonovsky, 1979; Strümpfer, 1995). The pathogenic paradigm focuses on factors causing ill health (the burnout variable), the positive psychology perspective focuses on psychological growth and wellness of employees and managers (the work engagement variable), and the salutogenic paradigm focuses on the origins of health and wellness (the sense of coherence variable). In addition, the influence of the three wellness constructs on the dependent variables, namely attitude towards work place safety (safety consciousness, driver attitude and quality orientation) are also evaluated.

The dependent variables (attitude towards work place safety) on the right-hand side represent the safety attitudinal constructs, namely safety consciousness (consisting of safety control, risk avoidance and stress tolerance), driver attitude and quality orientation. The construct safety consciousness represents the primary safety attitudinal variable and driver attitude, with quality orientation secondary (e.g. Forcier et al, 2001; Forgarty & Shardlow, no date; Reams, 2007). In the model, (see Figure 6.1), the possible path relationships depicting the variables (the independent variables intelligence, personality, burnout, work engagement, and sense of coherence) influencing attitude towards work place safety (dependent variables, safety consciousness, driver attitude and quality orientation) are presented. The arrows indicate hypothesised relationships as depicted from the literature, which are tested (statistical significance) in the field study by means of the partial least squares path modelling (PLS) approach. The hypothesised links, as depicted from the literature, between the different variables follow next.

Starting with the independent psychological variables (from a traits perspective) on the left-hand side of Figure 6.1, namely intelligence and personality, the following links are proposed.

6.2.1.1 The relationship between intelligence and attitude towards work place safety (safety consciousness, driver attitude and quality orientation) and work place incidents/accidents

As highlighted in section 6.2. and annexure A, a person's level of intelligence and information processing capability (e.g. cognitive failure, mindfulness, etc.) has been cited in the literature to influence a person's beliefs or attitude towards an object, person or situation (e.g. Ajzen & Fishbein, 2005; Briñol & Petty, 2005; Cooper & Dinerman, 1951; Crutchfield, 1955; McGuire, 1969), as well as a predictor of work place incidents/accidents (e.g. Carty et al., 1999; Gottfredson, 2007; Wallace & Vodanovich, 2003) and vehicle accidents (e.g. Blasco, 1994; Lawton & Parker, 1998; O'Toole, 1990; Smith & Kirkham, 1982). According to Glendon et al. (2006), attitudes have the potential for influencing behaviour on the assumption that some form of thought process always precedes action. According to Fazio (1986), attitude influences behaviour by selectively activating various though processes held in the individual's memory. This produces selective perception of the object or person related to the attitude in question. For example, if a person holds a positive attitude toward injury prevention, this could mean that the individual is more likely to think consciously about positive safety working measures. Exposure to further safety related training or safety campaigns are likely to strengthen a person's selective perceptions of what precautionary measures exist to avoid incidents/accidents, including vehicle accidents.

Thus, attitudes are cognitions operating at a more general level. In addition, the cognitive aspect of attitudes is therefore related to the risk cognition or risk perception a person have towards a particular task. Employees' attitudes towards work place injuries is likely to be influenced by previous experience, perceived likelihood of injury, and knowledge of the ways in which injuries occur (Donald & Canter, 1994), as well as individual dispositions, such as intelligence and personality, such as safety locus of control (Jones & Wuebker, 1985). The safety locus of control aspect reflects the extent to which a person thinks and beliefs (cognitive interpretation) they have control over external events (e.g. perceived hazardous tasks or work conditions) (e.g. Cox & Cox, 1991; Glendon et al., 2006). Furthermore, a person's overall beliefs and attitudes toward retaliatory aggressive driving accounted for 30% of the variation in committing aggressive violations (Glendon et al., 2006).

According to Lawton and Parker (1998), most of the research investigating the association between intelligence and incidents/accidents has focused on road/vehicle accidents. In a study conducted by Smith and Kirkham (1982), investigating the relationship between intelligence and driving records of 113 young male drivers, (statistically significant) evidence was found that more-intelligent individuals had fewer vehicle accidents at intersections but not in other driving situations. Their study proposes that the speed of information processing, which is one element of intelligence, may be required to avoid vehicle accidents. Similarly, Schultz and Schultz (1990) report that inexperience in a task is likely to lead to an accident, but that below-average intelligence appears to be significantly related to accidents only on jobs that require frequent judgements. Investigating the relationship between intelligence (*g*) and the probability of death caused by vehicle accidents or suicide, O'Toole (1990) found that the Australian Army intelligence test was a good predictor of death by vehicle accidents for Australian military men aged 20 to 44. Some of the findings revealed that lower *g* scores were related to higher probability of death by vehicle accidents. In support of their findings, Blanco (1994) found empirical evidence that the underlying cause behind the high number of individual traffic accidents in bus drivers in Spain could be cognitive and psycho-motor skills.

In addition, Arthur et al. (1991) conducted a meta-analysis on vehicle accident causation and found moderate-to-marginally statistically significant associations for selective attention, regard for authority, locus of control, and intelligence as predictors of vehicle accident involvement. However, arguments against their finding (the association between intelligence and accidents) suggest that the correlation of $r = -.11$ did not meet the required minimum standard of practical or theoretical importance (Vickers & Villaseñor, 2006). In their study, Lawton and Parker (1998) identified two critical mechanisms which could explain the relationship between individual difference factors and accident involvement, namely cognition and motivation. The cognitive mechanisms refer to non-intentional errors and are associated with failures in information processing and short-term memory or skill. The other mechanism, motivation, has to do with the deliberate violation of safety procedures. In another study, Carty et al. (1999) examined both cognitive and non-cognitive psychological measures amongst sixty male transport drivers. On the cognitive measures, statistically significant correlations ($r = .445$; $r = .353$ and $r = .327$) were found suggesting that those individuals reporting problems with short-term memory and/or attention span report more work accidents. Carty et al. (1999) concluded that higher driving accident rates were best predicted by scores on non-verbal, and especially spatial ability tests.

Other researchers such as Buffardi et al. (2000), found that error rates (human error probabilities) on work tasks in Air Force and nuclear power plant work environments correlate (0.5 to 0.6) with the number and level of cognitive abilities that the task requires. In support of their findings Schmidt and Hunter (2004) found that individuals with higher cognitive abilities outperform their co workers (on average) in all jobs, but especially in more complex ones. Gottfredson (2007, p. 407) concludes that the "same task requirements that typify complex jobs are also at the heart of preventing unintentional injury: dealing with unexpected situations, identifying problem situations quickly, and responding promptly when unexpected problems occur".

Thus, it is anticipated that a statistically significant link is likely to exist between intelligence and attitude towards work place safety, namely safety consciousness, and intelligence and driver attitude. Based on previous studies (e.g. Arthur et al., 1991;

Buffardi et al., 2000; Smith & Kirkham, 1982), it appears that a stronger statistically significant relationship is likely to exist between intelligence and driver attitude. With regard to the development of the structural model, it appears that no significant path coefficients are likely to exist between intelligence and the other variables, namely personality, burnout, work engagement, sense of coherence and quality orientation.

6.2.1.2 The relationship between personality and attitude towards work place safety (safety consciousness, driver attitude and quality orientation) and work place incidents/accidents

The influence of personality on a person's attitude formation has been presented in Chapter 2 (section 2.4.4) and Chapter 4 (section 4.4). The Five Factor model of Personality and its influence on attitude formation have shown that dominant (extraverted) and submissive (introverted) individuals are more responsive to individual persuaders (e.g. Blankenship et al., 1984; Moon, 2002), and openness, conscientiousness, emotional stability, and agreeableness are related to people's voting behaviour (Schoen & Schumann, 2007) and political inclination (Gerber et al., 2010). The personality variable safety locus of control, which reflects the extent to which an individual believes that they have control over external events, has been found to influence a person's attitude towards work place incidents/accidents, including vehicle accidents (Jones & Wuebker, 1985).

A wide range of personality traits and emotional states have been cited in most safety related studies as possible predictors of work place incidents/accidents (see Section 6.2.) (e.g. Arthur et al., 1991; Arthur, Jr., & Graziano, 1996; Celler et al., 2001; Hansen, 1989; Venter et al., 2004; Yagil, 2001), including driver accidents:

- assertiveness
- persuasiveness
- pragmatism
- trust
- locus of control
- flexibility
- extraversion

- neuroticism/phlegmatism
- openness to experience
- conscientiousness
- type A behaviour/contesting

The freedom from accidents profile of Cattell et al. (1970) initiated subsequent research on the influence of personality variables in predicting accident involvement in a number of industries. For example, this profile (based on the Cattell 16 Personality Factor Questionnaire) suggests that factor M (abstractness), factor C (low ego strength), factor E (high dominance), and factor F (high liveliness) are significantly related to accident involvement. Venter et al. (2004) found statistically significant correlations between personality factors on the 15FQ$^+$ Personality Questionnaire (Q1$^+$ radical and M$^+$ abstract) and OPP dimensions (assertive positively, persuasive positively and pragmatic negatively) with the work place accident records of 125 senior electricians.

Other researchers opted to use the Big Five personality measurement in examining the relationship between personality and accident involvement including vehicle accidents. Past and recent studies provide empirical evidence of significant relationships between low conscientiousness and low agreeableness predicting accidents (e.g. Arthur & Grazziano, 1996; Clarke & Robertson, 2005), low conscientiousness and accidents (e.g. Cellar et al., 2001; Christian et al., 2009; Wallace & Vodanovich, 2003), and high neuroticism (e.g., Frone, 1998; Hansen, 1989, 1991; Lawton & Parker, 1998; Wickens, 1996) and extraversion, agreeableness, high openness and accidents (e.g. Beirness & Simpson, 1988; Clark & Robertson, 2008; Henning et al., 2009; Judge & LePine, 2007). In addition, other personality constructs, such as external locus of control (e.g. Celsi et al., 1993; Jones, 1984; Jones & Wuebker, 1985, 1993; Wuebker, 1986) and Type A personalities (e.g. Frone, 1998; Cooper & Sutherland, 1987; Sutherland, 1993; Sutherland & Cooper, 1991) were found to be positively related with work place accidents, risk taking or accident involvement.

In light of the above paragraph, it is anticipated that a statistically significant path relationship is likely to exist between personality variables and attitude towards work place safety, namely safety consciousness and driver attitude. No relationship is expected between personality and quality orientation.

The relationship between personality and the wellness factors (burnout, work engagement, and sense of coherence) follow next.

6.2.1.3 The relationship between personality and the wellness factors (burnout, work engagement, and sense of coherence)

A number of studies have reported evidence of a positive association between personality constructs and burnout (e.g. Bakker et al., 2006), work engagement (e.g. Langelaan et al., 2006; Rich 2006), and sense of coherence (e.g. Feldt et al., 2007). The relationship between personality and the burnout, work engagement and sense of coherence constructs are discussed separately.

6.2.1.3.1 The relationship between personality and burnout

In a study done by Bakker et al. (2006) investigating the relationship between the Big Five Personality Factors and burnout among 80 volunteer counsellors, it was found that emotional exhaustion is uniquely predicted (accounted for 13% of the variance in feelings of exhaustion) by emotional stability (neuroticism). Three personality factors (neuroticism, introversion and less autonomous) accounted for 17 % of the variance in depersonalisation (cynicism). The author's further state that some of the basic personality factors (e.g. conscientiousness, emotional stability, agreeableness and extraversion) moderate the relationship between negative experiences and burnout, suggesting that personality may help to protect individuals against known risks of developing burnout.

Other researchers also found that extraversion is negatively associated with emotional exhaustion (e.g. Eastburg, Williamson, Gorsuch & Ridley, 1994; Francis, Louden & Rutledge, 2004) as well as between extraversion and depersonalisation (cynicism) (e.g. Francis et al., 2004; Zellers, Perrewe & Hochwarter, 2000). In two studies, Piedmont (1993) found that agreeableness correlates negatively with exhaustion and depersonalisation. Zellars et al. (2000) found similar results, but report a weak negative relation between agreeableness and depersonalisation (cynicism). On the factor conscientiousness, LePine, LePine and Jackson (2004) report a negative relationship between conscientiousness and emotional exhaustion whereas Deary, Watson and Hogston (2003) report a positive relationship between conscientiousness and depersonalisation (cynicism). Moreover, neuroticism has been found to be consistently and positively associated with the two burnout scales, namely exhaustion and depersonalisation (e.g. Deary, Blenkin, Agius, Endler, Zeally & Wood, 1996; Langelaan et al., 2006; LePine et al., 2004; Zellars et al., 2000). With regard to the fifth factor, openness, contradictory results are reported. For example, Zellars et al. (2000) found a negative relationship between openness and cynicism (depersonalisation), whereas Piedmont (1993) reports no significant relationships between openness and the three burnout scales. In a South African study, emotional stability, extraversion, openness, agreeableness and conscientiousness were related with lower emotional exhaustion and cynicism and higher personal accomplishment (Storm & Rothmann, 2003).

Brookings, Bolton, Brown and McKvoy (1985) found some evidence that an external locus of control is associated with burnout among females working in human services. Schaufeli and Enzmann (1998) report that individuals with an external locus of control are more emotionally exhausted and are likely to experience a negative attitude (cynicism) towards their work. In addition, Glass and McKnight (1996) state that an external locus of control explains about 10% of the variance of emotional exhaustion and about 5% of the variance of depersonalisation. However, Rothmann (2004) found no statistically significant relationship between locus of control and the two primary burnout scales (exhaustion $r = .22$ and cynicism $r = .17$). In addition, Schaufeli and Enzmann (1998) found in more than 100 articles on burnout that lower order personality constructs such as low levels of hardiness, external locus of control, Type A personality, lower self-esteem and lower achievement motivation are positively related to burnout.

Therefore it is predicted that a statistically significant path relationship is likely to exist between personality variables and burnout.

Next, the relationship between personality and work engagement are explained.

6.2.1.3.2 The relationship between personality and work engagement

In conducting a literature review on the relationship between personality and engagement, only three published articles could be found, namely by Langelaan et al. (2006), Rich (2006) and Wildermuth (2008). Using a sample of 572 Dutch employees from various organisations and professional backgrounds, Langelaan et al. (2006) investigated whether burnout and work engagement could be differentiated based on personality and temperament. To assess engagement, participants completed the Utrecht Work Engagement Scale (Schaufeli & Bakker, 2003) and the NEO inventory (Costa & McCrae, 1992b) to assess the Five Factors of personality. The researchers found that the engaged group was characterised by low scores on neuroticism (r = -.49), paired with high scores on extraversion (r = .36). In the second study, Rich (2006) developed and validated a new job engagement scale measuring Kahn's (1990) physical, emotional, and cognitive engagement components. The results of his study support a positive correlation between conscientiousness and engagement (r = .59).

Lastly, Wildermuth (2008) also conducted research (sample of 292 non-managerial professional and paraprofessional employees from three social services agencies in the Midwest of the United States) on the relationship between engagement (Rich's Job Engagement Survey) and the Big Five personality traits (The Workplace Big Five Profile™ by Howard & Howard, 2001b). The results support significant correlations between three Five Factor traits and engagement: neuroticism (r = -.19), extraversion (r =.30), and conscientiousness (r = .16). In conclusion, Wildermuth (2008) reports that research results so far support a low to modest relationship between personality (the Five-Factor Model of personality traits) and work engagement. One could argue that work engagement is more positively influenced by situational factors (e.g. job resources) than by personality factors.

Based on the above findings, a low to modest path relationship is likely to exist between personality and work engagement.

In the next section, the relationship between personality and sense of coherence is presented.

6.2.1.3.3 The relationship between personality and sense of coherence

The theoretical base of the construct sense of coherence was discussed in depth in section 6.2.2.1.3.3. Researchers such as Amelang (1997), Cibson and Cook (1996) and Mlonzi and Strümpfer (1998) report a negative correlation between SOC and neuroticism and a positive relationship between SOC and extraversion. Feldt et al. (2007) argue that despite the relatively stable nature of SOC, it should not be regarded as a separate personality trait, in the same way as those presented in the Five-Factor Model (McCrae & Costa, 1999). Sense of coherence, as a stable, generalised orientation, develops through maturation and life experiences, whereas personality traits are considered to represent an individual's basic tendencies, which in transaction with the environment produce characteristics such as skills, beliefs, attitudes and interpersonal relationships. In investigating the relationship between sense of coherence and personality, Feldt et al. (2007) found that neuroticism (-0,85) showed the strongest relationship with SOC. In addition, moderate links were found with extraversion (0,43), conscientiousness (0,31) and agreeableness (0,40).

Therefore, it is anticipated that a moderate relationship is likely to exist between personality and sense of coherence.

In the next section, the relationship between sense of coherence, burnout, work engagement and quality orientation are discussed.

6.2.1.4 The relationship between sense of coherence with burnout and work engagement

It is evident from the literature that statistically significant positive and negative relationships exist between burnout (e.g. Gilbar, 1998; Wissing, De Waal & De Beer, 1992) and work engagement (e.g. Van der Linde & Coetzer, 2004; Rothmann et al., 2005). The association between the salutogenic construct sense of coherence and the wellness constructs, burnout and work engagement, as well as the possible link with quality orientation are discussed next.

6.2.1.4.1 The relationship between sense of coherence and burnout

Wissing et al. (1992) found correlations of 0.50 (study 1) to 0.64 (study 2) between the Pines, Aronson and Kafry (1981) Tedium Measure of burnout and the three subscales of the SOC scale in two studies on university staff and students. Other studies report a moderate association between SOC and emotional exhaustion and psychosomatic symptoms (Feldt, 1997), emotional strain and burnout (Söderfeldt et al., 2000). In another study, Gilbar (1998) found statistically significant correlations between SOC and emotional exhaustion ($r = -.30$) amongst social workers. Rothmann's (2004) study reports significant correlations between SOC and emotional exhaustion ($r = -.51$), and SOC and cynicism ($r = -.48$) amongst 64 senior managers in a manufacturing organisation. Van der Linde and Coetzer (2004) report statistically significant correlations between sense of coherence and burnout ($r = -.35$) amongst 341 protection services employees in South Africa. In addition, Rothmann et al. (2005) mention the following statistically significant correlations between SOC and burnout scales, emotional exhaustion ($r = -.30$) and cynicism ($r = -.42$ between a sample of 38 engineers, 86 technicians and 91 electricians in an electricity supply organisation in South Africa.

Therefore, it is evident that individuals with high levels of burnout can be expected to demonstrate weaker levels of SOC. A strong (statistically significant) path relationship is thus predicted between sense of coherence and burnout.

Next, the relationship between SOC and work engagement is presented.

6.2.1.4.2 The relationship between sense of coherence and work engagement

Studies conducted by Antonovsky (1987; 1993) and Rothmann (2003) argue strongly that a person's sense of coherence is an important component of one's health and well-being. Both Feldt (1997) and Mlonzi and Strümpfer (1998) argue that a strong relationship is likely to exist between sense of coherence and work wellness and emotional stability. Van der Linde and Coetzer (2004) report the following relationship between sense of coherence and vigour/dedication (two primary scales of engagement): $r = .30$. In addition, Rothmann et al. (2005) also mention the existence of a statistically significant positive relationship between sense of coherence and engagement (r = .44). In support of the above findings, Strümpfer and Mlonzi (2006) conducted three studies (*N*=234, *N*= 141, and a sample of academic staff) to test the relationship between sense of coherence and engagement. In the first and second studies, strong positive relationships were found between sense of coherence and engagement, but not in the third.

Thus, sense of coherence acts as a warding-off of burnout as well as an individual resource (Rothmann, 2007) in strengthening work engagement inclinations. Therefore, a strong path coefficient is predicted between sense of coherence and work engagement.

The relationship between the pathogenic construct burnout and the positive psychology construct, work engagement are discussed next.

6.2.1.5 The relationship between burnout and work engagement

Both of these concepts have been adequately discussed in Chapter 4, together with their possible association with workplace safety behaviour (section 6.2.2.1.3). Burnout and work engagement could be regarded as indicators of the work wellness of employees in the work place (e.g. Shaufeli & Bakker, 2004; Rothmann et al., 2005). An abundance of studies have confirmed that burnout and work engagement are independent states that are negatively, but not perfectly, related (e.g. Demerouti, Bakker, De Jonge, Jansen & Schaufeli, 2001; Schaufeli & Bakker, 2004; Schaufeli et al., 2002b). The engagement scales vigour and dedication are the direct opposite of the burnout scales exhaustion and cynicism (González-Romá et al., 2006). In support of their findings, Coetzer (2004) found in a study carried out among employees in a South African insurance company that work wellness can be conceptualised within two dimensions, namely exhaustion versus vigour, and cynicism versus dedication.

In support of the above theoretical explanation, Schaufeli and Bakker (2004) report the following statistically significant relationships from four independent occupational samples (N = 1698), namely exhaustion and vigour (r = -.40) and cynicism and dedication (r = -.29). Langelaan et al. (2006) found the following statistically significant correlations, namely exhaustion and vigour (r = -.37) and cynicism and dedication (r = -.60) among 572 Dutch employees. Within a South African context, Van der Linde and Coetzer (2004) found (N = 341) a statistically significant negative correlation between burnout and vigour/dedication (r = -.37). In their study (N = 215), Rothmann et al. (2005) report a statistically significant negative correlation between exhaustion and work engagement (r = -.38), and cynicism (r = -.50).

Based on the above findings, a statistically significant negative path relationship is predicted between burnout and work engagement.

In the next section, the relationship between burnout and attitude towards work place safety (safety consciousness, driver attitude and quality orientation) are presented.

6.2.1.6 The relationship between burnout and attitude towards work place safety (safety consciousness, driver attitude and quality orientation) and work place incidents/accidents

Burnout, as explained by Schaufeli and Enzmann (1998), is a persistent, negative, work-related state of mind in normal individuals that is primarily characterised by exhaustion, which is accompanied by distress, a sense of reduced effectiveness, decreased motivation, and the development of dysfunctional attitudes (e.g. job dissatisfaction, poor organisational commitment, and intention to quit) and impaired organisational behaviours such as absenteeism, job turnover and poor performance. Role overload, as one of the causes of burnout (e.g. Schaufeli & Enzmann, 1998) has been found to be related to employees taking shortcuts in order to get work done (Hoffman & Stetzer, 1996).

Stress factors and avoidance coping have been implicated (e.g. Pienaar, 2002; Steyn et al., 2004) as variables contributing to the experience of burnout and have the potential to negatively influence an employee's ability to apply effective stress management strategies (stress tolerance). Levels of stress experienced and hours worked were found to be the best predictors of work-related accidents, with risk attitude and work-related driving distance also predicting accidents to a lesser extent (e.g. Trimpop, Austin & Kirkcaldy, 2000). Thus, the affective component of attitudes that is concerned with feelings and emotions can be very potent in effecting a person's attitude and subsequent behaviour especially when someone who has witnessed or experienced a traumatic injury (e.g. electrical contact injury as a consequence of burnout experience) is likely to feel more strongly about safety than a person who has not learned through such experience (Glendon et al., 2006).

For the first time Hansez and Chmiel (2010), by making use of the JD-R model (Demerouti et al., 2001b), investigated the effect of job-related factors on safety outcomes, specifically routine safety violations and situational safety violations provoked by the organisation. The results of their study provide strong evidence of a statistically significant relationship between job quality and job strain ($r = -.56$), work overload ($r = -.22$), role ambiguity ($r = -.34$), and routine violations ($r = -.25$). This finding supports the findings of Turner, Chmiel and Walls (2005) that employees who report high job demands define their safety role with respect to their jobs more narrowly, and higher strain relates to more accidents and near misses. In addition, Gulian, Glendon, Davies, Matthews, & Debney (1990) suggest that work demands (one of the causes of burnout) could influence driver's general attitude and reactions towards safe driving behaviour.

Furthermore, Glendon et al. (2006) propose that job stress influences a person's attitude and general health directly, which in turn influences the occurrence of work place incidents/accidents, including vehicle accidents indirectly. Therefore, when excessive experiencing of high job demands and job strain continues, chronic exhaustion develops that can lead people to distance themselves emotionally and cognitively from their work, so that they become less involved with, or responsive to, the needs of other people or the demands of the task (Maslach & Leiter, 1997). In distancing oneself mentally from a job, a negative attitude towards work starts to evolve such as not taking responsibility for working safety, avoidance of hazardous situations, a lower quality of work being performed, impaired driver awareness, and so forth.

Thus, based on the above, a link is likely to exist between burnout and attitude towards work place safety, namely safety consciousness and driver attitude. The path relationship between burnout and quality orientation is predicted through the safety consciousness construct because of the strong relationship between quality orientation and the three primary safety attitudinal scales safety control, risk avoidance and stress tolerance (safety consciousness). According to Forgarty and Shardlow (no date) and Reams (2007), lower overall safety awareness influences a person's ability to concentrate on the quality of work being performed and on personal work habits and adherence to safety rules and procedures.

The relationship between sense of coherence and attitude towards work place safety (safety consciousness, driver attitude and quality orientation) are discussed below.

6.2.1.7 The relationship between sense of coherence and attitude towards work place safety (safety consciousness, driver attitude and quality orientation) and work place incidents/accidents

The construct sense of coherence and its association with workplace safety was explained in detail in Chapter 5. To date, no empirical evidence could be found showing the existence of a relationship between sense of coherence and variables related to attitude towards work place safety, such as safety consciousness (safety control, risk avoidance and stress tolerance), driver attitude and quality orientation. The aim of this section is to argue possible links between sense of coherence and the dependent variables (safety consciousness, driver attitude and quality orientation).

According to Rotter (1966), the concept locus of control refers to a person's perception of his or her ability to exercise control over the environment. Thus, a person with an internal locus of control believes that he or she has control over his or her environment and his or her personal success. A person with an external locus of control, on the other hand, views his or her life as controlled by external factors such as chance or powerful others. The scale safety locus of control (e.g. Jones & Wuebker, 1985) refers specifically to an individual's locus of control in matters related to avoiding work place incidents/accidents. In the context of safe work performance, an internal safety locus of control refers to an individual's belief (aspect of attitude formation) that he or she is in control of the outcomes of his or her behaviour, and to take responsibility for job safety and any injuries that may or may not happen. An individual with a high external safety locus of control exhibits low safety consciousness (Forcier et al., 2001) and does not see a cause and effect relationship between his or her actions and safety outcomes. Safety outcomes are viewed as being beyond his or her control and blame is attributed to external factors such as other people's actions, change events, or bad luck (Lawton & Parker, 1998).

According to Antonovsky (1979), a relationship exists between sense of coherence and locus of control. Kalimo and Vuori (1990) argue that some of the elements of locus of control exist within the construct sense of coherence in that both constructs lead to the anticipation of wellbeing-promotion orientations. In a South African study, Rothmann and Malan (2003) report a statistically significant positive relationship between sense of coherence and locus of control (as measured by the work-locus-of-control scale (Spector, 1988)). The scale stress tolerance (one of the three scales of the safety consciousness construct) refers to an individual's ability to contend with stress of a situational and temporary nature. All employees experience stress at some point in time, but some are more likely than others to react in ways that lead to mistakes and errors (Jones, DuBois & Wuebker, 1986). Evidence exists (e.g. Steyn et al., 2004) that employees who have a weak sense of coherence are inclined to suffer from job stress, which will lead to exhaustion.

Therefore, employees who have a weak sense of coherence probably find it difficult to structure their world to be understandable, orderly and consistent. They tend to experience life events as unmanageable and perceive that they lack the resources to meet the demands and they might feel that life does not make sense on an emotional level. In addition, significant negative correlations have been reported (e.g. Basson & Rothmann, 2002; Levert et al., 2000; Malan & Rothmann, 2003) between burnout (response to stress) and sense of coherence.

Based on the above, a significant path relationship is likely to exist between sense of coherence with safety consciousness (specifically the safety control and stress tolerance scales).

Quality orientation, a secondary scale of the safety consciousness construct, refers to an individual's attitude to the overall quality of the work being performed, including the quality of the individual's personal work habits and adherence to the organisation's safety procedures. It further gives a clear indication of how committed the individual is to detecting and avoiding errors and to continually improving the overall quality of the service or product being provided (Forgarty & Shardlow, no date). The key element of an individual with a strong sense of coherence is the extent to which the person has a pervasive, enduring and dynamic feeling of confidence and that he or she: (1) believes that stimuli from the internal and external environment are structured, predictable and understandable: (2) has resources available to meet the demands posed by these stimuli: and (3) views these demands as challenges, worthy of investment and engagement (Antonovsky, 1979). Hence, it could be argued that a strong sense of coherence is likely to contribute strongly to positive work behaviours, such as a positive attitude towards the quality of work performed and being conscientiously aware of personal work habits and adherence to company safety procedures.

Therefore, repeated experiences of high job demands, role overload and continuous work pressure, which are unpredictable, uncontrollable and uncertain, are likely to result in a weak sense of coherence that could influence an employee's ability to focus on the quality of work being performed and adherence to company safety procedures. Hence, based on the above, a significant path relationship is predicted between sense of coherence and quality orientation.

The scale locus of control has been found to be associated with driver accidents (e.g. Jones & Wuebker, 1985; Lawton & Parker, 1998), and with sense of coherence (Antonovsky, 1979; Kalimo & Vuori, 1990; Rothmann & Malan, 2003). A driver with a strong sense of coherence is likely to make sense of possible hazardous situations on a cognitive level (comprehensibility), believing that the situation is manageable and acting in manner to avoid a negative safety outcome such as an accident or damage to vehicles. Therefore, based on the above, a path relationship is also anticipated between sense of coherence and driver attitude.

An explanation now follows on the relationship between work engagement with attitude towards work place safety (safety consciousness, quality orientation and driver attitude).

6.2.1.8 The relationship between work engagement and attitude towards work place safety (safety consciousness, driver attitude and quality orientation) and work place incidents/accidents

As discussed in Chapter 5, engaged employees are likely to work harder, go the extra mile and have a tendency to add more value through their day-to-day contributions. From a positive psychology perspective, engaged individuals find pleasure in working hard and dealing with job demands (Seligman & Csikszentmihalyi, 2000). According to Nelson and Simmons (2003), meaningful work leads to eustress, which promotes work engagement even if the situation is demanding. The two primary scales of work engagement, namely vigour and dedication, are characterised by high levels of energy and identification with one's work (e.g. Schaufeli et al., 2002; Schaufeli & Bakker, 2004). The energy component refers to high mental resilience while working, to the willingness to exert effort and to persist even through tough times, and to dedication and a sense of significance in one's work, feeling excited, inspired and proud, and viewing it as a challenge (e.g. Schaufeli et al., 2002; Schaufeli & Bakker, 2004).

Limited empirical evidence could be found linking work engagement with attitude towards work place safety (safety consciousness, driver attitude and quality orientation). However, in a recent study, Hansez and Chmiel (2010) report the following statistically significant correlations, namely job engagement and job quality ($r = .37$), job engagement and routine violations (taking short cuts) ($r = -.19$), job engagement and situational violations (essential to get the job done) ($r = .24$), and job engagement and perceived management commitment to safety ($r = .35$). This finding supports the view that job resources (e.g. management or supervisor commitment to safety, training and development, etc.) can influence job or work engagement positively, resulting in an enhanced focus on taking responsibility for one's own and colleagues' safety, avoidance of risk or hazardous situations and ability to manage work pressure effectively. In addition, a person experiences a sense of dedication towards the quality of work being performed as well as adherence to the company safety rules and procedures. These types of behaviours are likely to be observed in the individual's attitude towards driving practices and serve as an indication of the likelihood of not being involved in a motor vehicle accident.

Conversely, when an individual's levels of energy and identification with his or her work and organisation become depleted (e.g. through lack of support from manager or supervisor, no or minimum training and development opportunities, etc.) (e.g. Bakker, Schaufeli, Leiter & Taris, 2008), dysfunctional behaviour, such as a lesser focus on working or driving safely (e.g. routine and situational violations, accidents, near misses), the quality of work being performed or service rendered (e.g. Turner, Chmiel & Walls, 2005; Hansez & Chmiel, 2010) becomes unavoidable (e.g. coping resources become depleted, and fatigue and susceptibility to distraction on the job increase).

Thus, a low to moderate path coefficient is predicted between work engagement and attitude towards work place safety, namely safety consciousness, quality orientation and driver attitude.

In the next section, the relationship between the three constructs measuring attitude towards work place safety, namely safety consciousness, driver attitude and quality orientation are explained.

6.2.1.9 The relationship between safety consciousness (safety control, risk avoidance, stress tolerance), quality orientation and driver attitude

As discussed in section 6.2., many organisational and individual factors are related to safety behaviours and attitude towards work place safety. The dependent variable, attitude towards work place safety, consists of the following constructs: (1) safety consciousness, consisting of three independent scales namely safety control, risk avoidance and stress tolerance: (2) driver attitude: and (3) quality orientation. Statistically significant correlations between the safety consciousness index were reported in two studies, namely in study 1 (N= 159) safety control and risk avoidance ($r = .65$), safety control and stress tolerance ($r = .58$), and risk avoidance and stress tolerance ($r = .70$). Statistically significant relationships were also found between the overall safety consciousness index and driver attitude and quality orientation. In study 2 (N= 644), similar findings were reported, safety control and risk avoidance ($r = .59$), safety control and stress tolerance ($r = .52$), and risk avoidance and stress tolerance ($r = .52$). Statistically significant relationships were also found between the overall safety consciousness index and driver attitude and quality orientation (Fogarty &

Shardlow, no date). According to the researchers the three scales making up the overall safety consciousness index tap into the secondary scales, namely driver attitude (e.g. locus of control, stress, and traffic violations) and quality orientation (e.g. conscientiousness, risk avoidance).

According to Forcier et al. (2001) the safety consciousness construct (safety control, risk avoidance and stress tolerance) consists of personality and attitudinal variables associated with a higher risk of accident involvement. Therefore, it can be concluded that a safety conscious individual has an internal locus of control in matters related to workplace safety, has a high tolerance for work-related stress, and avoids engaging in high-risk, sensation-seeking activities. These behaviours tap into attitudes to traffic risk, stress, and driver distance exposure (e.g. Trimpop et al., 2000) and the personal work habit of an individual to focus on the quality of work being executed.

Lastly, a statistically significant link is predicted between the attitude towards work place safety variables (right-hand side of Figure 6.1) safety consciousness, driver attitude and quality orientation (Forcier et al., 2001; Forgarty & Shardlow, no date; Reams, 2007).

A brief summary of the chapter is presented next.

6.3 SUMMARY

The chapter was introduced by explaining the rationale for the inclusion of the independent and dependent variables in the development of the proposed theoretical model predicting employee's attitude towards work place safety in a public electricity company in South Africa. From the literature, it was found that intelligence, personality (e.g. neuroticism), wellness factors (e.g. stress) and safety attitudinal factors (e.g. safety control, driver violations) were identified as the core components contributing to work place accidents and vehicle accidents.

Lastly, the proposed theoretical model (Figure 6.1) depicting the psychological variables influencing a person's attitude towards work place safety was introduced. Specific reference was made to those variables that are likely to demonstrate significant path coefficients with the dependent variable attitude towards work place safety, specifically safety consciousness, driver attitude and quality orientation as well as work place incidents/accident including vehicle accidents.

6.4 CONCLUSION

In conclusion, no evidence in the literature could be found where a multi-dimensional approach of this nature has been conducted before on the influence of psychological factors, namely intelligence, personality, burnout, work engagement, and sense of coherence on employee attitude towards work place safety, which is likely to result in work place incidents or accidents within a public electricity company in South Africa.

The study design and research methodology are discussed in the next chapter.

CHAPTER 7

RESEARCH METHODOLOGY

7.1 INTRODUCTION

The aim of this chapter in relation to the overall purpose of this study is to provide a detailed explanation of all the technical aspects involved in conducting the study. In this chapter, aspects such as the research design, population and sampling, data gathering procedure, measuring instruments, and the process of statistical analysis used for this study are presented. In addition, the reliability statistics of the measurement instruments used in this study are also presented. Furthermore, evidence of the exploratory and confirmatory factor analysis conducted on the measurement instruments that measure burnout, work engagement, sense of coherence, safety control, risk avoidance, stress tolerance, quality orientation, and driver attitude are shown.

7.2 RESEARCH APPROACH AND DESIGN

The purpose of this study is two-fold: firstly, it aims to construct a sequential model from the literature depicting the psychological variables influencing attitude towards work place safety, and secondly, it aims to test the theoretical model (see Figure 6.1) with the data collected from the study sample. A cross-sectional survey design with a correlational field study approach was used to achieve the research objectives. This design allows for the description of the population at a specific point in time, and is also suited to the development and validation of questionnaires (Shaughnessy & Zechmeister, 1997).

Furthermore, this design can be used to address descriptive and predictive functions associated with correlational research as well as to establish the strength of the interrelationships among variables (Morgan & Griego, 1998). A structural equation modelling (SEM) approach was used in the evaluation of the research model (Byrne, 2001). The partial least squares (PLS) path modelling technique was used to evaluate the model depicting which factors influence or predict attitude towards work place safety.

7.3 SELECTION OF THE RESPONDENTS

According to Bailey (1987), sampling entails the selection of a subset of some predetermined size from the population being studied: those selected will participate in the study. The study population (N = 633) consisted of all permanent employees who were involved in workplace incidents and accidents from April 2006 to November 2008 in a public electricity company in South Africa. The employee incident/accident data was retrieved from the organisation safety incident register from January 2006 to November 2008.

According to Sekaran (2000), the minimum acceptable test sample size (S) for a population size (N) of 633 is 236. A stratified, random sample (S = 279) of employees involved in lost time, medical and near-miss (see Table 7.3) incidents participated in the study (44.08% response). The sample (279) was slightly above the minimum acceptable sample size proposed by Sekaran (2000). Although the majority of respondents were involved in vehicle incidents/accidents (87%), the researcher ensured that employees involved in non-vehicle-related incidents (e.g. electrical contact) (13%) were also included in the sample. The biographical composition of the sample (see Table 7.1) is described below.

7.4 BIOGRAPHICAL CHARACTERISTIS OF THE PARTICIPANTS

In this section, a brief explanation of the biographical information of the participants is presented. The characteristics are presented in a table format supported by a brief explanation regarding the distribution of the specific characteristic of the sample, for example race, gender, and work related aspects. The biographical characteristics of the participants (gender, race, age, marital status, and qualification) are presented in Table 7.1. In the next table (Table 7.2), the work related characteristics (task grade, years of service, and nature of work) of the participants are presented. Lastly, characteristics regarding the safety incident/accident data of the participants are presented in Table 7.3.

7.4.1 Distribution of the participants according to gender, race, age, marital status and qualification

The biographical characteristics of the sample of participants are presented in Table 7.1.

Table 7.1 Biographical characteristics of the participants

Biographical characteristics		Frequency	Percent	Cumulative percent
Gender	Male	229	82.1	82.1
	Female	50	17.9	100.0
	Missing responses	0		
Race	African	196	70.3	70.3
	Coloured	17	6.1	76.3
	Indian	1	.4	76.7
	White	65	23.3	100.0
	Missing responses	0		
Age	19-29 years	56	20.1	20.1
	30-39 years	78	28.0	48.0
	40-49 years	87	31.2	79.2
	50-65 years	58	20.8	100.0
	Missing responses	0		
Marital status	Single	82	29.4	29.4
	Married	173	62.0	91.4
	Divorced	19	6.8	98.2
	Separated	2	.7	98.9
	Remarried	3	1.1	100.0
	Missing responses	0		
Qualification	Grade 10	49	17.6	17.6
	Grade 11	14	5.0	22.6
	Grade 12	75	26.9	49.5
	Technical College Diploma	64	22.9	72.4
	Technikon Diploma	27	9.7	82.1
	Technikon Degree	11	3.9	86.0
	University Degree	12	4.3	90.3
	Postgraduate Degree	10	3.6	93.9
	Below Grade 10	17	6.1	100.0
	Missing responses	0		

The participants were predominantly African (70.3%), male (82.1%), married, and had an education of Grade 12 (26.9%) and technical college diploma (22.9%). The age of the respondents ranged from 18-65 years with 31.2% between 40 and 49 years, and 28.0% between 30 and 39 years. This indicates that the age group is a good representation of the total sample.

7.4.2 Distribution of the participants according to task grade, years of service and nature of work

The work related characteristics of the sample of participants are presented in Table 7.2.

Table 7.2 Work-related characteristics of the participants

Work-related characteristics		Frequency	Percent	Cumulative percent
Task grade	T4 – T7	129	46.2	46.2
	T9 – T13	130	46.6	92.8
	P/M14 – P/M18	20	7.2	100.0
	Missing responses	0		
Years of service	0-2 years	50	17.9	17.9
	3-7 years	64	22.9	40.9
	8-13 years	25	9.0	49.8
	14-18 years	30	10.8	60.6
	19-24 years	35	12.5	73.1
	25-30 years	59	21.1	94.3
	31-36 years	15	5.4	99.6
	37-41 years	1	.4	100.0
	Missing responses	0		
Nature of work	Non-technical	69	24.7	24.7
	Technical frontline (TO)	29	10.4	35.1
	Technical frontline (STO)	46	16.5	51.6
	Technical frontline (PTO)	46	16.5	68.1
	Technical support	71	25.4	93.5
	Manager / Supervisor	18	6.5	100.0
	Missing responses	0		

The task grade (job grade) indicates an even spread between the operational (46.2%) (e.g. technical entry levels such as junior electrician, customer service representative, administrative support), and functional (46.6%) (e.g. senior electrician, technician, engineer, supervisor) job categories. In addition, 22.9% of the sample reported 3-7 years of service and 21.1% between 25 and 30 years of service. The total number of technical frontline employees (N=121) accounts for 43.4% of the sample in relation to the nature of their work.

7.4.3 Distribution of the participants according to workplace incident, lost time injury, medical, damage, near misses, vehicle accident, fault, and average business kilometres travel per month

The characteristics of the participants according to self-reported safety incident data are shown in Table 7.3.

Table 7.3 Safety incident data of the participants

Safety incident-related characteristics		Frequency	Percent	Cumulative percent
Workplace incident/accident	Yes	201	72.0	72.0
	No	78	28.0	100.0
	Missing responses	0		

Table 7.3 Safety incident data of the participants (continued)

Safety incident-related characteristics		Frequency	Percent	Cumulative percent
Lost time injury	Contact	6	2.2	42.9
	Vehicle	1	.4	50.0
	Other	7	2.5	100.0
	None (missing)	265	95.0	
Medical	Contact	5	1.8	8.9
	Vehicle	28	10.0	58.9
	Other	23	8.2	100.0
	None (missing)	223	79.9	
Damage	Vehicle	212	76.0	98.1
	Other	4	1.4	100.0
	None (missing)	63	22.6	
Near miss Incident/accident	Contact	7	2.5	77.8
	Vehicle	2	.7	100.0
	None (missing)	270	96.8	
Fault	At fault	58	20.8	20.8
	Not at fault	148	53.0	73.8
	Not sure	73	26.2	100.0
Average business kilometres per month	0-1000km	61	21.9	21.9
	1001-2000km	63	22.6	44.4
	2001-3000km	41	14.7	59.1
	3001-4000km	28	10.0	69.2
	4001-5000km	21	7.5	76.7
	5001-6000km	5	1.8	78.5
	6001-7000km	4	1.4	79.9
	7001-8000km	5	1.8	81.7
	more than 8000km	12	4.3	86.0
	not sure	39	14.0	100.0

Results on the safety incident data, as reported by the respondents, indicate that 72.0% were involved in a workplace incident, with 76.0% related to vehicle damage compared to lost time and medical incidents as well as near misses. 223 respondents reported to have been involved in a vehicle accident (work- and non-work-related), with 53.0% indicating that they were not at fault. Furthermore, 22.6% indicated that they drive between 1001-2000 business kilometres per month, and 21.9% between 0-1000 kilometres per month.

An explanation of the differences between the psychological factors based on the biographical and safety performance data of the participants is presented in Chapter 8.

The process of data gathering is explained in the next section.

7.5 DATA GATHERING

The participants were informed by their respective managers about the objective of the study and encouraged to participate in the research project. Individuals were notified in writing of the date, time and venue where the completion of the measuring battery would take place. The Psytech instruments (GRT2, SRT2 and OPP) were completed on computer using the Genesys 3 Software System (Psytech International) at those venues where computers were available. The administration of the Psytech Tests was conducted by means of pen and paper at those sites without access to computers. The other questionnaires (e.g. the Maslach Burnout Inventory) were completed by means of pen and paper. The completion of the measuring battery was supervised by a person trained in behavioural science at each of the workstations according to a specific roster (date and time). All respondents were informed of the goal of the study and issues related to confidentiality and ethical use of the data were emphasised. A biographical questionnaire was included to capture information about the participants such as race, gender, age, language, qualification, job title, and various safety performance data, such as kilometres travelled, type of incident or accident etc.

In the next section, the measurement instruments selected for this study are explained, together with aspects such as reliability, validity and rationale for inclusion.

7.6 MEASURING INSTRUMENTS

The *General Reasoning Test* (GRT2 – verbal, numerical and abstract reasoning test) and the *Spatial Reasoning Test* (SRT2) were used to measure general intelligence. The *Occupational Personality Profile* (OPP) and the *Basic Traits Inventory* (BTI) measured personality. Three measuring instruments, namely the *Maslach Burnout Inventory – General Survey* (MBI-GS), the *Utrecht Work Engagement Scale* (UWES), and the *Orientation to Life Questionnaire* (OLQ) were used to measure aspects of work wellness. Lastly, the *Company Accident Risk Management Survey* (CARMS) was used to measure attitude towards work place safety (dependent variable).

A multi-sample study done by Schaufeli and Bakker (2004) investigating job demands and job resources, and their relationship with burnout and work engagement, combined the burnout and work engagement items randomly into a 33-item questionnaire to avoid answering bias. Similarly, for this research, the burnout (MBI-GS) and work engagement (UWES) items were randomly merged into a 21-item questionnaire concentrating on the core items/dimensions of burnout (Exhaustion and Cynicism) and work engagement (Vigour and Dedication) (e.g. Rothmann, 2003; Schaufeli & Bakker, 2004), also to avoid answering bias. In addition, a biographical questionnaire was included to capture aspects of the respondent's characteristics such as race, gender, age and other self-reported safety performance data. As mentioned in section 7.7.2.1, no exploratory or confirmatory factor analyses were conducted on the intelligence and personality measurement instruments due to aspects of intellectual property rights and confidentiality agreements. Therefore, the results of the reliability analysis performed on the measurement instruments by the service providers are reported as follows: (1) the intelligence constructs (verbal, numerical and abstract reasoning) in section 7.6.1.1.2 and spatial reasoning in section 7.6.1.2.2: (2) the personality constructs in section 7.6.2.1.2 (Occupational Personality Profile) and section 7.6.2.2.2 (Basic Traits Inventory).

The results of the exploratory factor analysis of the work wellness constructs (burnout, work engagement, and sense of coherence), and the attitude towards workplace safety constructs (safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) are reported in section 7.7.2.1.1. Lastly, the results of the confirmatory factor analysis of the work wellness constructs (burnout, work engagement and sense of coherence), and the attitude towards workplace safety constructs (safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) are reported in section 7.7.2.1.2.

The following section provides a detailed discussion on the measurement instruments that measure the cognitive constructs used in this study, namely general verbal, numerical and abstract reasoning and the spatial reasoning test.

7.6.1 GENERAL INTELLIGENCE

For the purpose of this study, the General Reasoning Test (GRT2), the Spatial Reasoning Test (SRT2), and a sub-scale of the Technical Test Battery (TTB2) developed by Psytech International (1998), were used to measure aspects of general intelligence. These tests are explained next, focusing on the nature and composition, reliability, validity and rationale for inclusion.

7.6.1.1 The General Reasoning Test (GRT2)

The General Reasoning Test (GRT2) (Psytech, 1998) was used to assess the general mental reasoning ability of the respondents. The GRT2 was designed to measure three areas of ability namely verbal, numerical and abstract reasoning. The three sub-tests of the GRT2 are explained next.

7.6.1.1.1 Nature and composition of the General Reasoning Test (GRT2)

The verbal (VR2) and numerical (NR2) sub-tests assess the ability to use words and numbers in a rational way, identifying logical relationships between these entities and drawing conclusions and inferences from them. The abstract reasoning (AR2) sub-test assesses the ability to identify logical relationships between abstract spatial relationships and geometric patterns. According to Psytech International (1998), the abstract reasoning tests are the least affected by educational experience and assess 'innate' reasoning ability. In addition, each item was constructed so that only a minimal educational level was needed in order to be able to correctly solve each item. A number of different item types (e.g. odd one out, word meanings etc.) were used to measure each aspect of reasoning ability. This was done in order to ensure that each sub-scale measures a broad aspect of reasoning ability (e.g. verbal reasoning ability), rather than measuring a very specific aptitude (e.g. vocabulary).

In addition, the use of different item types ensures that the test measures different components of reasoning ability. The GRT2 is intended for respondents with educational levels ranging from high school through to graduate levels. It is further recommended that these batteries should not be used on persons with an educational level below Grade 9 (Tredoux, 2004).

The subtests of the GRT2 can be administered separately or together, and may be combined with other measures, such as measures of personality, learning potential or abstract reasoning, to form a customised battery. The VR2 consists of 35 questions and takes 8 minutes to complete, the NR2 consists of 25 questions and takes 10 minutes to complete and the AR2 consists of 25 questions and takes 10 minutes to complete.

7.6.1.1.2 Reliability

The reliability of a specific measurement instrument tapping a specific construct has to do with the stability, dependability, and predictability of measuring something precisely or consistently. Whether it actually measures or taps the specific ability relates to the issue of validity (Kerlinger & Lee, 2000). While many personality tests are considered to have acceptable levels of reliability if they have reliability coefficients in excess of 0.7, reasoning tests should have reliability coefficients in excess of 0.8 (Psytech International, 1998). According to the technical manual for the General Reasoning Test, Psytech International (1998) found the following alpha coefficients for the three sub-scales of the GRT2 (N=135), VR2 (0.83), NR2 (0.84), and AR2 (0.83). Within a South African context, Tredoux (2004), reports the following internal consistency reliabilities for SA General Population (male N=1104, female N=1066), namely VR2 (0.86), NR2 (0.86) and AR2 (0.81).

In addition, Venter, Kriek and Tredoux (2004) found good internal reliabilities on the GRT2 of senior and junior electricians (N=88) in an electricity supply organisation in South Africa. The researchers report the following reliability coefficients for the subtests: VR2 (0.78), NR2 (0.85), and AR2 (0.84). It is clear from the above that the GRT2, with subtests VR2, NR2, and AR2 demonstrate high internal consistency in measuring each underlying ability.

The results of the reliability analysis conducted by Psytech South Africa (service provider) on the intelligence constructs (verbal, numerical and abstract reasoning) based on the responses of the participants are reported below (Tables 7.4, 7.5. and 7.6). The tables include information such as the mean score, standard deviation, valid responses (*N*), Cronbach's alpha, standardised alpha, and average inter-item correlation.

Table 7.4 Reliability analysis: general verbal reasoning (VR2)

Mean	Std dev	N	Cronbach's alpha	Standarised alpha	Average inter-item correlation
12.5740	6.26	277 (missing responses 2)	0.87	0.87	0.158

The results of the reliability analysis of the General Numerical Reasoning Tests are presented in Table 7.5.

Table 7.5 Reliability analysis: general numerical reasoning (NR2)

Mean	**Std dev**	**N**	**Cronbach's alpha**	**Standarised alpha**	**Average inter-item correlation**
7.24188	4.96	277 (missing responses 2)	0.86	0.87	0.207

The results of the reliability analysis of the General Abstract Reasoning Tests are presented in Table 7.6.

Table 7.6 Reliability analysis: general abstract reasoning (AR2)

Mean	**Std dev**	**N**	**Cronbach's alpha**	**Standarised alpha**	**Average inter-item correlation**
10.8231	6.00	277 (missing responses 2)	0.88	0.88	0.224

From Tables 7.4, 7.5 and 7.6, it is evident that the reliability coefficients of all three intelligence constructs (verbal, numerical and abstract reasoning) are above the acceptable range of 0.60 as proposed by Nunnally (1967). Therefore, the sub-tests of the General Reasoning Tests battery showed high internal consistency in measuring each underlying ability. The results are in line with the findings reported by Psytech International (1998), Tredoux (2004), and Venter et al. (2004).

7.6.1.1.3 Validity

Validity addresses the question of whether or not the scale is measuring the characteristic it was developed to measure. In assessing the relationship between the GRT2 test's three sub-scales by means of the Pearson product-moment correlation, Psytech International (1998) found strong correlations between each sub-scale (N=1441), VR2 and NR2 (0.60), VR2 and AR2 (0.56), and NR2 and AR2 (0.65). This finding indicates that each sub-scale is measuring one underlying characteristic, which is likely to be reasoning ability or mental alertness. The fact that each sub-scale accounts for less than 45% ($r<0.65$) of the variance in the other sub-scales indicates that the VR2, NR2, and AR2 sub-scales of the GRT2 are still measuring distinct aspects of reasoning ability.

Validation studies conducted in South Africa by Tredoux (2004) report significant correlations at the 5% level between the sub-scales of the GRT2 (N=25 candidates for articled clerkships at a South African bank), VR2 and NR2 (0.63), VR2 and AR2 (0.55), and NR2 and AR2 (0.78). These findings confirm those reported by Psytech International (1998) that the GRT2 is likely to measure reasoning ability or mental alertness. However, Tredoux (2004) recommends more validity studies within a South African context. The rationale for the inclusion of the general reasoning test (verbal, numerical and abstract reasoning) is discussed next.

7.6.1.1.4 Rationale for inclusion

The GRT2 has been shown to exhibit high reliability and validity results internationally as well as within a South African context. This means that the GRT2, with sub-scales VR2, NR2, and AR2, is likely to measure general intelligence or mental alertness. In addition, the GRT2 test forms part of the official psychological test instruments used by the electricity supply organisation for selection and career development purposes. Therefore, this research project provides the opportunity to strengthen the reliability and validity as well as the relationship with safety attitudinal behaviours in a public electricity company in South Africa.

7.6.1.2 The Spatial Reasoning Test (SRT2)

The Spatial Reasoning Test (SRT2) (Psytech, 1998) was used to assess respondents' ability to manipulate and reason about shapes and spatial relationships. The nature and composition of the SRT2 are discussed in the next section.

7.6.1.2.1 Nature and composition of the Spatial Reasoning Test (SRT2)

The SRT2 assesses the ability to work with three-dimensional relationships. In other words, it assesses how well a person thinks in three dimensions. According to Psytech International (technical test battery manual), research has demonstrated that certain technical abilities (mechanical reasoning, spatial reasoning and visual acuity) are not accounted for by 'general intelligence' but are specific, measurable abilities in their own right. However, general reasoning abilities should also be taken into account when considering technical ability.

The SRT2 is a sub-test of the technical test battery (TTB) developed by Psytech International (1998). It measures how well a person can visualise, or form mental pictures of, solid objects from looking at flat paper plans. The items were selected to represent a wide range of shapes like cubes, pyramids, cones, rhomboids and a variety of other multifaceted shapes. The subtests of the TTB can be administered separately or together, and may be combined with other measures, such as measures of personality, learning potential or abstract reasoning (Psytech International, 1998).

The TTB is intended for respondents with an educational level of Grade 12, or an equivalent technical qualification (Tredoux, 2004). The spatial reasoning test consists of 30 questions and respondents have 15 minutes in which to attempt them.

7.6.1.2.2 Reliability

The spatial reasoning test falls within the cognitive paradigm/structure measuring a specific ability and should have a reliability coefficient in excess of 0.8 (Psytech International, 1998). According to the technical manual for the technical reasoning test, Psytech International (1998), found the following alpha coefficient (0.84) for the spatial reasoning sub-scale of the technical test battery (TTB). Within a South African context, Tredoux (2004), reports the following reliability coefficients:

- SA apprentice applicants (N=228), educational level between Grade 9 and N3 diploma, with gender (male=205 and female=18), and race representation of (whites and coloureds = 68 and blacks = 156) reported alpha coefficient of 0.60 for the SRT2.
- Data collected during 2002-2003 of workers at and applicants to a construction company based in the Western Cape, South Africa (N=223) reported a reliability coefficient of 0.91. The sample consist of 124 Blacks, 2 Asians and 95 Whites and Coloureds of which 204 were male and 18 female.

In addition, Venter, Kriek and Tredoux (2004) found good internal reliabilities on the TTB of senior and junior electricians (N=88) in an electricity supply organisation in South Africa. The researchers report the following reliability coefficients for the sub-scale: SRT2 0.74.

The sample was also representative of the South African population in terms of race. The results of the reliability analysis conducted by Psytech South Africa (service provider) on the spatial reasoning test based on the responses of the participants are reported below (Table 7.7). The table includes information such as the mean score, standard deviation, valid responses (*N*), Cronbach's alpha, standardised alpha, and average inter-item correlation.

Table 7.7 Reliability analysis: spatial reasoning (SRT2)

Mean	Std dev	N	Cronbach's alpha	Standarised alpha	Average inter-item correlation
9.16245	4.323	277 (missing responses 2)	0.71	0.70	0.071

It is clear from the above table that the sub-scale SRT2 of the TTB demonstrates an acceptable reliability coefficient value of above 0.60 as proposed by Nunnally (1967), but lower than the proposed value (more than 0.80) for reasoning ability tests (Psytech International, 1998). As with the results of the intelligence tests, the reliability coefficient of the SRT2 test is in line with the findings reported by Psytech International (1998), Tredoux (2004) and Venter et al. (2004).

7.6.1.2.3 Validity

Validity addresses the question of whether or not the scale is measuring the characteristic it was developed to measure. In assessing the relationship between the TTB test's three sub-scales by means of the Pearson product-moment correlation, Psytech International (1998), found strong correlations (*N*= 83) between each sub-scale,, mechanical reasoning and spatial (0.44), and spatial and visual (0.45), which indicate that each scale measures one facet of an underlying trait. This is clearly consistent with the design of this test, where each test was intended to assess a different facet of technical ability. The fact that each sub-scale accounts for no greater than 25% (r<=0.50) of the variance in the other sub-scales indicates that the mechanical, spatial, and visual acuity tests of the TTB measure different facets of technical ability.

Pearson product-moment correlations between the three sub-scales of the GRT2 and the spatial reasoning test of the TTB amply demonstrate two points. Firstly, the fairly strong correlations between the reasoning sub-scales and the spatial reasoning test (spatial and verbal) 0.31, (spatial and numerical) 0.39, and (spatial and abstract) 0.45, indicate that reasoning ability, or mental alertness, plays a role in technical (including spatial) abilities. This is not surprising as numerical and verbal skills are important factors in technical fields. Secondly, the fact that each subscale accounts for less than 30% ($r < .55$) of the variance in the TTB indicates that the tests that make up the TTB do in fact measure more than just reasoning ability (Psytech International, 1998).

Validation studies conducted in South Africa by Tredoux (2004) report significant correlations at the 5% level between the sub-scale spatial reasoning ability of the TTB (N=157) with the three sub-scales of the GRT2, namely spatial and verbal (0.41), spatial and numerical (0.56), and spatial and abstract (0.52). The overall correlation points to the influence of a general ability factor. The VR2 subtest had the lowest correlation with SRT2, which can be explained by the fact that the SRT2 test has a low verbal content and therefore places fewer demands on a respondent's verbal ability.

Another study done by Tredoux (2004) with a sample of 464, indicates the following significant correlations between the SRT2 sub-scale of the TTB and the three sub-scales of the GRT2, namely SRT2 and VR2 (0.49), SRT2 and NR2 (0.51), and SRT2 and AR2 (0.55). This finding supports the findings of the aforementioned study, suggesting the influence of a general ability factor, or 'g'. The relationship between VR2 and SRT2 was lower than the other correlations, indicating that spatial reasoning relies on verbal ability to a lesser extent.

These findings confirm those reported by Psytech International (1998) that the sub-scale spatial reasoning of the TTB has a significant reasoning component and that it is not only a test of spatial perception (Tredoux, 2004).

In the next section, the rationale for the inclusion of the spatial reasoning in this study is shown.

7.6.1.2.4 Rationale for inclusion

The sub-scale SRT2 of the TTB has been shown to exhibit high reliability and validity results internationally as well as within a South African context. This means that the SRT2 measures technical spatial ability as well as a significant reasoning component of overall general intelligence. In addition, the TTB with sub-scale SRT2 is one of the official psychological test instruments used by the electricity supply organisation's for selection and career development especially within the technical field. Therefore, this research project provides the opportunity to strengthen the reliability and validity of the tests as well as the relationship with safety attitudinal behaviours in a public electricity company in South Africa.

7.6.2 PERSONALITY

The *Occupational Personality Profile* (OPP) (Psytech, 2002) and the *Basic Traits Inventory* (Taylor & De Bruin, 2006) were used to measure the construct personality. The reasons for the inclusion of two personality inventories are as follows:

- The Occupational Personality Profile (OPP) is developed to measure participants' personality within industry and organisational settings. Hence, it represents personality traits that are occupation specific.
- The Occupational Personality Profile (OPP) is one of the psychometric measuring instruments that the organisation uses for recruitment and selection purposes. Therefore, it is important to test whether these personality traits measured by the OPP are likely to influence attitude towards workplace safety.
- The Five-Factor Personality Inventory has been cited in many research studies (e.g. Arthur & Graziano, 1996; Frone, 1998; Hansen, 1989; Yagil, 2001) investigating the relationship between personality and safety-related behaviour, including driver behaviour. Because of the limited number of studies published regarding the use of the OPP personality questionnaire in safety behaviour, the South African version of the Big Five Personality Factor was included in the study.

The two personality inventories are discussed next.

7.6.2.1 The Occupational Personality Profile (OPP)

The occupational personality profile (OPP) is a personality test developed for use in industrial and organisational settings. The OPP was developed in the UK by using a large sample of applicants drawn from a wide range of occupational groups for use in personnel assessment and selection. The nature and composition of the OPP are discussed in the next section.

7.6.2.1.1 Nature and composition of the Occupational Personality Profile (OPP)

The OPP consists of 98 items that measure personality in terms of nine different personality dimensions (see Table 7.8) in addition to the distortion scale. Each of the nine dimensions measured by the OPP is bi-polar. That is, there are high and low scores on each dimension measure opposite personality characteristics (e.g. extraversion versus introversion, tough-minded versus tender-minded etc.). The OPP attempts to achieve an optimal balance between the amount of items and reliability and the measuring of broad, meaningful personality constructs. For this reason, a five-point response scale rather than the more usual three-point scale (e.g. strongly agree to strongly disagree rather than true, uncertain, false) was chosen by the test developers. A five-point scale has the advantage of increasing item variance with the result that fewer items are needed to achieve the same level of reliability (Psytech International, Technical Manual, OPP). A brief explanation of the meaning of a low and high score on the nine dimensions as measured by the OPP is shown in Table 7.8.

Table 7.8 Description of the Occupational Personality Profile (OPP) dimensions

FACTOR	LOW SCORE (-)	HIGH SCORE (+)
Accommodating – Assertive	**Low scorers** are likely to be empathic, people-oriented, accommodating, sensitive to people's feelings, and avoid confrontation.	**High scorers** are inclined to be dominant, task-oriented, challenging, unconcerned about others' feelings, and confrontational.
Detail-conscious – Flexible	**Low scorers** are likely to be punctilious, controlled, rigid, fine eye for detail, and conscientious.	**High scorers** are likely to be spontaneous, lack self-discipline and self-control, flexible, dislike attending to detail, and disregard rules and procedures.
Cynical – Trusting	**Low scorers** are likely to be suspicious, cynical, inclined to question others' motives, sceptical, and may distrust other people.	**High scorers** are likely to be trusting, philanthropic, take people at face value, have faith in others, and are sometimes a little credulous.
Emotional – Phlegmatic	**Low scorers** are likely to be prone to worry and moodiness, inclined to be anxious in social settings, troubled by feelings of anxiety and self-doubt, and easily take offence.	**High scorers** are likely to be self-assured, emotionally stable, socially confident, secure, and resilient.
Reserved – Gregarious	**Low scorers** are likely to be reserved, cool and introspective, prefer to work alone, enjoy own company, and may be aloof and detached.	**High scorers** are inclined to be outgoing and sociable, lively and talkative, enjoy working with others, high need for affiliation, and warm and participating.

Table 7.8 Description of the Occupational Personality Profile (OPP) dimensions (continued)

Genuine – Persuasive	**Low scorers** are likely to base their behaviour on own feelings and attitudes, forthright, honest and open, genuine and sincere, and may lack tact and diplomacy.	**High scorers'** behaviour is likely to be determined by the demands of the situation, diplomatic, manipulative and expedient, shrewd and calculating, and sensitive to political issues.
Composed - Contesting	**Low scorers** are likely to be calm and composed, able to delegate, keep work separate from home life, able to unwind and relax, are tolerant and able to distance themselves from work pressure.	**High scorers** are likely to be ambitious and competitive, may take on too much work, work long hours, have difficulty relaxing, be impatient, and may be prone to stress-related illnesses.
Optimistic – Pessimistic	**Low scorers** are likely to believe their own actions determine outcomes, are achieving and striving, have a positive approach to set-backs, are optimistic, and believe they are in control of their own destiny (internal locus of control).	**High scorers** are likely to feel resigned, prone to feelings of helplessness, inclined to pessimism, fatalistic, and have little faith in their ability to determine events (external locus of control).
Abstract – Pragmatic	**Low scorers** are likely to be imaginative, aesthetically sensitive, creative and artistic, abstract and intellectual, and may have a theoretical orientation.	**High scorers** are likely to be down to earth and concrete, not interested in artistic matters, practical and realistic, pragmatic, and more concerned with "how" than "why".

The OPP was introduced in South Africa in 1995. It was only once Psytech South Africa was formed in 1998 and comparative reliabilities with other tests computed, that the potential of the OPP for use in South Africa was realised. Based on research done with the assistance of the South African Police Services, some of the items were revised to raise the internal consistency reliabilities and make the test questions better understood. The South African revised items have been available since 2002, and are currently used by various South African organisations for recruitment and selection purposes. Furthermore, the Health Professions Council of South Africa has certified the OPP as a psychological test (Tredoux, SA user guide, OPP).

7.6.2.1.2 Reliability

In order to provide meaningful interpretations, the occupational personality profile (OPP) was standardised against a number of relevant groups (e.g. referred to as specific or relevant norm groups). A critical aspect in the validation process of personality measurements is the extent to which the variation in measurement is due to true differences between people on the trait being measured, or to measurement error. Therefore, low stability coefficients (< approx. 0.6) suggest that the behaviours/attitudes being measured are either volatile or situationally specific, which may influence the content of the scale to be irrelevant or obsolete.

Psytech International (technical manual, OPP) conducted studies on gender differences on the OPP by comparing results of 1194 males with 1395 female respondents. The findings indicate that the largest difference obtained between males and females is on the abstract-pragmatic dimension, with males emerging as significantly more pragmatic than females. Females in turn are more composed, genuine, emphatic, emotional and trusting than males. They are also more pessimistic (external locus of control) than males. No statistically significant differences were found on the flexible–rigid, reserved–gregarious and distortion scales. The relationship between age (16-64 with a mean of 31 and SD of 10.5) and OPP scores of 2392 respondents revealed only one dimension to have a substantial age effect, namely reserved–gregarious. Younger respondents are likely to be more attracted towards social events than the older respondents. No significant differences were found between ethnic groups (black, Asian, other, and Genesys UK undergraduate norm group) on OPP scores.

Internal consistency reliabilities (Cronbach's alpha) were computed for an OPP sample (UK respondents) of 942 and the OPP dimensions revealed reliability coefficients above 0.60 for both male and female groups indicating that the OPP meets an acceptable standard of reliability. The mean alpha scores (both males and females) are assertive (0.71), flexible (0.77), trusting (0.83), phlegmatic (0.75), gregarious (0.67), persuasive (0.75), contesting (0.75), pessimistic (0.71), pragmatic (0.70), and distortion (0.66). Furthermore, the OPP provided consistent measurements (> 0.60) for diverse groups with only relatively small fluctuations in alpha values. Test-retest estimates of reliability over one and three month-periods of two independent groups in the UK indicate that the OPP remains highly consistent over both time periods with all coefficients above 0.70 and on average above 0.80 (Psytech International, technical manual, OPP).

The following mean Cronbach's alpha coefficients (OPP original items) were found from 852 participants that were tested in South Africa by Psytech and users of the OPP in various occupational settings since 1996: Blacks (0.63), Whites, Coloureds and Asians (0.70) (Psytech SA, 2003). Tredoux (2004) further reports the following acceptable mean reliability coefficients (OPP revised SA items) for different race groups of SA Police applicants tested in 2001-2002: Whites (N=1748) 0.66, Blacks (N=30265) 0.51, Coloured (N=1585) 0.60, and Asian (N=1199) 0.67 (Tredoux, 2005).

Venter, Kriek and Tredoux (2004) used the OPP in a study investigating the psychological, physical, and competency characteristics of productive, safe working electricians in an electricity supply organisation in South Africa and reported the following mean Cronbach's alpha coefficient, namely 0.65 (0.61 accommodating–assertive, 0.53 detail-conscious–flexible, 0.67 cynical–trusting, 0.77 emotional–phlegmatic, 0.68 reserved–gregarious, 0.59 genuine–persuasive, 0.68 composed–contesting, 0.62 optimistic–pessimistic (internal external locus of control), 0.76 abstract–pragmatic and social conformity 0.59).

The results of the reliability analysis conducted by Psytech South Africa (service provider) on the Occupational Personality Profile based on the responses of the participants are reported below (Table 7.10). The table includes information such as the variable, mean score, standard deviation, valid responses (*N*), Cronbach's alpha, standardised alpha, and average inter-item correlation.

Table 7.9 Reliability analysis: occupational personality profile (OPP)

Variable	Mean	Std dev	N (missing 1)	Cronbach's alpha	Standarised alpha	Average inter-item correlation
Accomodating vs Assertive	30.53	4.918	278	0.56	0.56	0.114
Detail Conscious vs Flexible	15.78	3.839	278	0.51	0.53	0.123
Cynical vs Trusting	31.17	6.01	278	0.68	0.68	0.166
Emotional vs Phlegmatic	35.84	6.53	278	0.70	0.71	0.168
Reserved vs Gregarious	30.68	5.44	278	0.58	0.59	0.125
Genuine vs Persuasive	24.74	4.89	278	0.62	0.62	0.156
Composed vs Contesting	29.96	6.21	278	0.73	0.73	0.222
Optimistic vs Pessimistic	23.69	5.40	278	0.73	0.73	0.252
Abstract vs Pragmatic	30.89	4.93	278	0.52	0.52	0.099

The results in Table 7.9 indicate that five scales (assertive, flexible, gregarious, persuasive and pragmatic) show a lower value of acceptable reliability coefficient and may have limited applicability (Nunnally, 1967). Four scales, namely trusting, phlegmatic, contesting, and pessimistic (external locus of control) demonstrate an acceptable reliability coefficient above 0.65 as proposed by Nunnally (1967). Similar results have been reported by Psytech International (1998), Tredoux (2004), and Venter et al. (2004).

7.6.2.1.3 Validity

Numerous test validation studies (e.g. OPP and 16PF factors, OPP and 15FQ scales, OPP and OPQ Factor 5, etc.) have been done by Psytech International to determine the construct validity of the OPP in the UK. For example, a significant amount of overlap between the OPP and 15FQ scales was evident with multi-correlations exceeding 0.69 on eight OPP dimensions. Multiple correlations between the OPP and the OPQ Factor 5 clearly demonstrate that the personality characteristics measured by the OPP are consistent with those measured by the OPQ, with the exception of the OPP dimensions contesting (0.44) and pessimistic (0.43). In addition, multiple regression analysis between the OPP and the NEO short form revealed very high multiple R (e.g. 0.75 between NEO-neuroticism and low scores on OPP-assertiveness, low scores on OPP-trusting, low scores on OPP-phlegmatic and high scores on OPP-pessimism) in each case by a relatively small number of OPP dimensions. The high multiple regression (a statistical technique to examine which variable or variables have been significantly explained by a set of predictors) tends to demonstrate that the OPP has excellent coverage of the "Big-Five" and would more than justify using the OPP to predict "Big-Five" scores (Psytech International, Technical Manual, OPP).

Psytech South Africa has done construct validity studies on the original version of the OPP with a number of measuring instruments (e.g. Big Five self-ratings, OPQ 32n, 15FQ+ revised version, etc.) within the South African context. Psytech South Africa reports the following significant correlations between the OPP and the Big Five self-rating scale, namely neuroticism and phlegmatic (-0.32), extraversion and gregarious (0.46), extraversion and persuasive (0.49), agreeableness and conforming (0.31), and conformity and trusting (0.37). No significant correlation was found between openness and any of the OPP factors. While the correlations were not very high, the ones that were statistically significant reflect relationships that are in line with expectations according to the definitions of the scales.

Therefore, these correlations can be taken as evidence of the construct validity of the OPP.

In addition, correlations between the OPP and SHL OPQ 32n revealed the following multiple regression results of OPQ variables onto the OPQ scale, namely:

- Assertive (0.68) (OPQ scales outspoken and controlling)
- Flexible (0.64) (OPQ scales conventional, achieving, and rule following)
- Trusting (0.72) (OPQ scales trusting, conceptual, and evaluative)
- Phlegmatic (0.74) (OPQ scales tough- minded, worrying, trusting, detail conscious, and relaxed)
- Gregarious (0.67) (OPQ scales affiliative, socially confident, and conceptual)
- Persuasive (0.64) (OPQ scales conceptual, outgoing, persuasive, conventional, and evaluative)
- Contesting (0.52) (OPQ scales trusting and decisive)
- Pessimistic (0.70) (OPQ scales optimistic, behavioural, evaluative, trusting, persuasive, and forward thinking)
- Pragmatic (0.62) (OPQ scales innovative, optimistic, conceptual, and outgoing).

According to Psytech South Africa (SA user guide, OPP), the abovementioned results support the construct validity of both questionnaires.

The rationale for the inclusion of the OPP is discussed in section 7.6.2.2.4.

7.6.2.2 The Basic Traits Inventory (BTI)

The *Basic Traits Inventory* (BTI) (Taylor & De Bruin, 2006) is a personality inventory that has been developed in South Africa based on the Big Five factor model of personality, which has consistently shown to have cross-cultural applicability (McCrae et al., 2004). These factors are extraversion, neuroticism, conscientiousness, openness to experience, and agreeableness, which includes a measure of social desirability.

In the next section, the nature and composition of the BTI are explained.

7.6.2.2.1 Nature and composition of the Basic Traits Inventory (BTI)

According to Taylor and De Bruin (2006), each of the five factors is subdivided into four or five facets (see Table 7.10), which allows the test user to create a more meaningful and in-depth personality profile for the test taker. Furthermore, the BTI can be used in almost any context where personality assessment is done, such as psychodiagnostics, recruitment and selection, personal development, educational settings, counseling, and research. The instrument consists of 193 items that measure personality in terms of the Five Factors and items are rated on a five-point Likert-type scale, with responses ranging from "Strongly Agree" to "Strongly Disagree". Scoring is done by converting the test taker's raw scores into McCall's T scores. T scores typically range between 20 and 90 and have a mean of 50 and a standard deviation of 10. Scores below 40 can be interpreted as low, and scores above 60 are seen as high (Taylor & De Bruin, 2006).

Each factor and facet scale as measured by the BTI is described in Table 7.10.

Table 7.10 Definitions of the factors and facets of the Basic Traits Inventory (BTI)

BTI factor & definition	BTI facet	BTI facet definition
Extraversion (E) Extraversion refers to the degree to which an individual enjoys being around other people, likes excitement and stimulation and is cheerful in disposition.	Ascendance	The degree to which a person enjoys entertaining or dominating large groups of people
	Liveliness	The degree to which a person is bubbly, lively and energetic
	Positive affectivity	The tendency to frequently experience emotions such as joy, happiness, love, and be enthusiastic, optimistic and cheerful
	Gregariousness	The tendency to have a need for frequent social interaction and a preference for being surrounded by people
	Excitement-seeking	The degree to which a person has a need for adrenaline-pumping experiences and stimulation from noisy places, bright colours or other such intense sensations
Neuroticism (N) Neuroticism refers to a person's emotional stability, and the general tendency to experience negative effects to their environment.	Affective instability	The tendency to be easily upset, have feelings of anger or bitterness and be emotionally volatile
	Depression	A tendency to experience guilt, sadness, and hopelessness, and to feel discouraged and dejected
	Anxiety	The tendency to experience worry, nervousness, apprehensiveness, and tension
	Self-consciousness	The degree to which a person is sensitive to criticism, and has frequent feelings of shame and embarrassment

Table 7.10 Definitions of the factors and facets of the Basic Traits Inventory (BTI) (continued)

BTI factor & definition	BTI facet	BTI facet definition
Conscientiousness (C) Conscientiousness is the degree of effectiveness and efficiency with which a person plans, organises and carries out tasks.	Order	The tendency to keep everything neat and tidy and in its proper place, and to be methodical
	Self-discipline	The tendency to start tasks immediately and carry them through to completion, and to be able to motivate oneself to complete unpleasant tasks
	Dutifulness	The tendency to stick to principles, fulfill moral obligations and be reliable and dependable
	Effort	The degree to which an individual sets ambitious goals and works hard to meet them, and is diligent and purposeful
	Prudence	The tendency to think things through carefully, check the facets and have good sense
Openness to Experience (O) It deals with the extent to which people are willing to experience new or different things and are curious about themselves and the world.	Aesthetics	The tendency to have an appreciation for art, music, poetry and beauty, without necessarily having artistic talent
	Actions	The degree to which a person is willing to try new and different activities
	Values	The degree to which a person is willing to re-examine social, political and religious values
	Ideas	The degree to which a person has intellectual curiosity, enjoys considering new or unconventional ideas, and relishes philosophy and brainteasers
	Imagination	The degree to which a person has a vivid imagination, enjoys fantasies and thinking creatively
Agreeableness (A) This factor relates to the degree to which an individual is able to get along with other people, and has compassion for others.	Straightforwardness	The tendency to be frank and sincere, and value honesty
	Compliance	The degree to which a person defers to others, inhibits aggression and is able to "forgive and forget"
	Prosocial tendencies	The degree to which a person has concern for the greater community, and willingly devotes time to help the less privileged
	Modesty	The degree to which a person is humble and self-effacing
	Tender-mindedness	The tendency to have sympathy and concern for others

7.6.2.2.2 Reliability

Taylor and De Bruin (2006) performed internal consistency reliability coefficients for each of the factors, as well as for the individual facets. The reliability coefficients of each of the five factors for the total group (black and white) were all satisfactory: extraversion (0.87), neuroticism (0.92), conscientiousness (0.93), openness to experience (0.87), and agreeableness (0.89). In addition, only one facet had a low reliability coefficient in the White group, namely openness to values (0.58). Two facets had low alpha coefficients in the Black group, namely openness to values (0.38), and modesty (0.51). These findings suggest that the reliability of the BTI five factors is very high for both Black and White population groups in South Africa (Taylor & De Bruin, 2006). Acceptable reliability coefficients were found by Thomson and De Bruin (2007), namely 0.89 (extroversion), 0.94 (neuroticism), 0.89 (openness to experience), 0.90 (agreeableness), and 0.91 (conscientiousness).

The results of the reliability analysis conducted by Jopie van Rooyen & Associates South Africa (service provider) on the Basic Traits Inventory (BTI) based on the responses of the participants are reported below (Table 7.11). The results reflect the Five Factors only and not the facet scales of each factor. The table includes information such as the variable, valid responses (*N*), Cronbach's alpha, and number of items.

Table 7.11 Reliability analysis: basic traits inventory (BTI)

Variable	**N**	**Cronbach's alpha**	**Number of items**
Extraversion	279	0.87	36
Neuroticism	278 missing 1	0.93	34
Conscientiousness	277 missing 2	0.94	41
Openness to experience	278 missing 1	0.89	32
Agreeableness	278 missing 1	0.90	37

The results from Table 7.11 indicate that each factor of the Five Factors as measured by the Basic Traits Inventory show very good reliability coefficient as proposed by (Nunnally, 1967).

7.6.2.2.3 Validity

Taylor and De Bruin (2004) performed factor analysis of each of the South African cultural groups to investigate the construct validity of the Basic Traits Inventory as well as factor congruence analysis to investigate the congruence between the factor structures for Black and White race groups, men and woman, and English, Afrikaans, and Indigenous African language groups. The results showed that the five-factor structure of the BTI is well supported for the total group, as well as for the White group, gender groups, English and Afrikaans language groups. The factor structures of the Black and Indigenous African groups deviated from the expected structure, with the Black group's structure being closer to the theoretical structure than the Indigenous African groups. The factor congruency analysis did not support the factorial agreement of the Black and White group's structure, but did for the gender groups. Furthermore, support of the factorial structure was evident for the English and Afrikaans factor congruence, but not for the English and Indigenous or Afrikaans and Indigenous African factor congruence (Taylor & De Bruin, 2006).

The researchers concluded that the results have shown a relatively stable five-factor structure for the Basic Traits Inventory, but at a facet level, further investigation or revision of those facets that performed consistently poorly is needed. No evidence could be found on any convergent and divergent studies that have been done to determine the construct validity of the BTI with other established personality constructs (e.g. OPP) (Taylor & De Bruin, 2004).

The reason for the inclusion of the OPP and BTI as measures of personality for this study are explained next.

7.6.2.2.4 Rationale for inclusion

According to a study done by Laher (2008) on the structural equivalence and the NEO-PI-R, the FFM is only partially applicable in an African, and more specifically a South African context. The necessity for research investigating not only the universal applicability of Western theories and instruments (the etics), but also the necessity for investigating the possibility of other personality factors not addressed by Western models that may be indigenous to specific cultures (the emics) or which may in themselves prove to be additions to the etics, are strongly recommended by Cheung, Cheung, Leung, Ward and Leong (2003) and Laher (2008).

To date, no personality instrument exists in South Africa that truly captures or assesses an African theory of personality. As a result, the majority of personality instruments used in South Africa are adapted versions of imported personality instruments (e.g. Psytech OPP, SHL OPQ, Psytech 15FQ+, etc.). Nevertheless, studies done by the service providers (e.g. Psytech SA, SHL, etc.) report acceptable internal consistency coefficients on their personality instruments for all cultural groups in South Africa. Evidence also exists in terms of their construct validity (e.g. OPP, SA user guide, 2003). The recent construction of the Basic

Traits Inventory (Taylor & De Bruin, 2006) attempts to maximise its cross-cultural suitability and evidence does exist demonstrating that the five factors as measured by the BTI can be extracted across the diversity of cultures in South Africa (e.g. De Bruin, Schepers & Taylor, 2005; Ramsay, Taylor, De Bruin & Meiring, 2005). As Laher (2008) comments, this pseudo-etic approach, while promising, still does not address whether or not the five factors are a comprehensive representation of personality in a South African context.

Based on the above, the inclusion of both the OPP and BTI as measurements of personality in this research project is as follows:

- The OPP measures specific personality dimensions for use in industrial and organisational settings.
- The OPP demonstrates acceptable reliability and validity results in a South African context.
- The OPP forms part of the official psychometric instruments used by the organisation for recruitment and selection.
- The five-factor model of personality has been extensively used in safety incident and driver behaviour research, hence the inclusion of the BTI as the only South African version of the five-factor model of personality, which demonstrates promising results regarding its reliability and validity.

7.6.3 MEASURES OF WORK WELLNESS

For the purpose of this study, the three measures that were selected to assess respondents' levels of work wellness are the *Maslach Burnout Inventory – General Survey*, the *Utrecht Work Engagement Scale*, and the *Orientation to Life Questionnaire*. Results on the reliability and validity analysis conducted on the three measures of work wellness are reported under Section 7.6.3.3.2 and Section 7.6.3.3.3. The three measuring instruments are discussed next.

7.6.3.1 The Maslach Burnout Inventory – General Survey (MBI-GS)

The *Maslach Burnout Inventory - General Survey* (MBI-GS) (Schaufeli et al., 1996) was used to measure burnout. The MBI-GS defines burnout as a crisis in one's relationship with work and not necessarily as a crisis in one's relationships with people at work (Maslach et al., 1996).

The nature and composition of the MBI-GS are explained next.

7.6.3.1.1 Nature and composition of the Maslach Burnout Inventory – General Survey (MBI-GS)

The MBI-GS has three sub-scales: exhaustion (Ex) (five items, e.g. "I feel used up at the end of the workday"), cynicism (Cy) (five items, e.g. "I have become less enthusiastic about my work") and professional efficacy (PE) (six items, e.g. "In my opinion, I am good at my job"). Together, the sub-scales of the MBI-GS provide a three-dimensional perspective on burnout. Ex describes feelings of being emotionally overextended and exhausted by one's work; Cy describes an unfeeling and impersonal response (distant attitude) towards one's work, and PE describes feelings of competence and successful achievement in one's work (Maslach & Jackson, 1986). Therefore, burnout can be regarded as a state of exhaustion in which one is cynical about the value of one's occupation and doubtful of one's capacity to perform. Only two of the sub-scales, namely Ex and Cy, were used for the purposes of this study, because PE (one of the sub-scales of the MBI-GS) is regarded as a personality disposition rather than a wellness dimension (Rothmann, 2008). All items are scored on a 7-point frequency rating scale ranging from 0 (never) to 6 (daily). High scores on Ex and Cy are indicative of burnout. Therefore, Cy is expected to be positively correlated with Ex.

7.6.3.1.2 Reliability

Maslach and Jackson (1986) report Cronbach's alpha coefficients varying from 0.71 to 0.90. Test-retest reliability varies from 0.60 to 0.82 and 0.54 to 0.60 (applied after one year), which could be regarded as acceptable. Internal consistencies (Cronbach's alpha coefficients) reported by Schaufeli et al. (1996) varied from 0.87 to 0.89 for Ex, 0.73 to 0.84 for Cy and 0.76 to 0.84 for PE. Test-retest reliabilities after one year were 0.65 (Ex), 0.60 (Cy) and 0.67 (PE) (Schaufeli et al., 1996). Steyn, Rothmann and Mostert (2004) found the following Cronbach's alpha coefficients for Ex (0.90), Cy (0.75), and PE (0.80) compared to the guideline of $\alpha > 0,70$ (Nunnally & Bernstein, 1994). Furthermore, the inter-item correlations were considered acceptable compared to the guideline of $0.15 \leq r \leq 0.50$ (Clark & Watson, 1995). In order to avoid answering bias, Schaufeli and Bakker (2004) randomly merged the burnout and engagement items into a 33-item questionnaire. The researchers reported the following internal consistencies for four samples, namely Ex (sample 1, 0.89, sample 2, 0.90, sample 3, 0.86, and sample 4, 0.82), and for Cy (sample 1, 0.80, sample 2, 0.76, sample 3, 0.77, and sample 4, 0.72). Rothmann (2008) found the following Cronbach's alpha coefficients for the two burnout sub-scales, namely 0.86 for Ex and 0.74 for Cy.

The results of the reliability analysis conducted on the two primary scales of the burnout construct are presented in Table 7.12 below.

Table 7.12 Reliability analysis of the two burnout scales exhaustion and cynicism

Scale	N	Mean	Variance	Std dev	N of items	Cronbach's alpha
Ex	278	9.7230	37.450	6.11965	5	.820
Cy	279	8.0860	28.813	5.36775	4	.706

Note: Ex = Exhaustion, Cy = Cynicism,

It is evident from the table above that the two primary scales of burnout show evidence of a good reliability as proposed by Nunnally (1967).

7.6.3.1.3 Validity

According to Schaufeli, Leiter and Kalimo (1995), the MBI-GS has been found to be related to other constructs such as Ex to be associated with mental and physical strain, work over-load, and role conflict at work, whereas PE is related to satisfaction, organisational commitment, job involvement, and access to resources. Cy is primarily related to the same constructs as Ex, but with negative secondary loadings on the attitudinal constructs that are related with PE. Storm and Rothmann (2003a) confirm a 3-factor structure of the MBI-GS in a sample of 2 396 police members, but recommend that Item 13 be dropped from the questionnaire. The structural equivalence of the MBI-GS for different race groups was also confirmed. The following Cronbach's alpha coefficients were obtained for the MBI-GS: Ex: 0.88; Cy: 0.79; PE: 0.78 (Storm & Rothmann, 2003a). The rationale for the inclusion of the MBI-GS is explained in Section 7.6.3.3.4.

7.6.3.2 The Utrecht Work Engagement Scale (UWES)

The Utrecht Work Engagement Scale (UWES) (Schaufeli et al., 2002) was used to measure the levels of engagement. Work engagement is seen as a positive aspect of Occupational Health Psychology and considered to be the opposite pole of burnout. Whilst burned-out workers feel exhausted and cynical, their engaged colleagues feel vigorous and enthusiastic about their work (Schaufeli & Bakker, 2003). For this reason, burnout and work engagement are two distinct concepts and are assessed independently (Schaufeli & Bakker, 2001).

The nature and composition of the UWES are explained next.

7.6.3.2.1 Nature and composition of the Utrecht Work Engagement Scale (UWES)

Work engagement is a concept that includes three dimensions: vigour, dedication and absorption. The UWES is scored on a seven-point frequency-rating scale, varying from 0 "never" to 6 "always". The questionnaire consists of 17 items (6 vigour items, 5 dedication items, and 6 absorption items) and includes questions like "I am bursting with energy every day in my work", "Time flies when I am at work" and "My job inspires me".

7.6.3.2.2 Reliability

Cronbach's alpha values reported by Schaufeli and Bakker (2003) show that the three engagement scales have sufficient internal consistencies equal to or exceeding the critical value of 0.70 (Nunnaly & Bernstein, 1994). The total Cronbach's alpha values computed for the UWES-15 item (N = 9,679) are vigour (0.86), dedication (0.92), and absorption (0.82) and for the UWES-17 (N = 2,313), vigour (0.83), dedication (0.92), and absorption (0.82) (Schaufeli & Bakker, 2003). The alpha coefficients for the UWES in a sample of 2 396 members of the South African Police Services were 0.78 (vigour), 0.89 (dedication), and 0.78 (absorption) (Storm & Rothmann, 2003b). In another South African study, Coetzer and Rothmann (2007) report the following Cronbach's alphas: 0.80 (vigour), 0.87 (dedication), and 0.69 (absorption) from a sample of employees (N = 1,100) in an insurance company.

Results of the reliability analysis performed on the two primary scales of the work engagement construct are shown in Table 7.13 below.

Table 7.13 Reliability analysis of the two primary scales of work engagement namely vigour and dedication

Scale	N	Mean	Variance	Std dev	N of items	Cronbach's alpha
Vig	279	18.0538	16.799	4.09869	4	.671
Ded	278	24.3094	28.164	5.30697	5	.785

Note: Vig = Vigour, Ded = Dedication

As observed from Table 7.13, it is evident that the two scales vigour and dedication demonstrate acceptable reliability coefficient as proposed by Nunnally (1967).

7.6.3.2.3 Validity

Confirmatory factor analysis proved that the theoretical three-factor structure of the UWES is superior to the one-factor model and fits with the data of various international and South African samples (N = 2396) (e.g. Salanova, Schaufeli, Llorens, Pieró & Grau, 2000; Schaufeli et al., 2002a; Storm & Rothmann, 2003b). According to Schaufeli and Bakker (2003), correlations between the three scales usually exceed 0.65, whereas correlations between the latent variables range from 0.80 to 0.90 (e.g. Salanova et al., 2000; Schaufeli et al., 2002a). Furthermore, Schaufeli and Bakker (2003) report that detailed analyses suggest that the loadings of a maximum of three items differed significantly between the samples of three countries (Spain, The Netherlands and Portugal). In a study done by Storm and Rothmann (2003b) analysing the psychometric properties of the UWES in the South African Police Force, the researchers struggled to a find a good fit of the originally hypothesised 3-factor UWES model (17 items). After deleting item 4 and item 14 and allowing for two item pairs (VI8-AB9; VI15-AB16) to correlate on the 15-item revision, they found a better fit for the re-specified model. The researchers reported the following correlations (from the highest) between the three engagement dimensions namely, vigour and dedication 0.97, followed by vigour and absorption 0.96, and dedication and absorption with a correlation of 0.90. A one-factor model was also found on 13 items including correlated errors; however the researchers supported a three-dimensional construct of work engagement.

Construct equivalence of the UWES for different race groups (White, Black, Coloured, and Indian police members) was acceptable. Further bias analyses were carried out on 15 items of the adapted UWES and the results indicated that no uniform or non-uniform bias exists regarding the items of the UWES for Whites, Blacks, Coloureds, and Indians. Therefore, within a South African context, work engagement is an equivalent and unbiased construct for White, Black, Coloured and Indian police the members (Storm & Rothmann, 2003b). In addition, Coetzer and Rothmann (2007) report that work engagement, as measured by the UWES, can be defined as a three-dimensional construct with an equivalent structure for different language groups in South Africa.

The rationale for the inclusion of the UWES is explained in section 7.6.3.3.4.

7.6.3.3 The Orientation to Life Questionnaire (OLQ)

The *Orientation to Life Questionnaire* (OLQ) (Antonovsky, 1987) was used to measure the construct sense of coherence. The OLQ consists of 29 items, with a 7-point Likert scale response format that is anchored at the two poles of the scales. Thirteen of the items are negatively worded to counteract response styles and these items have to be reverse coded. Thus, a high score is indicative of a strong sense of coherence, whereas a low score represents a weak sense of coherence.

The nature and composition of the OLQ are explained next.

7.6.3.3.1 Nature and composition of the Orientation to Life Questionnaire (OLQ)

In the beginning, Antonovsky (1979; 1987) proposed three scales, namely comprehensibility (COMP) measured by 11 items, meaningfulness (MEAN) by 8 items and manageability (MANA) by 10 items. However, Antonovsky (1979) could not find empirical evidence of the three-factor structure as initially proposed and conceded that sense of coherence should be regarded as a unidimensional construct (Antonovsky, 1987). In contrast, Eriksson and Lindström (2005) propose a multidimensional rather than a unidimensional structure of the sense of coherence scale.

7.6.3.3.2 Reliability

Antonovsky (1993) reports alpha coefficients for the OLQ varying between 0.85 and 0.91. Test-retest reliability studies found coefficients varying between 0.41 and 0.97 (Antonovsky, 1993). Rothmann (2000) found an alpha coefficient of 0.89 for the total OLQ, which may be regarded as highly satisfactory (Nunnally & Bernstein, 1994). In addition, Rothmann (2004) also found an internal consistency value of 0.89 for general sense of coherence of senior managers in a manufacturing organisation in South Africa. In support of this finding, Steyn, Rothmann and Mostert (2004) report an alpha coefficient of 0.86 for total sense of coherence of electricians, technicians and engineers in an electricity supply organisation in South Africa. In both studies the mean inter-item correlation coefficients of the OLQ were acceptable compared to the guideline presented by Clark and Watson (1995), indicating that a mean inter-item correlation of 0.15 – 0.20 is desirable for scales that measure broad characteristics, while values of 0.40 – 0.50 are required for scales tapping narrower ones.

More recently, Eriksson and Lindström (2005) conducted a comprehensive review and analysis of empirical studies (458 scientific publications and 13 doctoral theses) from 1992 – 2003 on the validity and reliability of the orientation to life questionnaire (OLQ)/sense of coherence scale (SOC) that has been used in at least 33 languages in 32 countries in at least 15 different versions of the questionnaire. The researchers reported on 124 studies using the OLQ-29 items Cronbach's alpha ranges from 0.70 to 0.95. and ranges from 0.70 to 0.92 using the 13-item questionnaire. Test-retest correlation show stability and range from 0.69 to 0.78 (1 year), 0.64 (3 years), 0.42 to 0.45 (4 years), 0.59 to 0.67 (5 years) to 0.54 (10 years).

The results of the reliability analysis performed on the Orientation to Life Questionnaire (OLQ) applicable to this study are presented in Table 7.14 below. The reliability analysis of the SOC scale is conducted as a unidimensional structure as proposed by Antonovsky (1987).

Table 7.14 Reliability analysis of the sense of coherence variable

Scale	N	Mean	Variance	Std dev	N of items	Cronbach's alpha
SOC	279	92.33	245.071	15.655	18	.829

Note: SOC = Sense of coherence

It is evident from the table above that the results of the unidimensional structure of the sense of coherence construct show evidence of a good reliability coefficient as proposed by Nunnally (1967).

7.6.3.3.3 Validity

As mentioned in paragraph 7.5.3.3, Antonovsky (1987) confirms that sense of coherence should be regarded as a unidimensional construct. Frenz, Carey and Jorgenson (1993), who report inter-correlations of 0.71 or higher between the three sub-scales, support his viewpoint. Thus, the use of total scores on the SOC questionnaire, rather than separate scores on the three sub-scales, is recommended. On investigation into the construct validity of sense of coherence, researchers such as Flannery and Flannery (1990) and Frenz, Carey and Jorgenson (1993) found negative correlations with measures of negative affectivity, such as anxiety and neuroticism and job stress (Feldt, 1997). From a positive psychological perspective, a strong sense of coherence was found to be related to competence and life satisfaction (Kalimo & Vuori, 1990), general well-being (Feldt, 1997), emotional stability (Mlonzi & Strümpfer, 1998) and successful coping with life stress (McSherry & Holm, 1994). Furthermore, regarding the construct validity of the OLQ, it was found that a negative relationship between the OLQ and experienced stress exists, and that the OLQ correlates negatively with the "State-Trait Anxiety Inventory" and the "Beck Depression Inventory" (Frenz et al., 1993).

Rothmann (2004) found significant negative correlations with the two sub-scales of the burnout dimension (OLQ – exhaustion, -0.51; OLQ – cynicism, -0.48). In addition, Steyn, Rothmann and Mostert (2004) found similar significant correlation coefficients between total sense of coherence and exhaustion (-0.31) and cynicism (-0.43). Eriksson and Lindström (2005) conclude that there is at present no need for further testing of the psychometric properties of the SOC instrument because the findings prove the SOC instrument to be reliable, valid, feasible, and cross-culturally applicable.

The rationale for the inclusion of the MBI-GS, UWES and OLQ is discussed below.

7.6.3.3.4 Rationale for the inclusion of the MBI-GS, UWES and OLQ

Comprehensive empirical studies have been done confirming the reliability, validity and cross-cultural application of the burnout, work engagement and sense of coherence constructs as well as on their relationship with other variables such as job demands, job resources, personality factors and many others. Hence, the Maslach Burnout Inventory – General Survey (MBI-GS), the Utrecht Work Engagement Scale (UWES) and the Orientation to Life Questionnaire (OLQ) have demonstrated consistent empirical evidence amongst all cultural groups, within a South African context, in measuring burnout, work engagement and sense of coherence. In addition, empirical evidence exists regarding their predictive validity regarding such items as health problems (burnout) and low turnover intention (engagement), and the moderating effect of sense of coherence in enhancing engagement. In addition, empirical evidence suggests that a strong sense of coherence moderates the effects of job stress on exhaustion (Steyn, Rothmann & Mostert, 2004). Therefore, these three concepts are likely to act as independent components of work-related wellbeing that could influence the employee's attitude towards safety behaviour.

The measuring instrument that was selected for assessing attitude towards work place safety is explained next.

7.6.4 MEASUREMENT OF ATTITUDE TOWARDS WORK PLACE SAFETY

Psychological Safety Awareness is comprised of the thinking constructs that determine an individual's perceptions, judgment and awareness of personal ability and responsibility to avoid risks by managing hazards in the environment. The ARM Survey (ARM) is a user-friendly self-report survey of the safety attitudes that comprise one's individual attitudinal safety awareness.

7.6.4.1 The Company Accident Risk Management Survey (CARMS)

The *Company Accident Risk Management Survey* (CARMS), developed by People and Quality Solutions Pty Ltd in Australia, was used to measure employees' attitudes towards safety and quality. The instrument is based on the Accident Risk Management Questionnaire (ARM-Q), which is an Australian-adapted version of the Employee Safety Inventory (ESI) developed by NCS/London House to measure safety awareness and attitude towards safety behaviours. This instrument is widely used for selection and training purposes in Australia and overseas, and measures safety awareness factors that are correlated with safety behaviour and outcomes (Forgarty & Shardlow, no date).

The nature and composition of the CARMS measurement are explained next.

7.6.4.1.1 Nature and composition of the Company Accident Risk Management Survey (CARMS)

The CARMS consists of 96 items, which are rated on a six-point Likert-type scale, with responses ranging from a score of one indicating "Strongly Agree", to a score of six indicating "Strongly Disagree". The CARMS includes the following safety attitudinal scales, namely Safety Control (SC), Risk Avoidance (RA), Stress Tolerance (ST), Driver Attitude (DA), Quality Orientation (QO), and Safety Index (SI) as well as an Accuracy and Distortion scale. A full description of the scales is provided in Table 7.6. After examination (at face validity) of the survey items by internal experts within the organisation (e.g. the researcher, technical training officer, experienced electricians from different language groups), 14 of the 96 items were changed for ease of reading and understanding and 4 items were added at the request of management (see Table 7.15 for the revised and additional items). The respondents completed the CARMS survey by means of pen-and-paper and the individual responses were manually captured via an internet link provided by People and Quality Solutions (PaQS) for scoring.

An explanation of the different scales as measured by the CARMS including its theoretical base is presented in Table 7.15.

Table 7.15 Dimensions of the Company Accident Risk Management Survey (CARMS)

Scales measured by the CARMS	**Explanation of the scales**	**Theoretical base of the scales**
Safety Control	The Safety Control scale assesses whether an employee will assume responsibility for job safety and accident prevention.	This scale is based on the 'locus-of-control' theory. A person's 'locus-of-control' refers to the attitudes or beliefs about who or what controls one's behaviour and consequences. Individuals with an 'internal' locus-of-control take personal responsibility for safe behaviour and accident prevention. Individuals with an 'external' locus of-control tend to blame accidents on external factors such as fate, chance or bad luck. The Safety Control score provides a measure of safety consciousness.
Risk Avoidance	The Risk Avoidance scale assesses tendencies to engage in high risk, dangerous and thrill-seeking behaviours.	This scale measures whether a person is likely to routinely follow company safety rules and regulations or to break these rules due to boredom, carelessness or a desire to engage in risk-taking behaviour. The Risk Avoidance scale also assesses proneness to engage in other counter-productive and dangerous behaviours (e.g. not using safety equipment) that can result in on-the-job accidents.
Stress Tolerance	The Stress Tolerance scale measures an individual's on-going experience with stress and the ability to withstand stress.	This scale measures an inability to cope with stress, as opposed to the normal temporary feelings of stress that we all experience. Stress-prone employees are potentially at higher risk to have on-the-job accidents since they are more susceptible to distraction. Stressed employees often become fatigued, increasing the probability of over-exertion injuries and careless or reactionary behaviours in their attempts to 'cut corners'.

Table 7.15 Dimensions of the Company Accident Risk Management Survey (CARMS) (continued)

Scales measured by the CARMS	Explanation of the scales	Theoretical base of the scales
Quality Orientation	The Quality Orientation scale is an additional set of questions designed to help identify individuals with strong quality orientations.	The QO scale measures four areas resulting in one overall score, which can be used to provide insight into an individual's propensity for producing quality goods and services. Quality Locus-of-Control: the degree to which the individual takes responsibility for providing quality products and services. Quality Skills: measures the extent to which the individual engages in work habits and behaviours that ensure a high level of quality and excellence in all of his/her pursuits. Error Avoidance: measures the extent to which the individual is committed to detecting and avoiding errors in his/her work. Continuous Improvement: measures how much the individual strives to continually improve his/her product and service offerings.
Safety Index	Overall Safety Awareness: Combined score consisting of the three primary scales: safety control, risk avoidance, and stress tolerance.	
Validity Candidness	A measure of a person's intentional or unintentional exaggeration of their safety awareness. This scale ensures that everyone is represented equally and there is a level playing field.	
Validity Accuracy	A measure of a person's ability to read, understand and complete the survey accurately. The accuracy scale ensures participants will not be assessed on safety awareness if, in fact, due to poor literacy, comprehension, cultural bias, or undue anxiety, they were unable to complete the survey accurately. Validity accuracy can also be compromised due to an uncooperative or hostile survey posture indicated by random responding.	

Table 7.16 shows a list of the original items that were revised for ease of reading and understanding.

Table 7.16 List of changed items and additions

Original item	Revised items
Item 3. Providing **error-free** products and services to customers at all times.	3. Providing **non-hazardous** products and services to customers at all times is impossible.
Item 6. Sometimes little things at work really get on my **nerves.**	6. Sometimes little things at work **frustrate** me.
Item 12. With my luck I will **probably** have an accident sooner rather than later.	12. With my luck I will **have** an accident sooner rather than later.

Table 7.16 List of changed items and additions (continued)

Original item	Revised items
Item 20. I am good **at working out** the causes and solutions to problems.	20. I am good at **finding** the causes and solutions to problems.
Item 26. I always follow procedures to the **letter.**	26. I have never taken a shortcut.
Item 30. I find it hard to **switch off** to problems.	30. I find it hard **not** to **worry about** problems.
Item 36. I **admire** people who are prepared to take risks to get the job done.	36. I **honour** people who are prepared to take risks to get the job done.
Item 39. **Workmates** won't respect you if you don't take a **few personal** risks.	39. **Colleagues** won't respect you if you don't take a few personal risks.
Item 57. I am good at **spotting** and correcting faults.	57. I am good at **observing** and correcting faults.
Item 64. Most people are victims of **misfortune** when they have an accident.	64. Most people are victims of **bad luck** when they have an accident.
Item 74. I know everything **there is to know** about safety.	74. I know everything about safety.
Item 79. I feel "**worn out**" at the end of a normal working day.	79. I feel **tired** at the end of a normal working day.
Item 92. Completing a job safely is more important than on time.	92. **Finishing** a job safely is more important than **completing** it on time.
Item 96. If people followed safety procedures, there would be **far fewer** incidents and injuries.	96. If people followed safety procedures, there would be **fewer** incidents and injuries.
	Additional items
	97. **Additional:** I change safe working practices, if I think my way is safer.
	98. **Additional:** Some safety procedure shortcuts are needed to meet company performance targets.
	99. **Additional:** The company values performance targets more than safety concerns.
	100. **Additional**: If there are safety concerns, my company will stop work, even if it means upsetting customers.

7.6.4.1.2 Reliability

In a study done by Forgarty and Shardlow (no date) analysing 26 unpublished technical reports of the Employee Safety Inventory (ESI), it was found that these abstracts indicate that the ESI scales demonstrate sound internal consistency and test-retest reliabilities (generally above 0.80). Only in one published validation study, that of Boye, Slora and Britton (1990), are the test-retest reliability values reported to range from 0.75 to 0.91 for the ESI scales. A study conducted by Forcier et al. (2001), exploring how organisations can prevent workplace accidents through the psychological assessment of employees, found the following reliability coefficients for the scales that measure an overall Safety Index, namely safety control (0.85), risk avoidance (0.80), and stress tolerance (0.81).

In a report (unpublished) prepared for PaQS, Kendall and Want (2001), technical abstracts supplied by NCS/London House and PaQS and ARM-Q survey forms completed between 1994 and 2000 from Australian organisations across a variety of industries were reviewed. Their findings confirmed that the ARM-Q meets acceptable standards for psychometric instruments used for selection purposes. Forgarty and Shardlow (no date) conducted reliability and validity studies on 159 ARM-Q profiles of drivers working for transport organisations and found the following acceptable Cronbach's alpha coefficients: safety control (0,81), risk avoidance (0,87), stress tolerance (0,88), driver attitude (0,62) and quality attitude (0,80). The lower internal consistency reliability value for the driver attitude scale could be attributed to the multidimensional nature of the scale, tapping attitudes to safe driving and locus-of-control (Forgarty & Shardlow (no date). Based on the above-mentioned reliability analyses, the scales of the Accident Risk Management Questionnaire (ARM-Q) show acceptable internal consistencies.

The results of the reliability analysis performed in this study on the scales safety control, risk avoidance, stress tolerance, quality orientation as measured by the CARMS measurement are presented in Table 7.17.

Table 7.17 Reliability analysis of the safety control, risk avoidance, stress tolerance, quality orientation, and driver attitude scales

Scale	N	Mean	Variance	Std dev	N of items	Cronbach's alpha
SC	279	52.98	66.812	8.174	11	0.74
RA	279	89.19	199.955	14.141	18	0.86
ST	279	39.60	59.428	7.709	10	0.73
QA	279	22.40	49.989	7.070	12	0.75
DA	279	42.95	84.717	9.204	10	0.75

Note: T Safety = Safety consciousness, SC = Safety control, RA = Risk avoidance, ST = Stress tolerance, QA = Quality orientation, and DA = Driver attitude

As observed from Table 7.17, the Cronbach alpha coefficients for all scales measured by the CARMS instrument are satisfactory as proposed by Nunnally (1967).

7.6.4.1.3 Validity

Construct validity on the three primary scales (overall Safety Index) of the ESI showed the following intercorrelations, safety control and risk avoidance (0.65), safety control and stress tolerance (0.67), and risk avoidance and stress tolerance (0.61) (Forcier et al., 2001). Forgarty and Shardlow (no date) conducted two validation studies on the ARM-Q and in study 1 (N = 159) the scales (safety control, risk avoidance, stress tolerance, driver attitude, and quality attitude) correlated significantly but also tapped separate constructs with no scales sharing more than 50% of their variance, and in study 2 (N = 644) the five scales of the ARM-Q scales were moderately correlated ($p < .001$) but far from co-linear, suggesting that the scales could be tapping different underlying constructs. Furthermore, Forgarty and Shardlow (no date) found some evidence of the predictive validity of the ARM-Q attitudinal data with safety performance data.

The ESI scales were found to predict and co-vary (correlate) with relevant criterion behaviours, such as accidents, drug usage, and supervisor ratings of work performance, especially the three primary scales namely safety control (e.g. poor safety record was related to two or more work-related injuries), risk avoidance (e.g. unsafe driving, drug and/or alcohol use, and distractibility) and stress tolerance (e.g. emotional control, safe driving behaviours, and lower scores on the general social adjustment and distractibility scales) (Forcier et al., 2001).

Based on the above results, the ARM-Q is likely to be a powerful and innovative approach to accident prevention that involves the assessment of people's beliefs and attitudes towards work place safety. The rationale for the inclusion of the CARMS instrument for this study measuring attitude towards work place safety is explained next.

7.6.4.1.4 Rationale for inclusion

Although numerous questionnaires exist in the market to assess safety culture and safety climate, not one focuses specifically on measuring attitude towards workplace safety. The focus of this study is to investigate individual psychological factors and attitudes towards workplace safety and not safety culture per se. The *Company Accident Risk Management Survey* (CARMS) (People & Quality Solutions Pty Ltd) was found to be best suited (and supported by some empirical evidence) to measuring an individual attitude towards workplace safety (Fogarty & Shardlow, no date). The ARM Survey was introduced to Australia in 1992. In 1992/93 Australian adaptation and validation of the ARM safety survey for Australian workforce populations was completed. The ARM Survey is re-normed every two years. Up to 2006 more than 100,000+ ARM Surveys were completed in Australia and New Zealand (PaQS), hence the inclusion of the ARM-Q in this study to measure employees' attitudes towards workplace safety.

In the next section, the statistical techniques used to reach the research objectives are explained. This includes the process and method used to identify which independent variables (predictors) explain the strongest variance in influencing attitude towards work place safety. Thereafter, an in-depth explanation will follow on the method used to evaluate the statistical model against the theoretical model (see Chapter 6 for in-depth discussion on the theoretical development of the model).

7.7 STATISTICAL ANALYSES

The statistical techniques implemented to reach the research objectives are explained next. Furthermore, the results of the exploratory (EFA) and confirmatory factor analysis (CFA) of the burnout, work engagement, sense of coherence, and attitude towards work place safety constructs (safety control, risk avoidance and stress tolerance), driver attitude and quality orientation constructs are presented in section 7.7.2.1.1.3.

7.7.1 STATISTICAL TECHNIQUES USED TO PROCESS THE DATA

Statistical analysis of the data was carried out with the following software programs: SPSS statistics version 17.0, LISREL (Jöreskog & Sörbom, 1993) and SmartPLS (Ringle, Wende & Will, 2005). The SPSS program was used to conduct the following analyses:

- Analyses of the biographical information (e.g. frequency)
- Descriptive statistics (e.g. means, standard deviations, skewness and kurtosis)
- Exploratory factor analysis (e.g. factor extraction and factor rotation)
- Reliability analysis (e.g. internal consistency coefficients)
- Correlational analyses between the different variables (e.g. Pearson product-moment correlations)
- Multiple regression analysis (e.g. to determine which independent variable or variables explain the highest or strongest variance in the dependent variables)

The LISREL programme was used to obtain goodness-of-fit statistics of the different constructs. The SmartPLS was used in the evaluation of the theoretical model. The partial least squares path modelling approach was used in the evaluation of the measurement model (e.g. outer model) and the theoretical model (e.g. inner model). In other words, this was the method used to evaluate the statistical model against the theoretical model (see Figure 6.1. in Chapter 6).

In the next section, a brief explanation is given of the nature and application of the statistical techniques associated with the research objectives.

7.7.2 NATURE AND APPLICATION OF THE TECHNIQUES

The purpose of this section is to explain the statistical methods and techniques used to gain answers to the research questions derived from the research objectives listed in Chapter 1. In short, the focus is on identifying those variables (guided by factors cited in the literature) that explain the strongest variance in influencing the dependent variables (attitude towards work place safety, driver attitude and quality orientation). In conclusion, the results will then be used to evaluate (e.g. existence of statistically significant path coefficients) the research model by means of path modelling techniques.

In order to succeed in reaching the research objectives, the following statistical process was followed (see Table 7.18 for a brief outline of the statistical methods used). Firstly, to determine the underlying factor structures of the constructs (e.g. exploratory and confirmatory factor analysis), secondly to determine whether statistically significant differences exist between different groups of variables (e.g. parametric and non-parametric tests), thirdly, to investigate whether statistically significant correlations exist between the different variables (e.g. Pearson-product-moment correlation), fourthly to determine which set of variables (predictors) influence attitude towards work place safety, driver attitude and quality orientation (e.g. multiple regression analysis), and lastly to evaluate the statistical significance of the theoretical model (e.g. path coefficients).

The statistical techniques implemented to reach the research objectives are presented in Table 7.18).

Table 7.18 Statistical techniques implemented to reach the research objectives

Research objective / questions	Statistical technique	Brief explanation of the nature and application of the specific technique
To determine the most applicable factor structure for each of the constructs	1. Exploratory factor analyses applying the principal axis factoring with oblique rotation method. 2. Confirmatory structural equation modelling (SEM) applying the robust maximum likelihood method of estimation.	1. Exploratory factor analyses – cleaning of the structure (e.g. remove non-significant item loadings). To determine the reliability of the items per construct. 2. To conduct goodness-of-fit analyses of the measurement instruments. A confirmation of the validity and reliability of the measurement instruments applicable to the research sample.
To determine whether statistically significant differences exist between the biographical and employee safety data with the independent and dependent variables.	1. Parametric analyses: ○ t-test and ○ ANOVA 2. Non-parametric analyses: ○ Mann-Whitney U-test and ○ Kruskall-Wallis H-test.	1. The t-test is used to determine whether the numerical difference in the means between two independent groups is significantly different (the Mann-Whitney U test is the non-parametric equivalent of the t-test. 2. ANOVA helps to examine whether or not significant mean differences exist between more than two independent groups, as indicated by the F statistic (the Kruskall-Wallis H-test is the non-parametric equivalent of ANOVA). Non-parametric analyses are used when the sample or data are unequal or skewed.

Table 7.18 Statistical techniques implemented to reach the research objectives (continued)

Research objective / questions	Statistical technique	Brief explanation of the nature and application of the specific technique
To determine whether statistically significant correlations exist between the independent (intelligence, personality, burnout, engagement and sense of coherence) and dependent variables (safety consciousness, driver attitude, and quality orientation).	1. Pearson-product-moment correlation.	1. To determine the strength (e.g. statistical significance) of the relationship between the independent and dependent variables. 2. To compare results against similar findings reported in the literature.
To test whether statistically significant path coefficients exist which confirm that employees' attitude towards workplace safety can be influenced (predicted) by intelligence, personality traits, work wellness (burnout and engagement), and sense of coherence in a public electricity company in South Africa. (Empirical evaluation of the theoretical model.)	1. Stepwise multiple regression analyses. 2. The SEM partial least squares path-modelling approach.	1. To identify the most important predictors from a number of independent variables that are likely to influence the dependent variable. 2. This method was used to evaluate the measurement (outer) model (e.g. reliability of the variables) and to empirically evaluate the theoretical model (inner model) through path coefficients. The T-value indicates which path is statistical significant.

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7.7.2.1 Determining the underlying factor structures of the constructs

One of the aims of this study was to determine the underlying factor structure associated with each of the measurement constructs. Data obtained from the respondents were used to examine the underlying dimensionality of the item set and to confirm the factor structure.

Exploratory factor analysis (EFA) was utilised to explore the data, based on the original factor structure given by the test providers. Confirmatory factor analysis (CFA) was utilised to confirm the observed structure of the constructs. Due to issues of intellectual property rights (e.g. scoring methodology) and confidentiality agreements with the test providers, the raw scores of the GRT2, SRT, OPP and BTI instruments were sent to the test providers for reliability analysis (factor analyses), therefore no EFA and CFA analyses could be conducted. In addition, substantial research evidence exists regarding the factor structure, reliability and validity of these instruments within a South African context.

The following sections focus on the two major approaches to factor analysis, namely exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

7.7.2.1.1 Exploratory factor analysis (EFA)

Item analysis consists of exploratory factor analysis as well as reliability analysis. An item analysis was conducted on the MBI-GS, UWES, SOC and CARMS scales. The purpose of item analysis was twofold, namely to determine acceptable factor loadings, and to investigate reliability and inter-item correlations. In determining significant item loadings, the general guide used is that the item loadings should be greater than 0.3 (Kerlinger & Lee, 2000). Items that loaded less than 0.3 were removed, but in removing the items, careful consideration was taken not to compromise the integrity of the data.

For the purpose of this study, exploratory factor analysis (EFA) was done on the MBI-GS, UWES, SOC and CARMS measurement constructs based on the theoretical factor structure as outlined in the test manual and published articles provided by service providers. Typically, the goal of exploratory factor analysis (EFA) is to let the data determine the interrelationships among a set of variables. Although a researcher using EFA may have a theory relating the variables to one another, there are relatively few restrictions on the basic factor model in an

EFA. First, the EFA is useful in data reduction when interrelationships among variables are not specified beforehand. A second benefit of EFA is the ability to detect a general factor. Thirdly, EFA is particularly useful in scale or test development because it allows the researcher to determine the dimensionality of the test and to detect cross-loadings (e.g. correlations of variables with more than one factor) (Fletcher, 2007).

The purpose of investigating reliability and inter-item correlations is to ascertain which of the items in a scale, if any, have a negative effect on the overall reliability of the scale due to their inclusion in the particular scale. If a significant improvement in overall scale reliability occurs as a result of excluding a particular item, such item is also excluded from the subsequent factor analysis. In order to conduct exploratory factor analysis on the identified variables in question, the following steps are proposed (Field, 2005; Grimm & Yarnold, 1995; Hair et al., 2006; Kerlinger & Lee, 2000): (1) determining how many factors can be extracted: (2) deciding which method of factors extraction should be used: (3) identifying the most appropriate method of rotating the factors: and (4) determining how factor scores must be computed if factor scores are of interest. For purposes of the present study only steps 1, 2 and 3 as mentioned above were used.

7.7.2.1.1.1 Determining the number of factors to be extracted

Before determining how many factors can be extracted, it is important first to determine if the identified construct can be factor analysed. This was done by calculating both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity. The KMO can be calculated for individual and multiple variables and represents the ratio of the squared correlation between variables to the squared partial correlation between variables. The KMO statistic varies between 0 and 1. A value of 0 indicates that the sum of partial correlations is large relative to the sum of correlations, indicating diffusion in the pattern of correlations, thereby deeming factor analysis inappropriate. A value close to 1 indicates that patterns of correlations are relatively compact and therefore factor analysis should present distinct and reliable factors. The cut-off value that is utilised in this study is 0.6 (Field, 2005).

Another method of determining the appropriateness of factor analysis examines the entire correlation matrix. The Bartlett test of sphericity is one such measure as it is a test for the presence of correlations among the variables. It examines the correlations among all variables and assesses whether, collectively, significant intercorrelations exists (Hair et al., 2006). Significance is measured at the 0.05 level.

The two most commonly used factor-extraction methods are principal-components analysis (PCA) and common-factors analysis (FA) (Worthington & Whittaker, 2006). The purpose of PCA is to reduce the number of items while retaining as much of the original item variance as possible whereas the purpose of FA is to understand the latent factors or constructs that account for the shared variance among items. Therefore, FA is more closely aligned with the development of new scales (Worthington & Whittaker, 2006). According to Gerbing and Hamilton (1996) principal-axis factoring and maximum-likelihood approaches are equal in their capacities to extract the correct model when the model is known in the population. However, Gorsuch (1997) argues that maximum-likelihood extractions result in occasional problems that do not occur with principal-axis factoring. The FA technique employed to extract factors in the present research study was principal-axis factoring (PAF). In addition, this method is normally used when the factors are assumed or known to be correlated (Worthington & Whittaker, 2006).

Rather than arbitrarily constraining the factor rotation to an orthogonal solution, the oblique rotation identifies the extent to which each of the factors is correlated. The oblique rotation assumes that the extracted factors are correlated (Byrne, 2005). This method is deemed suitable if the ultimate goal of the factor analysis is to determine the possibility of a hierarchical factor structure (Byrne, 2005). Conclusions drawn from this method are restricted to the sample collected and generalisation of the results can be achieved only if analysis using different samples reveals the same factor structure (Field, 2005).

For the purpose of the present research factor extraction on the MBI-GS, UWES, SOC and CARMS measurement constructs was based on the original factor structure as provided by the different service providers. The final structure obtained through EFA had items that loaded significantly on the dimensions.

7.7.2.1.1.2 Determine the reliability of the measurement constructs

Cronbach's alpha coefficient can be considered a perfectly adequate index of the overall consistency reliability of the measurement instrument or construct (Clark & Watson, 1995).

In determining the reliability of the measuring instruments, two basic types of reliability studies could be carried out, namely internal consistency, and test-retest analysis. In the present study, only internal consistency analysis was computed. This differs from validity in that it relates not to what should be measured but instead to how it is measured. Cronbach's alpha as the measure of reliability ranges from 0 to 1, with values of 0.60 to 0.65 deemed the lower limit of acceptability (Clark & Watson, 1995). The general guidelines (Nunnally, 1967) for interpreting levels of reliability for the scales and sub-scales are indicated in Table 7.19.

Table 7.19 General guidelines for interpreting reliability coefficients

Reliability coefficient value	Interpretation
0.90 and above	Excellent
0.80 - 0.89	Good
0.70 - 0.79	Adequate
below 0.70	may have limited applicability

The following section provides detailed results of the exploratory factor analysis conducted on the work wellness constructs (burnout, work engagement, and sense of coherence), and the attitude towards work place safety constructs (safety control, risk avoidance, stress tolerances, driver attitude, and quality orientation). As highlighted in section 7.6.2.1, no exploratory factor analysis was conducted on the intelligence constructs (verbal, numerical, abstract, and spatial reasoning) and personality measurement instruments (Occupational Personality Profile and Basic Traits Inventory) due to issues of intellectual property rights (e.g. scoring methodology and factor extraction rights) and confidentiality agreements with the test providers. The results of the reliability analysis conducted by the service providers on the intelligence constructs were reported in section 7.6.1.1.2 (general verbal, numerical and abstract reasoning) and 7.6.1.2.2 (spatial reasoning). Reliability results for the OPP were reported in section 7.6.2.1.2 and for the BTI in section 7.6.2.2.2.

7.7.2.1.1.3 Exploratory factor analysis of the work wellness constructs (burnout, work engagement and sense of coherence) and attitude towards work place safety constructs (safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation).

The following sections report results of the factor structure of the instrument that was used to measure the constructs burnout, work engagement, sense of coherence, attitude towards work place safety (safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) applicable to the current study sample.

7.7.2.1.1.3.1 Exploratory factor analysis of the burnout and work engagement constructs

The results of the factor structure of the instrument that was used to measure the construct burnout and work engagement are presented as follows: (1) KMO statistic and Bartlett's Test of Sphericity: (2) eigenvaules and total variance explained: (3) structure matrix: and (4) item analysis. The factor structure of the burnout and work engagement constructs was based on the original factor structure of burnout, namely exhaustion, cynicism, and professional efficacy (Maslach & Leiter, 1997) and work engagement, namely vigour, dedication, and absorption (Schaufeli & Bakker, 2003). For the purpose of this study, only the two primary scales of burnout, namely exhaustion and cynicism, and work engagement, namely vigour and dedication (see Chapter 4) were used in the factor exploratory process.

The results of the exploratory factor analysis of the burnout and work engagement constructs of the sample of participants are reported below.

Table 7.20 KMO statistic and Barlett's test for the burnout-exhaustion scale

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.823
Bartlett's Test of Sphericity	Approx. chi-square	449.171
	Df	10.000
	Sig.	.000

From Table 7.20 it is evident that the exhaustion scale of the burnout construct can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the wellbeing: burnout-exhaustion scale are shown in Table 7.21.

Table 7.21 The eigenvalues and total variance explained: burnout-exhaustion

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.910	58.207	58.207	2.409	48.174	48.174
2	.674	13.483	71.690			
3	.560	11.195	82.885			
4	.504	10.080	92.965			
5	.352	7.035	100.000			
Extraction method: principal axis factoring.						

The results of the eigenvalues and total variance explained supported a one-factor solution for the burnout-exhaustion scale which accounts for 48.174% of the variance. The following section reports on additional results of the exploratory factor analysis for a one-factor solution of the burnout-exhaustion scale. Only the factor matrix (Table 7.22) is reported and interpreted for a one-factor solution of the burnout-exhaustion scale.

Table 7.22 Factor matrix: burnout-exhaustion

Item	Factor
	1
W 05	.774
W 01	.762
W 02	.691
W 10	.646
W 06	.578

From Table 7.22 it is evident that all the items of the burnout-exhaustion scale have factor loadings greater than 0.30.

Examples of items that are related to the exhaustion scale are:

- I feel tired when I get up in the morning and have to face another day at work
- I feel emotionally drained from my work

The following section reports item analysis results for the one factor extracted based on the participants' response to the exhaustion scale. Both inter-item correlations and reliability are reported.

Table 7.23 Item analysis for the burnout-exhaustion scale

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
W01	7.5216	24.041	.668	.767
W02	7.6151	24.310	.616	.783
W05	7.8669	24.065	.679	.764
W06	8.0863	27.357	.520	.809
W10	7.8022	25.466	.578	.794

All the items in the burnout-exhaustion scale have inter-item correlations higher than 0.30, as reported in Table 7.23. The overall reliability coefficient of the burnout-exhaustion scale (5 items) demonstrates a well above average value of 0.820 as proposed by Nunnally (1967).

The factor structure of the second burnout scale, cynicism, is reported next. Only the result of the final round/revision of factor extraction is reported.

Table 7.24 KMO statistic and Barlett's test for the burnout-cynicism scale (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.717
Bartlett's Test of Sphericity	Approx. chi-square	199.322
	Df	6.000
	Sig.	.000

From Table 7.24 it is evident that the cynicism scale of the burnout construct can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the burnout-cynicism scale are shown in Table 7.25.

Table 7.25 The eigenvalues and total variance explained: burnout-cynicism (revised)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.132	53.305	53.305	1.530	38.249	38.249
2	.794	19.846	73.151			
3	.576	14.402	87.553			

Table 7.25 The eigenvalues and total variance explained: burnout-cynicism (revised) (continued)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
4	.498	12.447	100.000			

The results of the eigenvalues and total variance explained supported a one-factor solution for the burnout-cynicism scale which accounts for 38.249% of the variance. The following section reports on additional results of the exploratory factor analysis for a one-factor solution of the burnout-exhaustion scale. Only the factor matrix (Table 7.26) is reported and interpreted for a one-factor solution of the wellbeing burnout-cynicism scale.

Table 7.26 Factor matrix: burnout-cynicism (revised)

Item	Factor
	1
W17	.704
W29	.635
W14	.617
W26	.501

Five items were extracted for the one-factor solution, but item 25 (I just want to do my work and not be bothered) was removed from further analysis due to its low factor loading (below 0.30) within the one-factor solution. From Table 7.26 it is evident that the remaining four items of the burnout-cynicism scale has factor loadings greater than 0.30.

Examples of items that are related to the cynicism scale are:

- I have become less enthusiastic about my work.
- I doubt the significance of my work.

The following section reports item analysis results for the one factor extracted (revised) based on the responses of the participants for the burnout-cynicism scale. Both inter-item correlations and reliability are reported.

Table 7.27 Item analysis for the burnout-cynicism scale (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
W14	6.7025	18.490	.487	.646
W17	6.1004	16.911	.544	.609
W26	5.2258	18.499	.419	.687
W29	6.2294	17.285	.519	.625

All the items in the burnout-cynicism scale have inter-item correlations higher than 0.30, as reported in Table 7.27. The overall reliability coefficient of the burnout-cynicism scale (4 items) is within the acceptable range of 0.706 as proposed by Nunnally (1967).

The results of the exploratory factor analysis conducted on the sub-scales of the second construct work engagement, namely vigour and dedication are presented next. Again, only the results of the revised version of factor extraction are reported.

Table 7.28 KMO statistic and Barlett's test for the work engagement-vigour scale (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.700
Bartlett's Test of Sphericity	Approx. chi-square	180.082
	df	6.000
	Sig.	.000

From Table 7.28 it is evident that the vigour scale of the work engagement construct can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the work engagement-vigour scale are shown in Table 7.29.

Table 7.29 The eigenvalues and total variance explained: work engagement-vigour (revised)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.046	51.146	51.146	1.469	36.737	36.737
2	.857	21.425	72.571			
3	.612	15.304	87.874			
4	.485	12.126	100.000			

The results of the eigenvalues and total variance explained supported a one-factor solution for the work engagement-vigour scale which accounts for 36.737% of the variance. The following section reports on additional results of the exploratory factor analysis for a one-factor solution of the work engagement-vigour scale. Only the factor matrix (Table 7.30) are reported and interpreted for a one-factor solution of the work engagement-vigour scale.

Table 7.30 Factor matrix: work engagement-vigour (revised)

Item	Factor
	1
W20	.763
W28	.633
W33	.595
W12	.364

Six items were extracted for the one-factor solution, but item 3 (I always persevere at work, even when things do not go well) and item 7 (I am very resilient, mentally, in my job) were removed from further analysis due to their low factor loading (cut-off value 0.30) within the one-factor solution. From Table 7.30 it is evident that the remaining four items of the work engagement-vigour scale have factor loadings greater than 0.30.

Examples of items that are related to the vigour scale are:

- When I get up in the morning, I feel like going to work
- I feel strong and vigorous in my job.

The following section reports item analysis results for the one factor extracted (revised) based on the responses of the participants for the work engagement-vigour scale. Both inter-item correlations and reliability are reported.

Table 7.31 Item analysis for the work engagement-vigour scale (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
W12	13.8351	11.613	.304	.699
W20	13.2939	9.697	.569	.524
W28	13.2975	10.670	.479	.588
W33	13.7348	9.965	.474	.589

All the items in the work engagement-vigour scale have inter-item correlations higher than 0.30, as reported in Table 7.31. The overall reliability coefficient of the work engagement-vigour scale (4 items) is within the acceptable range of 0.671 as proposed by Nunnally (1967).

The factor structure of the second work engagement scale, dedication, is reported next.

Table 7.32 KMO statistic and Barlett's test for the work engagement-dedication scale

Kaiser-Meyer-Olkin-measure of sampling adequacy.		.816
Bartlett's Test of Sphericity	Approx. chi-square	396.670
	df	10.000
	Sig.	.000

From Table 7.32 it is evident that the dedication scale of the work engagement construct can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the work engagement-dedication scale are shown in Table 7.33.

Table 7.33 The eigenvalues and total variance explained: work engagement-dedication

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	2.765	55.301	55.301	2.251	45.016	45.016
2	.761	15.218	70.519			
3	.620	12.395	82.914			
4	.468	9.360	92.274			
5	.386	7.726	100.000			

The results of the eigenvalues and total variance explained supported a one-factor solution for the work engagement-dedication scale which accounts for 45.016% of the variance. The following section reports on additional results of the exploratory factor analysis for a one-factor solution of the work engagement-dedication scale. Only the factor matrix (Table 7.34) is reported and interpreted for a one-factor solution of the work engagement-dedication scale.

Table 7.34 Factor matrix: work engagement-dedication

Item	Factor
	1
W23	.803
W32	.734
W27	.654
W16	.641
W11	.477

From Table 7.34 it is evident that the five (original) items of the work engagement-dedication scale has factor loadings higher than 0.30.

Examples of items that are related to the dedication scale are:

- My job inspires me
- I find my work full of meaning and purpose

The following section reports item analysis results for the one factor extracted based on the responses of the participants for the work engagement-dedication scale. Both inter-item correlations and reliability are reported.

Table 7.35 Item analysis for the work engagement-dedication scale

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
W11	19.8777	18.794	.432	.799
W16	19.0072	19.870	.568	.744
W23	19.5180	17.507	.669	.707
W27	19.5504	19.303	.568	.743
W32	19.2842	19.497	.619	.730

All the items in the work engagement-dedication scale have inter-item correlations higher than 0.30, as reported in Table 7.35. The overall reliability coefficient of the work engagement-dedication scale (5 items) is within the acceptable range of 0.785 as proposed by Nunnally (1967).

Exploratory factor analysis conducted on sense of coherence is presented in the next section.

7.7.2.1.1.3.2 Exploratory factor analysis of the construct sense of coherence

The results of the factor structure of the instrument that was used to measure the construct sense of coherence is presented as follows: (1) KMO statistic and Bartlett's Test of Sphericity: (2) eigenvaules and total variance explained: (3) structure matrix: and (4) item analysis. The factor structure of the sense of coherence was based on a one-dimensional factor solution (e.g. Steyn et al., 2004).

The results of the exploratory factor analysis (final round/revised factor structure) of the construct sense of coherence are reported below.

Table 7.36 KMO statistic and Barlett's test for the sense of coherence (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.858
Bartlett's Test of Sphericity	Approx. chi-square	1246.413
	df	153.000
	Sig.	.000

From Table 7.36 it is evident that the construct sense of coherence can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the fortigenic construct sense of coherence are shown in Table 7.37.

Table 7.37 The eigenvalues and total variance explained: sense of coherence (revised)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	4.823	26.796	26.796	4.072	22.623	22.623
2	2.254	12.523	39.320			
3	1.204	6.687	46.007			
4	.997	5.540	51.547			
5	.929	5.160	56.707			
6	.865	4.806	61.513			
7	.811	4.503	66.016			
8	.738	4.100	70.116			
9	.713	3.963	74.080			
10	.650	3.611	77.690			
11	.635	3.528	81.219			
12	.614	3.409	84.628			
13	.541	3.004	87.632			
14	.539	2.995	90.627			
15	.499	2.774	93.401			
16	.444	2.465	95.866			
17	.398	2.208	98.074			
18	.347	1.926	100.000			

Although there are three eigenvalues greater than 1, the current study treated SOC construct as unidimensional (Antonovsky, 1987). The following section reports on additional results of the exploratory factor analysis for a unidimensional factor solution of the construct sense of coherence. Only the factor matrix (Table 7.38) is reported and interpreted for a one factor solution of the construct sense of coherence.

Table 7.38 Factor matrix: sense of coherence scale (revised)

Item	Factor
	1
SOC14	.628
SOC22	.577
SOC13	.531

Table 7.38 Factor matrix: sense of coherence scale (revised) (continued)

SOC27	.530
SOC16	.525
SOC20	.524
SOC29	.513
SOC19	.483
SOC21	.483
SOC11	.475
SOC28	.459
SOC24	.422
SOC23	.419
SOC7	.418
SOC8	.414
SOC12	.382
SOC9	.357
SOC26	.300

Eighteen items of the 29-item questionnaire were extracted for the one-factor solution, while 12 items were removed from further analysis due to their low factor loading (cut-off value 0.30) within the one-factor solution. Table 7.38 suggests that all the remaining items making up the sense of coherence construct be retained for subsequent statistical analysis, due to their factor loadings being above the 0.30 cut-off.

Examples of items that are related to the sense of coherence scale are:

- Do you have the feeling that you are being treated unfairly?
- Do you have the feeling that you are in an unfamiliar situation and don't know what to do?

The following section reports item analysis results for the one factor extracted (revised) based on the responses of the participants for the sense of coherence scale. Both inter-item correlations and reliability are reported.

Table 7.39 Item analysis for the construct sense of coherence (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
SOC14	86.32	219.867	.531	.816
SOC22	86.23	224.942	.515	.818
SOC13	86.47	221.610	.455	.819
SOC27	86.48	225.236	.435	.820
SOC16	86.87	222.055	.449	.819
SOC20	86.83	220.565	.455	.819
SOC29	87.57	212.756	.503	.816
SOC19	87.87	215.904	.472	.818
SOC21	88.08	215.174	.470	.818
SOC11	86.63	227.084	.379	.823
SOC28	87.63	215.981	.445	.819
SOC24	88.06	217.770	.419	.821
SOC23	86.90	221.306	.371	.823
SOC7	87.29	220.394	.347	.825
SOC8	86.71	225.989	.375	.823
SOC12	87.36	220.533	.382	.823
SOC9	88.17	220.205	.352	.825
SOC26	88.12	226.961	.291	.827

All the items in the sense of coherence scale have inter-item correlations higher than 0.30, as reported in Table 7.39. The overall reliability coefficient of the sense of coherence construct (18 items) is within the above acceptable range of 0.829 as proposed by Nunnally (1967).

The final exploratory factor analysis was carried out on the dependent variable attitude towards work place safety which includes the scales safety control, risk avoidance and stress tolerance, driver attitude and quality orientation as measured by the CARMS measurement instrument. The factors extracted were based on the original factor structure whereby each scale was factor analysed separately. To remain consistent, only the results of the revised factor extraction values are reported.

The attitude towards the work place safety construct consisting of safety control, risk avoidance, and stress tolerance scales were factor analysed separately and are presented in the next section.

7.7.2.1.1.3.3 Exploratory factor analysis of the safety control, risk avoidance, and stress tolerance scales as measured by the CARMS instrument

The results of the factor structure of the instrument that was used to measure safety control, risk avoidance, and stress tolerance (safety consciousness) scales are presented as follows: (1) KMO statistic and Bartlett's Test of Sphericity: (2) eigenvaules and total variance explained: (3) structure matrix: and (4) item analysis. Firstly, the results of the exploratory factor analysis (final round/revised factor structure) of the safety control scale is reported, secondly the risk avoidance scale, and thirdly the stress tolerance scale.

Table 7.40 KMO statistic and Barlett's test for the safety control scale (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.809
Bartlett's Test of Sphericity	Approx. chi-square	493.935
	df	55
	Sig.	.000

From Table 7.40 it is evident that the safety control scale of the safety consciousness construct can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the safety control scale of the safety consciousness construct are shown in Table 7.41.

Table 7.41 The eigenvalues and total variance explained: safety control (revised)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.189	28.988	28.988	2.453	22.297	22.297
2	1.399	12.720	41.708			
3	1.090	9.906	51.614			
4	.846	7.691	59.305			
5	.793	7.213	66.518			
6	.736	6.690	73.208			
7	.713	6.484	79.693			
8	.615	5.587	85.280			
9	.587	5.334	90.614			

Table 7.41 The eigenvalues and total variance explained: safety control (revised) (continued)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
10	.539	4.898	95.512			
11	.494	4.488	100.000			

The results of the eigenvalues indicate a loading of three factors, but to remain with the original structure a one factor solution for the safety control scale of the safety consciousness construct was decided upon. The first factor also accounts for the highest variance of the proposed three scales. The following section reports on additional results of the exploratory factor analysis for a one factor solution of the safety control scale. Only the factor matrix (Table 7.42) is reported and interpreted for a one factor solution of the safety control scale.

Table 7.42 Factor matrix: safety control as measured by the CARMS instrument (revised)

Item	Factor
	1
S12	.620
S56	.614
S54	.570
S11	.499
S71	.494
S64	.494
S19	.386
S58	.385
S66	.354
S72	.324
S84	.318

Eleven items were extracted for the one-factor solution, while 5 items were removed from further analysis due to their low factor loading (cut-off value 0.30) within the one-factor solution. Table 7.42 suggests that all the remaining items making up the safety control scale could be retained for subsequent statistical analysis, due to their factor loadings being above the 0.30 cut-off.

Examples of items that are related to the safety control scale as measured by the CARMS instrument are:

- With my luck I will have an accident sooner rather than later.
- It's only a matter of time before I have an accident at work.

The following section reports item analysis results for the one factor extracted (revised) based on the responses for the safety control scale. Both inter-item correlations and reliability are reported.

Table 7.43 Item analysis for the safety control scale (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
S11	48.30	53.695	.443	.718
S12	47.82	54.723	.518	.709
S19	48.76	55.622	.345	.734
S54	48.15	54.248	.479	.713
S56	47.94	53.981	.508	.709
S58	47.76	61.020	.337	.733
S64	48.31	54.236	.448	.717
S66	47.67	60.078	.294	.737
S71	47.86	56.751	.412	.723
S72	49.33	57.748	.276	.743
S84	47.89	60.829	.257	.741

All the items in the safety control scale have inter-item correlations higher than 0.30, as reported in Table 7.43. The overall reliability coefficient of the safety control scale (11 items) as measured by the CARMS instrument is within the acceptable range of 0.744 as proposed by Nunnally (1967).

The results of the exploratory factor analysis performed on the risk avoidance scale as measured by the CARMS instrument are presented next.

Table 7.44 KMO statistic and Barlett's test for the risk avoidance scale (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.875
Bartlett's Test of Sphericity	Approx. chi-square	1430.318
	df	153
	Sig.	.000

Table 7.44 provides evidence that the risk avoidance scale of the safety consciousness construct can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the risk avoidance scale of the safety consciousness construct are shown in Table 7.45.

Table 7.45 The eigenvalues and total variance explained: risk avoidance (revised)

Factor	**Initial eigenvalues**			**Extraction sums of squared loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	5.536	30.758	30.758	4.832	26.844	26.844
2	1.726	9.590	40.348			
3	1.216	6.755	47.102			
4	1.041	5.785	52.887			
5	.918	5.098	57.985			
6	.910	5.056	63.040			
7	.833	4.627	67.667			
8	.813	4.517	72.184			
9	.679	3.775	75.959			
10	.667	3.706	79.665			
11	.616	3.420	83.085			
12	.545	3.026	86.111			
13	.495	2.748	88.860			
14	.461	2.561	91.421			
15	.426	2.369	93.790			
16	.422	2.342	96.132			
17	.381	2.117	98.250			
18	.315	1.750	100.000			

The observed eigenvalues propose a loading of four factors, but to remain consistent with the original structure a one factor solution for the risk avoidance scale of the safety consciousness construct was decided upon. The first factor also accounts for the highest variance of the proposed four factors. In the next section, additional results of the exploratory factor analysis for a one factor solution of the risk avoidance scale is presented. Only the factor matrix (Table 7.46) is reported and interpreted for a one factor solution of the risk avoidance scale.

Table 7.46 Factor matrix: risk avoidance as measured by the CARMS instrument (revised)

Item	Factor
	1
S14	.634
S29	.631
S83	.596
S48	.574
S67	.552
S27	.551
S62	.548
S39	.548
S75	.532
S51	.526
S21	.522
S98	.513
S97	.512
S90	.493
S36	.480
S25	.334
S96	.322
S33	.304

The results show that eighteen items were extracted for the one-factor solution, but 3 items were removed from further analysis due to their low factor loading (cut-off value 0.30) within the one-factor solution. It is evident from Table 7.46 that all the remaining items making up the risk avoidance scale could be retained for subsequent statistical analysis, due to their factor loadings being above the 0.30 cut-off.

Examples of items that are related to the risk avoidance scale as measured by the CARMS instrument are:

- Sometimes you have to take shortcuts to get the job done.
- If I want to do my job well, I have to take a few risks.

The following section reports item analysis results for the one factor extracted (revised) based on the responses for the risk avoidance scale. Both inter-item correlations and reliability are reported.

Table 7.47 Item analysis for the risk avoidance scale (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
S14	84.21	175.297	.584	.851
S21	84.42	177.050	.489	.855
S25	84.10	189.717	.304	.862
S27	84.23	177.820	.503	.854
S29	84.19	175.334	.593	.850
S33	85.35	184.158	.285	.865
S36	84.20	178.967	.435	.857
S39	84.13	178.048	.513	.854
S48	84.16	177.743	.537	.853
S51	84.67	175.927	.498	.855
S62	83.98	179.291	.502	.854
S67	84.51	176.287	.518	.854
S75	84.16	180.181	.493	.855
S83	84.05	178.882	.544	.853
S90	83.78	182.982	.453	.857
S96	83.63	190.946	.296	.862
S97	84.43	177.504	.466	.856
S98	84.08	180.199	.478	.855

The observed items from Table 7.47 in the risk avoidance scale have inter-item correlations higher than 0.30. The overall reliability coefficient of the risk avoidance scale (18 items) as measured by the CARMS instrument can be regarded as acceptable (0.863) as proposed by Nunnally (1967).

The results of the exploratory factor analysis performed on the stress tolerance scale as measured by the CARMS instrument are presented next.

Table 7.48 KMO statistic and Barlett's test for the stress tolerance scale (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.787
Bartlett's Test of Sphericity	Approx. chi-square	376.062
	df	45
	Sig.	.000

The results from Table 7.48 provide evidence that the stress tolerance scale of the safety consciousness construct can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the stress tolerance scale of the safety consciousness construct are shown in Table 7.49.

Table 7.49 The eigenvalues and total variance explained: stress tolerance (revised)

Factor	**Initial eigenvalues**			**Extraction sums of squared loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	2.914	29.143	29.143	2.150	21.504	21.504
2	1.173	11.733	40.877			
3	.973	9.726	50.603			
4	.905	9.051	59.654			
5	.826	8.257	67.910			
6	.815	8.146	76.056			
7	.692	6.923	82.979			
8	.630	6.301	89.280			
9	.559	5.586	94.867			
10	.513	5.133	100.000			

The observed eigenvalues propose a loading of two factors, but to remain consistent with the original structure a one factor solution for the stress tolerance scale of the safety consciousness construct was decided upon. The first factor also accounts for the highest variance of the proposed two factors. In the next section, additional results of the exploratory factor analysis for a one factor solution of the stress tolerance scale are presented. Only the factor matrix (Table 7.50) is reported and interpreted for a one factor solution of the stress tolerance scale.

Table 7.50 Factor matrix: stress tolerance as measured by the CARMS instrument (revised)

Item	**Factor**
	1
S4	.578
S18	.546
S6	.523
S35	.504

Table 7.50 Factor matrix: stress tolerance as measured by the CARMS instrument (revised) (continued)

Item	Factor
	1
S63	.478
S60	.421
S79	.414
S73	.398
S68	.397
S17	.311

The results show that ten items were extracted for the one-factor solution, but 5 items were removed from further analysis due to their low factor loading (cut-off value 0.30) within the one-factor solution. It is evident from Table 7.50 that all the remaining items making up the stress tolerance scale could be retained for subsequent statistical analysis, due to their factor loadings being above the 0.30 cut-off.

Examples of items that are related to the stress tolerance scale as measured by the CARMS instrument are:

- I often get tense from stress at work.
- I often lose my temper with people at work.

The following section reports item analysis results for the one factor extracted (revised) based on the responses for the stress tolerance scale. Both inter-item correlations and reliability are reported.

Table 7.51 Item analysis for the stress tolerance scale (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
S4	36.28	47.029	.487	.686
S6	36.40	48.155	.431	.696
S17	35.23	53.118	.258	.722
S18	35.32	47.514	.460	.691
S35	34.99	48.906	.433	.696
S60	35.67	48.799	.347	.711
S63	35.03	50.154	.408	.701

Table 7.51 Item analysis for the stress tolerance scale (revised) (continued)

S68	34.97	50.802	.334	.712
S73	36.44	50.930	.327	.713
S79	36.06	50.640	.355	.709

The results observed from Table 7.51 suggest that the stress tolerance scale has inter-item correlations higher than 0.30. Therefore, the overall reliability coefficient of the stress tolerance scale (10 items) as measured by the CARMS instrument can be regarded as acceptable (0.726) as proposed by Nunnally (1967).

In the next section, the results of the exploratory factor analyses of the driver attitude scale as measured by the CARMS measuring instrument are shown.

7.7.2.1.1.3.4 Exploratory factor analysis of the driver attitude scale as measured by the CARMS measurement instrument

The results of the factor structure of the instrument that was used to measure the driver attitude scale are presented as follows: (1) KMO statistic and Bartlett's Test of Sphericity: (2) eigenvaules and total variance explained: (3) structure matrix: and (4) item analysis. In line with the reporting for the safety consciousness scales, only the results of the final/revised factor extraction analysis of the driver attitude scale are presented.

Table 7.52 KMO statistic and Barlett's test for the driver attitude scale (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.805
Bartlett's Test of Sphericity	Approx. chi-square	506.191
	df	45
	Sig.	.000

The results (Table 7.52) therefore indicate that the driver attitude scale can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the driver attitude are shown in Table 7.53.

Table 7.53 The eigenvalues and total variance explained: driver attitude scale (revised)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.150	31.498	31.498	2.408	24.076	24.076
2	1.465	14.649	46.147			
3	.935	9.351	55.498			
4	.863	8.627	64.126			
5	.762	7.625	71.750			
6	.662	6.620	78.371			
7	.611	6.115	84.486			
8	.573	5.727	90.212			
9	.503	5.032	95.245			
10	.476	4.755	100.000			

The results of the eigenvalues propose a two factor solution, but to remain consistent a one factor solution for the driver attitude scale was decided upon. The proposed first factor also explains the highest variance between the proposed two factor structures. The following section reports on additional results of the exploratory factor analysis for a one factor solution of the driver attitude scale. Only the factor matrix (Table 7.54) is reported and interpreted for a one factor solution of the driver attitude scale.

Table 7.54 Factor matrix: driver attitude scale as measured by the CARMS instrument (revised)

Item	Factor
	1
S87	.627
S9	.548
S95	.525
S31	.503
S37	.487
S93	.482
S82	.461
S61	.442
S85	.407
S80	.376

Ten of the 18 items were extracted for the one-factor solution, but 8 items were removed from further analysis due to their low factor loading (cut-off value 0.30) within the one-factor solution. Table 7.54 suggests that all the remaining items making up the driver attitude scale could be retained for subsequent statistical analysis, due to their factor loadings being above the 0.30 cut-off.

Examples of items that are related to the driver attitude scale as measured by the CARMS instrument are:

- The more you drive, the more incidents and injuries you will have.
- If you are driving a lot, you have to be lucky to avoid an accident.

The following section reports item analysis results for the one factor extracted (revised) based on the responses for the driver attitude scale. Both inter-item correlations and reliability are reported.

Table 7.55 Item analysis for the driver attitude scale (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
S9	39.01	67.115	.469	.724
S31	38.35	71.013	.416	.732
S37	38.65	70.906	.390	.736
S61	38.55	71.910	.370	.738
S80	39.80	73.159	.335	.743
S82	39.10	68.928	.412	.733
S85	39.13	70.295	.362	.741
S87	38.16	69.666	.520	.719
S93	37.67	72.839	.419	.732
S95	38.13	69.254	.468	.724

All the items in the driver attitude scale have inter-item correlations higher than 0.30, as reported in Table 7.55. The overall reliability coefficient of the driver attitude scale (10 items) as measured by the CARMS measurement instrument is well within the acceptable limit of 0.752 as proposed by Nunnally (1967).

Lastly, the results of the exploratory factor analysis performed on the quality orientation scale as measured by the CARMS measurement instrument are shown in the next section.

7.7.2.1.1.3.5 Exploratory factor analysis of the quality orientation scale as measured by the CARMS measurement instrument

The results of the factor structure of the instrument that was used to measure the quality orientation scale are presented as follows: (1) KMO statistic and Bartlett's Test of Sphericity: (2) eigenvaules and total variance explained: (3) structure matrix: and (4) item analysis. Only the results of the final/revised factor extraction analysis of the quality orientation are shown.

Table 7.56 KMO statistic and Barlett's test for the quality orientation scale (revised)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.819
Bartlett's Test of Sphericity	Approx. chi-square	538.959
	df	66
	Sig.	.000

As reflected in Table 7.56, the quality orientation scale can be factor analysed due to the appropriate levels of both KMO statistic and Bartlett's Test of Sphericity.

The eigenvalues and total variance explained for the quality orientation scale are shown in Table 7.57.

Table 7.57 The eigenvalues and total variance explained: quality orientation scale (revised)

Factor	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.407	28.389	28.389	2.656	22.133	22.133
2	1.288	10.737	39.127			
3	1.079	8.991	48.118			
4	.962	8.019	56.136			
5	.860	7.165	63.301			
6	.829	6.907	70.208			
7	.726	6.047	76.255			
8	.625	5.212	81.467			
9	.606	5.050	86.517			
10	.582	4.851	91.368			
11	.546	4.553	95.921			
12	.489	4.079	100.000			

It is observed from the table above that the results of the eigenvalues propose a three factor structure. However, to remain consistent with the factor structure of all the safety attitudinal variables, a one factor solution for the quality orientation scale was decided upon. The first factor explains the highest variance between the proposed three factor loadings. The following section reports on additional results of the exploratory factor analysis for a one factor solution of the quality orientation scale. Only the factor matrix (Table 7.58) is reported and interpreted for a one factor solution of the quality orientation scale.

Table 7.58 Factor matrix: quality orientation scale as measured by the CARMS instrument (revised)

Item	Factor
	1
S57	.597
S69	.589
S92	.530
S38	.519
S28	.514
S20	.506
S49	.442
S22	.400
S53	.390
S83	.382
S88	.361
S94	.315

Twelve items were extracted for the one-factor solution, but 7 items were removed from further analysis due to their low factor loading (cut-off value 0.30) within the one-factor solution. Table 7.58 suggests that all the remaining items making up the quality orientation scale could be retained for subsequent statistical analysis, due to their factor loadings being above the 0.30 cut-off.

Examples of items that are related to the quality orientation scale as measured by the CARMS instrument are:

- I am good at observing and correcting faults.
- I check my work when I finish a job.

The following table (Table 7.59) reports on the item analysis results for the one factor extracted (revised) based on the responses for the quality orientation scale. Both inter-item correlations and reliability are reported.

Table 7.59 Item analysis for the quality orientation scale (revised)

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
S20	19.99	42.863	.410	.734
S22	20.54	43.019	.369	.738
S28	20.07	42.877	.409	.734
S38	20.72	43.139	.447	.731
S49	20.76	43.428	.387	.736
S53	20.60	43.752	.329	.743
S57	20.40	42.709	.506	.725
S69	20.68	41.742	.492	.724
S83	20.54	42.249	.346	.743
S88	20.18	41.632	.336	.746
S92	21.05	43.638	.471	.730
S94	20.85	44.325	.255	.753

The results suggest that all the items in the quality orientation scale have inter-item correlations higher than 0.30. Furthermore, the overall reliability coefficient of the quality orientation scale (12 items) as measured by the CARMS measurement instrument are well within the acceptable limit of 0.753 as proposed by Nunnally (1967).

In the next section, the second method of factor analysis namely confirmatory factor analysis (CFA) is explained.

7.7.2.1.2 Confirmatory factor analysis (CFA)

The next step, after exploratory factor analysis, was to evaluate the quality of the measurements in terms of the data obtained (e.g. measurement instruments) through confirmatory factor analysis. The latter procedure is discussed in the following section.

Confirmatory factor analysis is a way of testing if the factor structure produced by EFA fits the data of the sample under investigation (Worthington & Whittaker, 2006). CFA is similar to EFA in many respects, but according to Hair et al. (2006), philosophically it is quite different. In CFA, the researcher must specify the number of factors that exist within a set of variables and also which factor each variable will load highly on before results can be computed. This information is obtained from the EFA or theory, and therefore the CFA serves to confirm the observed structure of the constructs. Structural equation modelling is then used to test how well the researcher's *a priori* pattern of factor loadings fits the actual data. Therefore, CFA assists researchers to either reject or accept their preconceived theory.

Confirmatory factor analysis is particularly useful in a deductive reasoning process. Specific hypothesis testing is possible when using CFA. With CFA, it is possible to test the hypothesis that two factors versus only one factor (or any other numeric combination) underlie a set of data. Another use of CFA is to assess the equivalence of parts of the basic factor model within a given data set. It is also important to determine whether the results of a factor analysis are similar across demographic groups. Confirmatory factor analysis permits tests of invariance – that is, the equivalence of factor structure, loadings, uniqueness – across different groups (e.g. ethnic, gender, cultural) of individuals (Salkind, 2007, p. 245). However, this specific analysis was not one of the objectives in this study.

Confirmatory factor analysis has greater flexibility in control than exploratory factor analysis. With CFA, some factors may be specified as *oblique* (correlated with one another) whereas others are specified to be *orthogonal* (uncorrelated with one another). Within a single EFA, the factors are interpreted as either oblique or orthogonal but not a combination of the two. In addition, CFA allows the researcher to flexibly impose additional constraints subject to theory (e.g. allowing correlated uniqueness). However, a benefit of EFA is that no such theoretical constraints or specifications are needed. Therefore, if none exist, then EFA may be a better choice (Salkind, 2007).

The purpose of carrying out confirmatory factor analysis (CFA) was to provide statistical evidence on whether each of the identified variables is adequately defined in terms of the common variance among the indicators (e.g. items) in a measurement model (MacKenzie, Podsakoff & Jarvis, 2005). In this study, CFA was used to confirm the factor structure of the independent variables (work wellness that includes burnout – exhaustion and cynicism, and work engagement – vigour and dedication, sense of coherence) and dependent variables (safety consciousness, driver attitude and quality orientation), and to provide a confirmatory test of the measurement theory. This involved constructing a model of relationships that are tested by the measurement theory. The measurement theory specifies a series of relationships that suggest how measured variables represent a latent construct that is not measured directly. Once the researcher uses measurement theory to specify *a priori,* the number of factors as well as which variables load on these factors, a measurement model is operationalised (Hair et al., 2006). Only once this is done and the factor structure is accepted with confidence, can the researcher continue to evaluate the research questions.

After the factor-loading matrix of the abovementioned measuring instruments was finalised (e.g. poor item indicators of the desired construct were deleted) based on exploratory factor analysis, confirmatory structural equation modelling (SEM) techniques as implemented by the LISREL (Jöreskog & Sörbom, 1993) programme were used to conduct goodness-of-fit analysis for the work wellness construct (MBI-GS, UWES, SOC) and CARMS (safety attitudinal constructs). This method is normally used to establish whether the measuring instrument model fits the observed data. In other words, CFA helps to support the factor structure reliability and the validity of the scale following an EFA analysis (Worthington & Whittaker, 2006). Once the measurement models have been specified, the next step is to determine how the measurement model is estimated. The CFA technique that most researchers (e.g. Worthington & Whittaker, 2006) use when the data are not normally distributed or skewed or where large measurement errors (outliers) exist is the robust maximum likelihood (ML) method of estimation. ML makes estimates based on maximising the probability (likelihood) that the observed co-variances are drawn from a population assumed to be the same as that reflected in the coefficient estimates. That is, ML picks estimates which have the greatest chance of reproducing the observed data. The robust ML approach allows for the identification and clean-up of the outliers that are likely to influence the stability of the structure (path) coefficients in SEM (Pampel, 2000).

Byrne (2005) proposes that before one can start with the structuring or testing of the hypothesised model certain statistical conditions such as cleaning of the data (e.g. required reliability and validity computations) need to be completed; if this is not done it can lead to the distortion of goodness-of-fit indexes related to the model as a whole. The goodness-of-fit analysis of the instruments is a basic requirement before path analysis can be computed (Worthington & Whittaker, 2006). After the measurement model has been specified and the parameters have been estimated, the following step is the assessment of the validity of each of the measurement models using a number of goodness-of-fit statistics, including Satorra-Bentler chi-square (S-B $\chi 2$), goodness-of-fit index (GFI), standardised root mean square residual (SRMR), root mean square error of approximation (RMSEA), normed fit index (NFI), and comparative fit index (CFI).

The following section explores the variables used in conducting confirmatory factor analysis of each of the measurement models for the constructs (work wellness that includes exhaustion, cynicism, vigour, dedication, sense of coherence, and safety attitudinal constructs that include safety consciousness, driver attitude and quality orientation).

7.7.2.1.2.1 Variables in CFA

There are several identified constructs used in this study. However, these constructs are measured through several indicators (e.g. items in a questionnaire). Thus, latent variables are equivalent to the identified variables used in the study. The indicator variables (also known as manifest/observed variables) are equivalent to the items or parcels that are used to measure these constructs (Tabachnick & Fidell, 2001).

7.7.2.1.2.2 Evaluating the measurement models through confirmatory factor analysis

In evaluating the goodness-of-fit for the constructs used in the current study, several approximate fit indices may be consulted. Hence, the degree to which the observed matrix fits the sample matrix is determined through goodness-of-fit tests, discussed in the following section.

7.7.2.1.2.2.1 Goodness-of-fit statistics

Goodness-of-fit indices are numerical indices that evaluate how well the model accounts for the data. These indices can be compared for a series of models with an increasing number of common factors. The appropriate number of factors is determined by fitting a model in which a model with one less factor demonstrates substantially poorer fit and a model with one more factor provides little improvement in fit (Fletcher, 2007).

Amongst the goodness-of-fit indexes produced by the LISREL programme is the Satorra-Bentler scaled chi-square statistic (S-B $\chi 2$), which is the test for absolute fit of the model. However, the X2 value is sensitive to sample size. Therefore additional absolute goodness-of-fit indices, such as the normed fit index (NFI), the comparative fit index (CFI), the goodness of fit index (GFI), the standardised root mean square residual (SRMR), and the root mean square error of approximation (RMSEA), are important model fit indices (Worthington & Whittaker, 2006). However, important SEM fit indices applicable to this research project are the Satorra-Bentler chi-square (S-B χ^2), the goodness of fit index (GFI), the root mean square error of approximation (RMSEA), the comparative fit index (CFI) and the normed fit index (NFI).,Worthington and Whittaker (2006) rightly propose that the suggested cut-off criteria are general guidelines and are not to be seen as definitive rules. In addition, when interpreting fit indices the overall fit statistics need to be taken into consideration and not individual fit indexes such as the CFI for example. Each of these fit statistics is discussed briefly below.

1) Satorra-Bentler scaled chi-square (S-B X^2)

   A family of scaling corrections aimed at improving the chi-square approximation of goodness-of-fit test statistics in small samples, large models and non-normal data was proposed by Satorra and Bentler (1994). The Satorra-Bentler scaled chi-square is used when robust estimation techniques are employed. Robust estimation techniques are used when data deviates from the normal distribution. If the data departs markedly from multivariate normality, the Satorra-Bentler scaled chi-square statistic (S-B X^2) should be used to provide an improved estimate of the fit of a model (Satorra & Bentler, 2001).

2) Goodness-of-fit index (GFI)

   The goodness-of-fit index was an early attempt to produce a fit statistic that is less sensitive to sample size. The possible range of GFI values are 0 to 1, with higher values indicating better fit (Hair et al., 2006). It is suggested that values higher than 0.9 are indicative of acceptable model fit (Bentler & Bonett, 1980).

3) The root mean square error of approximation (RMSEA)

   The RMSEA is a good representation of how well the model fits the population, and not just the sample used for estimation. Lower RMSEA values indicate a better fit (Hair et al., 2006). In general, as with SRMR, values below 0.10 for the RMSEA are indicative of acceptable fit, with values below 0.05 suggesting a very good fit (Hair et al., 2006).

4) Comparative fit index (CFI) and normed fit index (NFI)

   A general guideline for the interpretation of the CFI and NFI is that values of 0.90 and higher indicate satisfactory fit between the postulated model and empirical data (Hair et al., 2006).

In the next section, the results of the confirmatory factor analysis of the measurements of the wellbeing construct (burnout and work engagement), sense of coherence, and attitude towards workplace constructs safety consciousness (safety control, risk avoidance and stress tolerance), driver attitude and quality orientation are presented.

7.7.2.1.2.2.2 Confirmatory factor analysis of the measurement models burnout and work engagement

On the basis of the suggested factor structures obtained from exploratory factor analysis of the work wellness variables, the quality of the measurements in terms of the data obtained was tested through confirmatory factor analysis. The results of the confirmatory factor analysis of the burnout and work engagement variables are presented in Table 7.60 below.

Table 7.60 Psychometric properties of the burnout and work engagement scales measured in the current study

Variable	Factor structure	Reliability Cronbach's alpha	SBX^2	df	RMSEA	SRMR	NFI	GFI	CFI
Work wellness	Original factor structure *N*=279	Work wellness total Burnout–exhaustion 0.82 Burnout–cynicism 0.71 Engagement –vigour 0.67 Engagement – dedication 0.79	396.21 (x^2/df = 2.17)	183	0.065	0.090	0.90	0.86	0.94

The results in Table 7.60 of the confirmatory factor analysis of the burnout and work engagement scales seem to suggest acceptable overall levels of fit, except the relatively poor fit (cut-off ≥ 90) in terms of GFI. All the scales accept the vigour scale have acceptable reliability coefficients above 0.70. Nevertheless, these results are acceptable to be used in further analyses.

7.7.2.1.2.2.3 Confirmatory factor analysis of the measurement for the construct sense of coherence

The quality of the sense of coherence measurement in terms of the data obtained through exploratory factor analysis was tested through confirmatory factor analysis. The results of the confirmatory factor analysis of the sense of coherence scale are presented in Table 7.61 below.

Table 7.61 Confirmatory factor analysis of the measurement model for the construct sense of coherence

Variable	Factor structure	Reliability Cronbach's alpha	SBX^2	df	RMSEA	SRMR	NFI	GFI	CFI
SOC	One factor *N*=279	Sense of coherence 0.829	13.029 (X^2/df = 1.45)	9	0.04	0.032	0.99	0.98	1.00

The fit statistics for the construct sense of coherence demonstrate excellent levels of fit. Also, the reliability coefficient of 0.83 is indicative of a good fit with the data obtained for this study. Therefore, the results can be used in further analysis in the current study.

7.7.2.1.2.2.4 Confirmatory factor analysis of the measurement models for the safety consciousness scales (safety control, risk avoidance, and stress tolerance), driver attitude and quality orientation scale

On the basis of the suggested factor structures obtained from exploratory factor analysis of the safety consciousness scales (safety control, risk avoidance, and stress tolerance), driver attitude, and quality orientation scale, the quality in terms of the data obtained was tested through confirmatory factor analysis. The results of the confirmatory factor analysis of the safety consciousness scales (safety control, risk avoidance, and stress tolerance), driver attitude scale, and quality orientation scale are presented in Table 7.62 below.

Table 7.62 Confirmatory factor analysis of the measurement models for the safety consciousness scales (safety control, risk avoidance, and stress tolerance), driver attitude scale, and quality orientation scale

Variable (attitude towards workplace safety	Factor structure	Reliability Cronbach's alpha	SBX^2	df	RMSEA	SRMR	NFI	GFI	CFI
	Three factor solution *N*=279	Safety control 0.74 Risk avoidance 0.86 Stress tolerance 0.73	49.739 ((x^2/df= 1.55)	32	0.045	0.036	0.98	0.96	0.99
Driver attitude	One factor *N*=279	Driver total 0.75	144.716 (x^2/df= 4.13)	35	0.106	0.08	0.82	0.90	0.86
Quality orientation	One factor *N*=279	Quality total 0.75	60.553. (x^2/df= 1.38)	44	0.037	0.06	0.93	0.94	0.98

The results in Table 7.62 of the confirmatory factor analysis of the safety consciousness scales, namely safety control, risk avoidance, and stress tolerance provided acceptable levels of fit. The three scales, safety control, risk avoidance, and stress tolerance have acceptable reliability coefficients above 0.70. However, the results of the confirmatory factor analysis of the driver attitude scale provided a relatively poor overall fit. It is noticeable that the driver attitude scale revealed an acceptable reliability coefficient of 0.75. Lastly, the quality orientation scale showed acceptable overall fit statistics as well as an acceptable reliability coefficient above 0.70. These results are thus acceptable to be used in further analysis, with only the driver attitude scale requiring more in-depth analysis for future research.

In the next section, the methods used in determining whether statistically significant mean differences exist between the biographical data and variables are discussed.

7.7.2.2 Determining the degree of differences between groups

An important factor to consider when analysing data is the assumption as to whether the population scores are normally distributed (Kerlinger & Lee, 2000). In other words, based on this assumption, researchers have to decide whether or not to use parametric or nonparametric statistical methods when analysing the data. According to Kerlinger and Lee (2000), parametric statistics depend on the assumption that the samples have been drawn from populations that are normally distributed, whereas nonparametric or distribution-free statistical tests depend on no assumptions as to the form of the sample population or the values of the population parameters. Although parametric statistical methods assume normally distributed data, they are fairly robust when this assumption is violated. Non-parametric statistical methods are suitable when the sample is small or when the comparison groups are unequal in size (The researchers argue further that when in doubt about the normality of a population or if an assumption is likely to have a negative influence on the conclusions drawn from the research data, a person should use a nonparametric statistical method (Kerlinger & Lee, 2000).

To compute the significant mean differences between different groups (normally distributed), a *t*-test (differences between two groups) and ANOVA (differences between more than two groups) parametric techniques are used. The t- and F statistics are an indication of whether two sample variances differ from one another significantly (Sekaran, 2000). In addition, in conditions where the data or groups are unequal, the Mann-Whitney U test (the nonparametric equivalent of the t-test) and the Kruskall-Wallis H test (the nonparametric equivalent of the ANOVA) were used in the computation of the significant differences between the different groups. However, it is also important to determine the effect size associated with the identified statistically significant difference. Calculating the effect size assists in determining whether or not the effect (of the difference between two or more than two groups) is substantive. Cohen's d (Cohen, 1998) is a measure of effect size that is used in this study. It is discussed in the following section.

7.7.2.2.1 Effect size (Cohen's *d*)

As it is important to interpret statistically significant correlations (e.g. determining the magnitude of *r* (see section 7.7.2.3.)) to evaluate the value of the obtained result to the research, similar interpretations need to be done to evaluate the statistically significant differences in terms of group differences. Cohen's *d* (Cohen, 1998) can be used to indicate the effect size associated with significant differences between two groups. The interpretation of the effect size associated with a statistically significant result is provided in the following table.

Table 7.63 Effect sizes associated with Cohen's *d*

Value of *d*	Effect size
< 0.10	Very small
0.20	Small
0.50	Medium
0.80	Large
> 1	Very large

In the next section, the method of determining whether statistically significant correlations exist amongst the different variables is presented. .

7.7.2.3 Determining the degree of relationship between variables

One of the research objectives was to determine whether statistically significant relationships exist among the measurement constructs. These propositions focus on both the descriptive and predictive purposes of research. All of these propositions focus on the question of relationship amongst variables and how to predict the dependent variables. In this study the dependent variable is attitude towards work place safety and consists of an overall safety consciousness construct (which is measured independently by three primary scales, safety control, risk avoidance, stress tolerance), and two secondary scales driver attitude and quality orientation.

Two of the most appropriate data analysis techniques that can be employed in evaluating these propositions are bivariate *r* and multiple *R* (Bless & Higson-Smith, 2000; Field, 2005; Hair et al., 2006; Kerlinger & Lee, 2000). Both of these techniques are discussed below.

7.7.2.3.1 Correlation (Bivariate *r*)

The Pearson product-moment correlation coefficient is a standardised measure of the strength of the relationship between variables. It can take any value from -1 (as one variable changes, the other changes in the opposite direction by the same amount), through 0 (as one variable changes the other doesn't change at all), to +1 (as one variable changes, the other changes in the same direction by the same amount) (Field, 2005).

7.7.2.3.2 Magnitude of *r* (Guilford's informal interpretations)

To evaluate the strength of a statistically significant relationship, it is useful to have a guide to interpret the strength of the identified correlation. Guilford (cited in Tredoux et al., 2002) provides a useful reference to interpret statistically significant relationships among variables. Thus, although a correlation may be statistically significant, it must still be evaluated in the context of its associated strength and value to the research. This guideline is similar to Cohen's *d* (Cohen, 1998), which indicates the effect size associated with a significant difference between two group differences. Guilford's informal interpretations of the magnitude of *r* are presented in the table below.

Table 7.64 Guilford's informal interpretations of the magnitude of *r*

Value of *r* (+ or -)	Informal interpretation
< 0.2	Slight; almost no relationship
0.2 – 0.4	Low correlation; definite but small relationship
0.4 – 0.7	Moderate correlation; substantial relationship
0.7 – 0.9	High correlation; strong relationship
0.9 – 1.0	Very high correlation; very dependable relationship

The following section (section 7.6.2.4) elaborates on multiple regression analysis (e.g. multiple *R)* to evaluate which independent variables contribute significantly to the variance in the dependent variables.

7.7.2.4 Multiple regression analysis

Regression analysis is the name for a family of techniques that attempts to predict one variable (an outcome or dependent variable) from another variable, or set of variables (the predictor or independent variables). Each of the parameters in the regression analysis can have a standard error associated with it, and hence a confidence interval can be calculated for each parameter with a p-value. Regression generalises to a case with multiple predictor variables, referred to as multiple regression. In this study, a stepwise multiple regression analysis approach was used to determine how much of the variance in the dependent variables is explained when several independent variables are theorised to simultaneously influence it. The square of multiple r, R-square or R2 is the amount of variance explained in the dependent variable by the predictors. The R-square value, the F statistic, and its significance level are important values in the interpretation of the results and to determine which variable or variables have been significantly explained by the set of predictors (Kerlinger & Lee, 2000). That is, it estimates what the slope would be if all other variables are controlled (Salkind, 2007).

Multiple regression analysis, a form of general linear modelling, is a multivariate statistical technique that is used in this study to examine the relationship between a single dependent variable (e.g. driver attitude) and a set of independent variables (e.g. personality). With its broad applicability, multiple regression has been used for many purposes. This application falls broadly within two groups, namely prediction and explanation. Prediction involves the extent to which the regression variate (one or more independent variables) can predict the dependent variable. Explanation examines the magnitude, sign and statistical significance of the regression coefficients (the amount of change in the dependent variable for a one-unit change in the independent variable) for each independent variable and attempts to develop a substantive or theoretical reason for the effects of the independent variables (Hair et al., 2006).

The result of the multiple regression analysis for this study is discussed in Chapter 8.

The following sections elaborate on structural equation modelling (SEM) and in particular the partial least squares path modelling approach specifically utilised in the present study.

7.7.2.5 Structural equation modelling (SEM)

Structural equation modelling (SEM) is a general term that describes a large number of statistical models used to evaluate the consistency of substantive theories with empirical data. It represents an extension of general linear modelling procedures such as factor extraction and multiple regression. SEM can be used to study the relationship between latent constructs that are indicated by multiple measures and is applicable to experimental or non-experimental data and to cross-sectional or longitudinal data (Salkind, 2007). There are two approaches to SEM. The first approach emphasises the testing of a theory and is known as covariance based SEM (hard-based modelling). In contrast, the second approach to SEM is known as soft modelling which is a variance-based approach to SEM (e.g. partial least squares modelling) and its main purpose is prediction (Henseler et al., 2009).

In the next section an explanation is presented on the motivation and characteristics for using partial least squares (PLS) path modelling. Thereafter, the structural component of SEM through PLS modelling is evaluated.

7.7.2.5.1 Motivation for using PLS modelling

The most important motivations for using PLS modelling are exploration and prediction, as PLS path modelling is recommended in an early stage of theoretical development in order to test and validate exploratory models. Another powerful feature of PLS path modelling is that it is suitable for prediction-oriented research. This methodology therefore assists researchers who focus on the explanation of endogenous constructs (Henseler et al., 2009). Chin and Newsted (1999) presented a Monte Carlo simulation study on PLS with small samples. They found that the PLS path modelling approach can provide information about the appropriateness of indicators at sample size as low as 20. This study confirms the consistency at large on loading estimates with an increased number of observations and numbers of manifest variables per measurement model.

7.7.2.5.2 Methodological characteristics of PLS modelling

PLS modelling is rooted in four genuine characteristics:

1) Instead of drawing solely on the common reflective mode, the PLS path modelling algorithm allows the unrestricted computation of cause-effect relationship models thatemploy both reflective and formative measurement models (Diamantopoulos & Winklhofer, 2001).
2) PLS can be used to estimate path models when sample sizes are small (Chin & Newsted, 1999).
3) PLS path models can be very complex (e.g. consist of many latent and manifest variables) without leading to estimation problems (Wold, 1985). PLS modelling is methodologically advantageous to covariance-based structural equation modelling (CBSEM) whenever improper or non-convergent results are likely to occur (e.g. Krijnen, Dijkstra & Gill, 1998). Furthermore, with more complex models, the number of latent and manifest variables may be high in relation to the number of observations.
4) PLS path modelling can be used when distributions are highly unequal/skewed (Bagozzi, 1994), or the independence of observations is not assured, because, as Fornell (1982, p. 443) has argued, "there are no distributional requirements."

7.7.2.5.3 Evaluating the structural component of SEM through PLS modelling

Partial least squares (PLS) is a family of alternating least squares algorithms, or "prescriptions", which extend principal component and canonical correlation analysis. The method was designed by Wold (1974, 1982, 1985) for the analysis of high dimensional data in a low-structure environment and has undergone various extensions and modifications. PLS, a variance-based technique, has been used by a growing number of researchers from various disciplines such as strategic management (e.g. Hulland, 1999), management information systems (e.g. Dibbern, Goles, Hircschheim, & Jayatilaka, 2004), e-business (e.g. Pavlou & Chai, 2002), organisational behaviour (e.g. Higgins, Duxbury, & Irving, 1992), marketing (e.g. Reinartz, Krafft, & Hoyer, 2004), and consumer behaviour (e.g. Fornell & Robinson, 1983).

PLS models are formally defined by two sets of linear equations: the outer model (e.g. measurement model) and the inner model (e.g. theoretical model). The outer model (e.g. measurement model) specifies the relationships between observed or manifest variables and latent variables whereas the inner model (e.g. theoretical model) specifies the relationships between unobserved or latent variables. The outer model in PLS is similar to the measurement model used in the hard-based modelling approach and the inner model is similar to the structural model used in the hard-based modelling approach. According to Henseler et al. (2009), the PLS path modelling does not provide any global goodness-of-fit criterion. To overcome this dilemma, Chin (1998) has proposed criteria to assess partial model structures via a systematic application consisting of a two-step process namely: (1) the assessment of the outer model (e.g. measurement model): and (2) the assessment of the inner model (e.g. theoretical model). Figure 7.1 provides an outline of the two-step process.

The two-step process begins with the outer model (measurement model), focusing on the measurement reliability and validity according to certain criteria that are associated with the formative and reflective outer model. The inner model (theoretical model) can only be evaluated when the latent variables in the measurement model show evidence of sufficient reliability and validity. The next section provides a brief explanation on the evaluation of the PLS path model results of the outer model (measurement model) and inner model (theoretical model) as outlined in Figure 7.1.

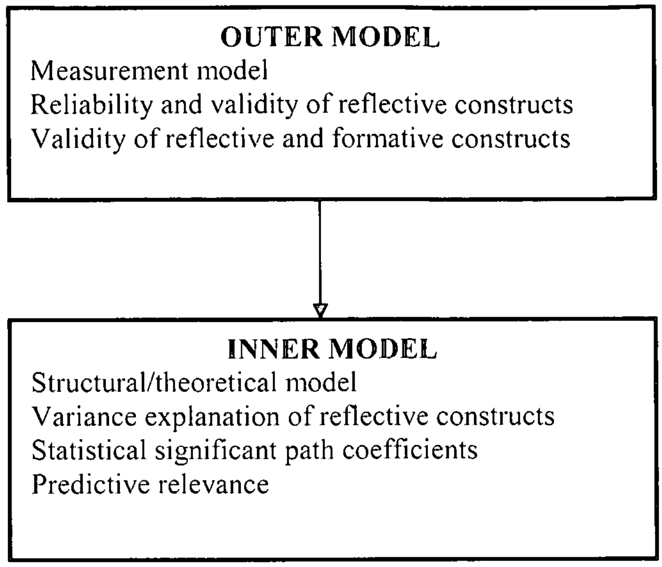

Figure 7.1 A two-step process of PLS path model assessment

7.7.2.5.3.1 Evaluating the results of the outer model of PLS

According to Henseler et al. (2009), the reflective measurement models should be evaluated with regard to their reliability and validity. Firstly, the internal consistency reliability criterion is Cronbach's α (Cronbach, 1951), which provides an estimate for the reliability based on the indicator intercorrelations. However, due to Cronbach's α severe underestimation of the internal consistency reliability of latent variables in PLS path models, the composite reliability measure (Werts, Linn & Jöreskog, 1974) was introduced. This alternative measure takes into account that indicators have different loadings, and can be interpreted in the same way as Cronbach's α. Similar to Cronbach's α (Cronbach, 1951), an internal consistency reliability value above 0.7 in early stages of research and values above 0.8 or 0.9 in more advanced stages of research are regarded as satisfactory (Nunnally & Bernstein, 1994), whereas a value below 0.6 indicates a lack of reliability (Henseler et al., 2009). For the assessment of validity, the average variance extracted (AVE) (Fornell & Larcker, 1981) is an important criterion of convergent validity, meaning that a latent variable is able to explain more than half of the variance of its indicators on average (Henseler et al., 2009). An AVE value of a least 0.5 indicates sufficient convergent validity.

The statistical results on the reliability and validity of the measurement model (outer model) of this study are presented in Chapter 8.

7.7.2.5.3.2 Evaluating the results of the inner model of PLS

According to Henseler et al. (2009), the reliability and validity value estimations of the outer model (measurement model) allows for the evaluation of the inner path model (theoretical model) estimates. The structural model as presented by PLS modeling refers to the theoretical model as illustrated in Figure 6.1. An important criterion of assessing the inner model (theoretical model) is the estimation of the path coefficients. The estimated values for path relationships in the inner model (theoretical model) should be evaluated in terms of sign, magnitude, and significance (Chin, 1998). In order to determine the confidence intervals of the path coefficients and statistical inference applicable to the proposed theoretical model, a re-sampling technique such as bootstrapping was used.

Bootstrapping is used to determine whether the path coefficients in the inner model (structural model) are significant. The nonparametric bootstrap (Davison & Hinkley, 2003; Efron & Tibshirani, 1993) procedure was used in PLS path modelling to provide confidence intervals for all parameter estimates, building the basis for statistical inference. In general, the bootstrap technique provides an estimate of the shape, spread, and bias of the sampling distribution of a specific statistic. Bootstrapping treats the observed sample as if it represents the population. The PLS results for all bootstrap samples provide the mean value and standard error for each path model coefficient. This information permits a student's t-test to be performed for the significance of the path model relationships. For the theoretical model/structural model (inner model), the T-statistic is an indication of the statistically significant path coefficient between the different variables (Henseler et al., 2009).

According to Homburg and Baumgartner (1998), a significance of 1% (0.01) corresponds to a t-value over 2.326, a significance of 5% (0.05) to a t-value between 1.645 and 2.326, and a significance of 10% (0.1) to a t-value between 1.282 and 1.645 for a one-tailed test. In addition, Ruiz and Banet (2009) propose the following t-values via bootstrapping technique (set at 200 samples), namely t-values greater than 1.65 to be significant at the 0.05 level and a t-value greater than 2 significant at the 0.01 level. For bootstrap samples set at 500, Campbell and Ntobedzi (2007) reported t-values greater than 2.33 to be significant at the 0.01 level and t-values greater than 1.66 to be significant at the 0.05 level. For this study, the cut-off t-value for the theoretical/structural model (inner model) path coefficients was set at > 1.95 and values with a greater absolute value than 1.96 are significant at the .05 level, and those greater than 2.58 are significant at the .01 level.

In closure, Chin (1998) argues that researchers should focus on the predictiveness of the model rather than global goodness-of-fit or pure statistical significance.

The significance of the path coefficients of the theoretical model (inner model) of this study are discussed in Chapter 8.

The following section provides a brief summary of this chapter.

7.8 SUMMARY

This chapter provides the reader with an in-depth explanation of the research methodological approach followed in this study. Firstly, the type of research design and sampling process were discussed and a brief description given of the biographical characteristics and safety performance data of the respondents.

Secondly, the process that was followed to collect the data and issues around confidentiality and ethical use of individual results were discussed. Thirdly, the different measuring instruments selected for this study were explained, focusing on their nature and composition, reliability and validity aspects as well as the rationale for inclusion. In addition, the reliability coefficients of the measurement instruments completed by the participants were also presented. Information on the factor structure and goodness-of-fit statistics of the burnout, work engagement, sense of coherence, safety consciousness scales (safety control, risk avoidance, and stress tolerance), driver attitude and quality orientation were discussed. Lastly, the statistical techniques used for the processing of the data and the evaluation of the theoretical model in reaching the research objectives were explained. The chapter is concluded with a brief summary.

Chapter 8 provides statistical evidence on significant differences between the biographical and safety performance data with the psychological factors, the degree of relationship between the variables (correlations) and which variables are significant predictors (multiple regression) of attitude towards work place safety (safety consciousness, driver attitude and quality orientation). Lastly, an in-depth discussion will follow on the psychometric properties of the measurement model (outer model) and path relationships between the unobserved and latent variables of the theoretical model (inner model) by means of the partial least squares path modelling approach.

CHAPTER 8

PRESENTATION OF RESULTS

8.1 INTRODUCTION

As indicated in Chapter 1, the main objectives of this study are firstly to determine whether a statistically significant relationship exists between the independent (psychological factors) and dependent variables (attitude towards work place safety), and secondly to develop a theoretical model depicting the influence or path relationship of the independent variables (psychological factors) with the dependent variables (attitude towards work place safety). However, although not included in the development of the theoretical model, the significance of the differences between the psychological factors as well as differences in attitude towards work place safety based on participants' biographical and safety performance data are important indicators for the organisation under study in terms of its overall safety risk management initiatives. Therefore, this data is also reported in this section. In addition, the reporting of the statistical differences assists in expanding the knowledge, understanding and determinants of work place incidents/accidents, including vehicle accidents in South Africa.

The first part of this chapter focuses on the statistical results (see Chapter 7) indicating whether statistically significant differences exist between psychological factors based on the biographical and safety performance data obtained from the participants. In addition, it provides evidence of where statistically significant differences were found, what the strength or magnitude of the differences in mean scores are. The correlation coefficient matrix is presented next to provide further information on whether the hypothesis as set out in Chapter 1 (section 1.5) is supported or not. Thereafter, the results of the multiple regression analysis are presented, highlighting which set of predictors, from a number of independent variables, are the most likely to influence the individual's attitude towards work place safety in terms of safety consciousness, driver attitude and quality orientation.

Lastly, as explained in Chapter 7 (meaning of outer and inner models), the results of the measurement model (outer model) are shown as well as the values of the path coefficients between the different variables as proposed in the theoretical model (Figure 6.1). The emphasis here is on the presentation of the results as they relate to hypothesis 2 (Chapter 1), indicating whether statistically significant path coefficients exist between the different variables (see Figure 6.1) which confirm that a person's attitude towards safety (safety consciousness, driver attitude and quality of work) can be influenced significantly by psychological factors (intelligence, personality, burnout, work engagement and sense of coherence). An in-depth discussion on the conclusions, limitations and recommendations as it relates to this study is provided in Chapter 9.

The following section reports the results of the analysis of differences comparing psychological factors based on the biographical and safety performance data obtained for this study.

8.2 DIFFERENCES IN PSYCHOLOGICAL FACTORS AMONG VARIOUS GROUPS BASED ON THE BIOGRAPHICAL AND SAFETY PERFORMANCE DATA OF PARTICIPANTS

The analyses of differences, particularly the analysis of differences between means, are intended for the purpose of studying and identifying statistically significant relations between the independent variables, dependent variables and the biographical data obtained from the participants (Kerlinger & Lee, 2000). In this study, an analysis of differences was performed to compare whether statistically significant differences exist between psychological factors based on the biographical and the safety performance data of the participants. In addition, it provides an integrated assessment or understanding of the workings of the psychological factors and attitude towards work place safety based on participants' biographical and safety performance data.

In the next section, results of the analysis of differences comparing psychological factors based on the biographical and participants' safety performance data are presented.

8.2.1 Results of the analysis of differences between psychological factors based on participants biographical information and safety performance data

No hypothesis was established regarding whether statistically significant differences exist between psychological factors based on the biographical and participants' safety performance data. It is however important to understand the effect of the relationship or influence, for example the relationship between the psychological factors based on participants' job grades or nature of work. However, limited attention is given to the results of the analysis of differences between groups: the primary objective of this study is to investigate the prediction of psychological factors on influencing a person's attitude towards workplace safety through partial least squares (PLS) path modelling techniques. A critical aspect is that any inferences made on the differences between mean scores on participants' scoring below or above average on safety consciousness, driver attitude and quality orientation with psychological factors need to be treated with caution. The average scores obtain by participants on these variables are not based on a specific norm group for safety consciousness for example, but on the participant score in relation to the average scores of all 279 participants for that particular variable, for example safety consciousness.

To compute the significant mean differences between groups, a *t*-test (differences between two groups) and ANOVA (differences between more than two groups) parametric techniques were used. The *t*- and F statistics are an indication of whether two sample variances differ from one another significantly (Sekaran, 2000). In addition, in conditions where the data or groups are unequal or small, the Mann-Whitney U test (the nonparametric equivalent of the t-test) and the Kruskall-Wallis H test (the nonparametric equivalent of the ANOVA) were used in the computation of the significant differences between the different groups. However, it is also important to determine the effect size associated with the identified statistically significant differences. Calculating the effect size assists in determining whether or not the effect (of the difference between two or more than two groups) is substantive. Cohen's *d* (Cohen, 1998) is a measure of effect size that is used in this study.

Firstly, the results of the statistically significant differences between psychological factors and the biographical/safety performance data are calculated and presented in a table format together with group means, group standard deviation, *t*-values (as well as effect sizes), *p*-values. The following comparisons are made between psychological factors based on specific biographical and safety performance data:

1) Comparing differences between psychological factors based on age.
2) Comparing differences between psychological factors based on levels of qualification.
3) Comparing differences between psychological factors based on two levels of job/task grades (T4-T7 and T9-T13).
4) Comparing differences between psychological factors based on the nature of work performed by the participants.
5) Comparing differences between psychological factors based on average business kilometres driven per month (self-reported data).
6) Comparing differences between psychological factors based on traffic violations (traffic offences) (self-reported data).
7) Comparing differences between psychological factors based on participants' involvement in vehicle accidents (self-reported data).
8) Comparing differences between psychological factors based on vehicle accidents in relation to at fault, not at fault and not sure responses (self-reported data).
9) Comparing differences between psychological factors based on participants' safety performance data (workplace incidents) (according to the organisation safety register).
10) Comparing differences between psychological factors based on participants' mean scores on safety consciousness.
11) Comparing differences between psychological factors based on participants' mean scores on driver attitude.
12) Comparing differences between psychological factors based on participants' mean scores on quality orientation.

The results of differences between psychological factors based on age are shown first in the next table.

Table 8.1 Differences in psychological factors among various age groups

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std Error	F value	Sig. (p-value)
Exhaustion	18-29 years	30-39 years	-.83150	1.03421	7.512	0.886
		40-49 years	-4.25369*	1.01161		0.001**
		50-65 years	-2.51232	1.10622		0.163
	30-39 years	18-29 years	.83150	1.03421		0.886
		40-49 years	-3.42219*	.92073		0.004**
		50-65 years	-1.68081	1.02378		0.442
Burnout	18-29 years	30-39 years	-1.08013	1.63342	6.704	0.932
		40-49 years	-5.86925*	1.59773		0.004**
		50-65 years	-5.08190*	1.74716		0.039*
	30-39 years	18-29 years	1.08013	1.63342		0.932
		40-49 years	-4.78912*	1.45420		0.014*
		50-65 years	-4.00177	1.61695		0.108
Abstract	18-29 years	30-39 years	1.73626	.99210	14.024	0.384
		40-49 years	4.79064*	.97042		0.000**
		50-65 years	5.79064*	1.06118		0.000**
	30-39 years	18-29 years	-1.73626	.99210		0.384
		40-49 years	3.05438*	.88324		0.008**
		50-65 years	4.05438*	.98209		0.001**
Numerical	18-29 years	30-39 years	.79716	.86040	3.521	0.835
		40-49 years	1.85242	.84159		0.186
		50-65 years	2.70874*	.92031		0.036*
Spatial	18-29 years	30-39 years	1.54212	.75299	4.359	0.244
		40-49 Years	2.53284*	.73654		0.009**
		50-65 Years	2.25123	.80542		0.052

Table 8.1 Differences in psychological factors among various age groups (continued)

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std Error	F value	Sig. (p-value)
Verbal	18-29 years	30-39 Years	1.54670	1.05168	11.214	0.540
		40-49 Years	4.10550*	1.02870		0.001**
		50-65 Years	5.75493*	1.12491		0.000**
	30-39 years	18-29 Years	-1.54670	1.05168		0.540
		40-49 Years	2.55880	.93629		0.061
		50-65 Years	4.20822*	1.04108		0.001**
OPP Persuasive	18-29 years	30-39 years	-2.36493	.86350	7.368	0.060
		40-49 years	-3.91975*	.84463		0.000**
		50-65 years	-2.92549*	.92363		0.020*
OPP Phlegmatic	30-39 years	18-29 years	1.21337	1.17471	5.286	0.785
		40-49 years	3.69408*	1.04582		0.007**
		50-65 years	3.44120*	1.16286		0.035*
Safety Consciousness	18-29 years	30-39 years	3.75366	4.00353	6.335	0.830
		40-49 years	12.66215*	3.91604		0.016*
		50-65 years	15.25985*	4.28230		0.006**
	30-39 years	18-29 years	-3.75366	4.00353		0.830
		40-49 years	8.90849	3.56424		0.103
		50-65 years	11.50619*	3.96315		0.040*
Stress Tolerance	18-29 years	30-39 years	1.31548	1.30615	7.359	0.798
		40-49 years	5.10283*	1.27761		0.001**
		50-65 years	4.44766*	1.39710		0.019*
	30-39 years	18-29 years	-1.31548	1.30615		0.798
		40-49 years	3.78736*	1.16284		0.015*
		50-65 years	3.13218	1.29298		0.121
Risk Avoidance	18-29 years	30-39 years	2.02701	2.06891	3.618	0.811
		40-49 years	5.01375	2.02369		0.108
		50-65 years	6.31835*	2.21297		0.045*

Table 8.1 Differences in psychological factors among various age groups (continued)

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std Error	F value	Sig. (p-value)
Safety Control	18-29 years	30-39 years	.41117	1.40808	4.129	0.994
		40-49 years	2.54557	1.37731		0.334
		50-65 years	4.49384*	1.50613		0.032*
	30-39 years	18-29 years	-.41117	1.40808		0.994
		40-49 years	2.13439	1.25358		0.409
		50-65 years	4.08267*	1.39388		0.037*
Quality Orientation	18-29 years	30-39 years	.73397	1.20830	5.669	0.946
		40-49 years	-1.29167	1.18189		0.754
		50-65 years	-3.96983*	1.29243		0.026*
	30-39 years	18-29 years	-.73397	1.20830		0.946
		40-49 years	-2.02564	1.07571		0.317
		50-65 years	-4.70380*	1.19611		0.002**

* $p \leq 0.05$ mean difference is statistically significant
** $p \leq 0.01$ mean difference is statistically significant

Table 8.1 shows that statistically significant differences exist between age 18-29 years and 40-49 years as well as between age 30-39 and 40-49 on the burnout scale, emotional exhaustion. On the burnout scale, age 18-29 differs significantly from ages 40-49 and 50-65 years as well as age 30-39 differs from age 40-49 years. On the cognitive scales, statistically significant differences on abstract reasoning were found between 18-29 years and 40-49 and 50-65 years as well as between 30-39 years and 40-49 and 50-65 years. Statistically significant differences on numerical reasoning were found between 18-29 and 50-65 years, and on verbal reasoning between 18-29 and 40-to-65 years, and between 30-39 and 50-65 years. Participants' spatial reasoning differs significantly between ages 18-29 and 40-49.

Only on the personality dimensions, OPP persuasive (18-29 years and 40-65 years) and OPP phlegmatic (30-39 years and 40-65 years) were statistically significant differences found. Lastly, statistically significant differences were found between the safety attitudinal factors and the age of participants. On safety consciousness (between ages 18-29 and 40-65, and 30-39 and 50-65), stress tolerance (18-29 and 40-65, and between 30-39 and 40-49), risk avoidance (between 18-29 and 50-65), safety control (between 18-29 and 50-56, and between 30-39 and 50-65), and quality orientation (between 18-29 and 50-65, and between 30-39 and 50-65 years).

In the next table the differences between psychological factors based on the levels of qualification are shown.

Table 8.2 Differences in psychological factors among groups with various levels of qualification

Dependent Variable	**(I) Qualification**	**(J) Qualification**	**Mean Difference (I-J)**	**Std Error**	**F value**	**Sig (p-value)**
Cynicism	Below Grade 10	Grade 10	2.15966	1.40732	6.305	0.967
		Grade 11	2.58824	1.80441		0.979
		Grade 12	6.29490*	1.34302		0.006**
		Technical College Diploma	4.60386	1.36418		0.186
		Technikon Diploma	3.55120	1.54797		0.728
		Technikon Degree	6.95187	1.93465		0.121
		University Degree	7.67157*	1.88507		0.039*
		Postgraduate Degree	8.28824*	1.99251		0.031*
	Grade 12	Grade 10	-4.13524*	.91839		0.011*
		Grade 11	-3.70667	1.45561		0.594
		Technical College Diploma	-1.69104	.85081		0.860
		Technikon Diploma	-2.74370	1.12210		0.650
		Technikon Degree	.65697	1.61423		1.000
		University Degree	1.37667	1.55447		0.999
		Postgraduate Degree	1.99333	1.68315		0.994
		Below Grade 10	-6.29490*	1.34302		0.006*

Table 8.2 Differences in psychological factors among groups with various levels of qualification (continued)

Dependent Variable	(I) Qualification	(J) Qualification	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
Abstract	Below Grade 10	Grade 10	-2.49100	1.36795	20.091	0.912
		Grade 11	-2.89916	1.75393		0.949
		Grade 12	-7.28392*	1.30545		0.000**
		Technical College Diploma	-9.37684*	1.32602		0.000**
		Technikon Diploma	-11.95207*	1.50467		0.000**
		Technikon Degree	-10.28877*	1.88053		0.000**
		University Degree	-11.97059*	1.83234		0.000**
		Postgraduate Degree	-12.47059*	1.93677		0.000**
	Grade 10	Grade 11	-.40816	1.47275		1.000
		Grade 12	-4.79293*	.89270		0.001**
		Technical College Diploma	-6.88584*	.92251		0.000**
		Technikon Diploma	-9.46107*	1.16479		0.000**
		Technikon Degree	-7.79777*	1.62145		0.004**
		University Degree	-9.47959*	1.56530		0.000**
		Postgraduate Degree	-9.97959*	1.68636		0.000**
		Below Grade 10	2.49100	1.36795		0.912
	Grade 11	Grade 10	.40816	1.47275		1.000
		Grade 12	-4.38476	1.41489		0.299
		Technical College Diploma	-6.47768*	1.43389		0.011*
		Technikon Diploma	-9.05291*	1.60054		0.000**
		Technikon Degree	-7.38961	1.95808		0.081
		University Degree	-9.07143*	1.91185		0.005**
		Postgraduate Degree	-9.57143*	2.01216		0.005**
		Below Grade 10	2.89916	1.75393		0.949
	Grade 12	Grade 10	4.79293*	.89270		0.001
		Grade 11	4.38476	1.41489		0.299
		Technical College Diploma	-2.09292	.82700		0.603
		Technikon Diploma	-4.66815*	1.09071		0.022*
		Technikon Degree	-3.00485	1.56907		0.885
		University Degree	-4.68667	1.51098		0.297
		Postgraduate Degree	-5.18667	1.63606		0.267
		Below Grade 10	7.28392*	1.30545		0.000

Table 8.2 Differences in psychological factors among groups with various levels of qualification (continued)

Dependent Variable	(I) Qualification	(J) Qualification	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
Numerical	Below Grade 10	Grade 10	-1.37695	1.16901	16.190	0.994
		Grade 11	-1.76471	1.49886		0.994
		Grade 12	-4.73804*	1.11560		0.024*
		Technical College Diploma	-6.57721*	1.13317		0.000**
		Technikon Diploma	-8.69063*	1.28584		0.000**
		Technikon Degree	-7.03743*	1.60704		0.016*
		University Degree	-7.68137*	1.56586		0.003**
		Postgraduate Degree	-10.96471*	1.65511		0.000**
	Grade 10	Grade 11	-.38776	1.25857		1.000
		Grade 12	-3.36109*	.76287		0.015*
		Technical College Diploma	-5.20026*	.78835		0.000**
		Technikon Diploma	-7.31368*	.99539		0.000**
		Technikon Degree	-5.66048*	1.38564		0.037*
		University Degree	-6.30442*	1.33766		0.006**
		Postgraduate Degree	-9.58776*	1.44111		0.000**
		Below Grade 10	1.37695	1.16901		0.994
	Grade 11	Grade 10	.38776	1.25857		1.000
		Grade 12	-2.97333	1.20912		0.642
		Technical College Diploma	-4.81250	1.22535		0.056
		Technikon Diploma	-6.92593*	1.36777		0.002**
		Technikon Degree	-5.27273	1.67332		0.275
		University Degree	-5.91667	1.63381		0.114
		Postgraduate Degree	-9.20000*	1.71953		0.001**
		Below Grade 10	1.76471	1.49886		0.994
	Grade 12	Grade 10	3.36109*	.76287		0.015*
		Grade 11	2.97333	1.20912		0.642
		Technical College Diploma	-1.83917	.70673		0.562
		Technikon Diploma	-3.95259*	.93209		0.024*
		Technikon Degree	-2.29939	1.34088		0.937
		University Degree	-2.94333	1.29124		0.736
		Postgraduate Degree	-6.22667*	1.39813		0.013*
		Below Grade 10	4.73804*	1.11560		0.024

Table 8.2 Differences in psychological factors among groups with various levels of qualification (continued)

Dependent Variable	(I) Qualification	(J) Qualification	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
Spatial	Below Grade 10	Grade 10	-1.69868	1.11961	8.317	0.970
		Grade 11	-1.23950	1.43552		0.999
		Grade 12	-4.34902*	1.06846		0.039*
		Technical College Diploma	-5.06985*	1.08529		0.007**
		Technikon Diploma	-7.17865*	1.23151		0.000**
		Technikon Degree	-3.79144	1.53913		0.640
		University Degree	-5.88235	1.49969		0.057
		Postgraduate Degree	-5.28235	1.58517		0.202
	Grade 10	Grade 11	.45918	1.20538		1.000
		Grade 12	-2.65034	.73063		0.112
		Technical College Diploma	-3.37117*	.75504		0.013*
		Technikon Diploma	-5.47997*	.95333		0.000**
		Technikon Degree	-2.09276	1.32709		0.962
		University Degree	-4.18367	1.28113		0.227
		Postgraduate Degree	-3.58367	1.38021		0.566
		Below Grade 10	1.69868	1.11961		0.970
	Grade 11	Grade 10	-.45918	1.20538		1.000
		Grade 12	-3.10952	1.15802		0.516
		Technical College Diploma	-3.83036	1.17357		0.228
		Technikon Diploma	-5.93915*	1.30998		0.010*
		Technikon Degree	-2.55195	1.60261		0.959
		University Degree	-4.64286	1.56477		0.363
		Postgraduate Degree	-4.04286	1.64687		0.644
		Below Grade 10	1.23950	1.43552		0.999
		Technikon Degree	2.09091	1.66033		0.991
		Postgraduate Degree	.60000	1.70309		1.000
		Below Grade 10	5.88235	1.49969		0.057

Table 8.2 Differences in psychological factors among groups with various levels of qualification (continued)

Dependent Variable	(I) Qualification	(J) Qualification	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
Verbal	Below Grade 10	Grade 10	-3.50060	1.35833	25.982	0.577
		Grade 11	-3.94958	1.74160		0.741
		Grade 12	-9.44863*	1.29627		0.000**
		Technical College Diploma	-10.26654*	1.31669		0.000**
		Technikon Diploma	-13.34641*	1.49408		0.000**
		Technikon Degree	-14.05348*	1.86730		0.000**
		University Degree	-14.48529*	1.81945		0.000**
		Postgraduate Degree	-15.13529*	1.92315		0.000**
	Grade 10	Grade 11	-.44898	1.46239		1.000
		Grade 12	-5.94803*	.88642		0.000**
		Technical College Diploma	-6.76594*	.91602		0.000**
		Technikon Diploma	-9.84580*	1.15660		0.000**
		Technikon Degree	-10.55288*	1.61004		0.000**
		University Degree	-10.98469*	1.55429		0.000**
		Postgraduate Degree	-11.63469*	1.67449		0.000**
		Below Grade 10	3.50060	1.35833		0.577
	Grade 11	Grade 10	.44898	1.46239		1.000
		Grade 12	-5.49905	1.40493		0.058
		Technical College Diploma	-6.31696*	1.42380		0.014*
		Technikon Diploma	-9.39683*	1.58928		0.000**
		Technikon Degree	-10.10390*	1.94431		0.001**
		University Degree	-10.53571*	1.89840		0.000**
		Postgraduate Degree	-11.18571*	1.99801		0.000**
		Below Grade 10	3.94958	1.74160		0.741
OPP Flexible	Grade 10	Grade 11	-1.82653	1.26381	3.598	0.978
		Grade 12	-1.23320	.76605		0.957
		Technical College Diploma	-1.17028	.79164		0.974
		Technikon Diploma	-1.99320	.99954		0.858
		Technikon Degree	-1.05380	1.39141		1.000
		University Degree	-5.82653*	1.34323		0.018*
		Postgraduate Degree	-5.12653	1.44711		0.134
		Below Grade 10	-2.32653	1.17388		0.862

Table 8.2 Differences in psychological factors among groups with various levels of qualification (continued)

Dependent Variable	(I) Qualification	(J) Qualification	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
OPP Persuasive	Below Grade 10	Grade 10	3.48980	1.40043	2.717	0.624
		Grade 11	3.85714	1.79558		0.797
		Grade 12	4.09333	1.33644		0.316
		Technical College Diploma	5.57813*	1.35750		0.035*
		Technikon Diploma	5.70370	1.54040		0.095
		Technikon Degree	5.36364	1.92518		0.460
		University Degree	4.66667	1.87584		0.626
		Postgraduate Degree	5.50000	1.98276		0.466
OPP Trusting	Grade 10	Grade 11	-2.53061	1.80200	5.028	0.981
		Grade 12	-4.49442*	1.09227		0.035*
		Technical College Diploma	-2.87213	1.12875		0.595
		Technikon Diploma	-4.38776	1.42519		0.308
		Technikon Degree	-7.75139	1.98394		0.059
		University Degree	-8.88776*	1.91524		0.007**
		Postgraduate Degree	-6.48776	2.06336		0.278
		Below Grade 10	-1.74070	1.67377		0.998
OPP External (external locus of control)	Below Grade 10	Grade 10	.57503	1.47270	5.706	1.000
		Grade 11	.12605	1.88823		1.000
		Grade 12	3.51843	1.40541		0.618
		Technical College Diploma	1.98989	1.42755		0.982
		Technikon Diploma	5.22658	1.61988		0.243
		Technikon Degree	5.59358	2.02452		0.472
		University Degree	8.16176*	1.97264		0.032*
		Postgraduate Degree	6.01176	2.08507		0.407
	Grade 10	Grade 11	-.44898	1.58552		1.000
		Grade 12	2.94340	.96105		0.316
		Technical College Diploma	1.41486	.99315		0.980
		Technikon Diploma	4.65155	1.25398		0.094
		Technikon Degree	5.01855	1.74560		0.411
		University Degree	7.58673*	1.68515		0.011*
		Postgraduate Degree	5.43673	1.81548		0.349
		Below Grade 10	-.57503	1.47270		1.000

Table 8.2 Differences in psychological factors among groups with various levels of qualification (continued)

Dependent Variable	(I) Qualification	(J) Qualification	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
OPP Phlegmatic	Grade 10	Grade 11	-1.27551	1.98783	4.259	1.000
		Grade 12	-5.41361*	1.20491		0.012*
		Technical College Diploma	-5.65944*	1.24515		0.010**
		Technikon Diploma	-4.19879	1.57217		0.524
		Technikon Degree	-5.89239	2.18853		0.512
		University Degree	-7.01361	2.11275		0.206
		Postgraduate Degree	-5.34694	2.27614		0.700
		Below Grade 10	-1.75870	1.84638		0.999

* $p \leq 0.05$ mean difference is statistically significant
** $p \leq 0.01$ mean difference is statistically significant

As shown in Table 8.2, on the burnout scale cynicism, statistically significant differences are shown between participants with a below Grade 10 qualification and participants with a Grade 12, university, or postgraduate degree. Another significant difference is between participants with a Grade 12 and those with a Grade 10 qualification. In addition, several statistically significant differences were found between the cognitive constructs and qualifications. Participants with qualifications lower than Grade 11 differ significantly from those with qualifications higher than Grade 12 on abstract, numerical and verbal reasoning ability. On spatial reasoning, significant differences were found between persons with a qualification below Grade 10 and those with a Grade 12, technical college diploma, or technikon diploma. Participants with a Grade 10 qualification differ significantly from technical college and technikon diploma holders, but Grade 11s only differ significantly from technikon diploma holders.

Statistically significant differences exist between the personality dimension OPP flexible and participants with a Grade 10 qualification and those in possession of a university degree. In addition, significant differences exist on the OPP persuasive dimension between participants with a qualification lower than Grade 10 and those with a technical college diploma. On the OPP trusting dimension, statistically significant differences exist between Grade 10 and participants with Grade 12 and university degree qualification. Interestingly, only one statistically significant difference is observed between the OPP external (external locus of control) dimension, between participants with a qualification lower than Grade 10 and those with a university degree, as well as between those with a Grade 10 and those with a university degree qualification. Lastly, on the emotional stability dimension (OPP phlegmatic) participants with a Grade 10 qualification differ significantly from those in possession of a Grade 12 and technical college diploma.

The following table compares differences between psychological factors based on two levels of the participants' job/task grade (T4-T7 and T9-T13). A task grade of T4-T7 represents an entry level position (e.g. low voltage official) in the organisation under study and a task grade of T9-T13 a slightly higher position in relation to the required job outputs (e.g. senior official electrical, service agent).

Table 8.3 Differences in psychological factors among groups with various job/task grades

Variable	Task Grade	N	Mean	Standard Deviation	t-value	Sig (p-value)	Effect size
SOC Revised 1 Factor	T4-T7	129	65.5504	12.56419	-1.375	0.001**	-0.171
	T9-T13	130	67.3615	8.19151			
Numerical	T4-T7	129	4.7674	3.28945	-7.569	0.001**	-0.941
	T9-T13	130	8.6385	4.79665			
Spatial	T4-T7	129	7.7829	3.44139	-4.122	0.004**	-0.513
	T9-T13	130	9.8308	4.48103			
OPP Assertive	T4-T7	129	30.7287	4.53416	0.406	0.042*	0.050
	T9-T13	130	30.4769	5.41490			
OPP Contesting	T4-T7	129	30.5504	5.67197	1.415	0.026*	0.176
	T9-T13	130	29.4538	6.75153			
Safety Consciousness	T4-T7	129	168.5659	26.28475	-3.354	0.001**	-0.417
	T9-T13	130	178.2923	19.98505			
Stress Tolerance	T4-T7	129	38.6357	8.23667	-1.959	0.020*	-0.243
	T9-T13	130	40.5231	7.24030			
Risk Avoidance	T4-T7	129	79.3101	13.22096	-2.364	0.001**	-0.293
	T9-T13	130	82.8077	10.44223			
Safety Control	T4-T7	129	50.6202	8.95579	-4.362	0.000**	-0.542
	T9-T13	130	54.9615	6.94318			
Quality Orientation	T4-T7	129	23.8527	8.13086	3.105	0.004**	0.386
	T9-T13	130	21.1000	5.98299			

Table 8.3 Differences in psychological factors among groups with various job/task grades (continued)

Variable	Task Grade	N	Mean	Standard Deviation	t-value	Sig (p-value)	Effect size
Driver Attitude	T4-T7	129	39.2481	9.70344	-6.175	0.001**	-0.767
	T9-T13	130	45.9154	7.54730			

* $p \leq 0.05$ statistically significant
** $p \leq 0.01$ statistically significant

From Table 8.3 it is evident that the following statistically significant differences exist between participants on task/job grade T4-T7 and T9-T13 in regard to 11 psychological factors. The results are reported starting from those variables showing a large effect in terms of the significance of their differences. Firstly, a significant difference is observed between task grades T4-T7 and T9-T13 on numerical reasoning ability (large effect) and driver attitude (large effect). Secondly, T9-T13 differ significantly more from T4-T7 on spatial reasoning (medium effect), the safety attitudinal scale safety control (medium effect), and safety consciousness (medium effect). Thirdly, the participants with a task/job grade T9-T13 differ significantly from T4-T7 on the fortigenic construct sense of coherence (small effect) and stress tolerance (small effect) but on the personality dimension OPP contesting (small effect) and quality orientation (small effect) T4-T7s differ significantly compared to task/job grade T9-T13. The remaining 1 observable difference (OPP assertive) does show the existence of a statistically significant difference, but the effect or magnitude of the difference is not substantive (very small effect). No statistically significant differences were observed between task grades T4-T7 and T9-T13 on the other psychological variables.

In the next table, results of the testing for differences between psychological factors based on the nature of work performed by the participants are presented.

Table 8.4 Differences in psychological factors among groups differing in nature of work

Dependent Variable	(I) Nature of Work (Technical/ Non-Technical)	(J) Nature of Work (Technical/ Non-Technical)	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
Exhaustion	Non-Technical	Technical: Frontline (TO)	.58771	1.31791	3.902	0.999
		Technical: Frontline (STO)	3.89130*	1.13355		0.041*
		Technical: Frontline (PTO)	-.30435	1.13355		1.000
		Technical: Support	2.68096	1.00671		0.218
		Manager/Supervisor	1.78502	1.57614		0.936
	Technical: Frontline (STO)	Non-Technical	-3.89130*	1.13355		0.041
		Technical: Frontline (TO)	-3.30360	1.41205		0.364
		Technical: Frontline (PTO)	-4.19565*	1.24174		0.047*
		Technical: Support	-1.21035	1.12715		0.949
		Manager/Supervisor	-2.10628	1.65566		0.899
Abstract	Non-Technical	Technical: Frontline (TO)	2.84358	1.24447	9.741	0.392
		Technical: Frontline (STO)	-.83333	1.07038		0.988
		Technical: Frontline (PTO)	-3.11594	1.07038		0.136
		Technical: Support	-2.93835	.95061		0.093
		Manager/Supervisor	-7.03382*	1.48831		0.001**
	Technical: Frontline (TO)	Non-Technical	-2.84358	1.24447		0.392
		Technical: Frontline (STO)	-3.67691	1.33336		0.183
		Technical: Frontline (PTO)	-5.95952*	1.33336		0.002**
		Technical: Support	-5.78193*	1.23927		0.001**
		Manager/Supervisor	-9.87739*	1.68736		0.000**
	Technical: Frontline (STO)	Non-Technical	.83333	1.07038		0.988
		Technical: Frontline (TO)	3.67691	1.33336		0.183
		Technical: Frontline (PTO)	-2.28261	1.17255		0.581
		Technical: Support	-2.10502	1.06434		0.563
		Manager/Supervisor	-6.20048*	1.56340		0.009**

Table 8.4 Differences in psychological factors among groups differing in nature of work (continued)

Numerical	Non-Technical	Technical: Frontline (TO)	1.53023	1.02224	9.992	0.814
		Technical: Frontline (STO)	-.61594	.87925		0.992
		Technical: Frontline (PTO)	-2.37681	.87925		0.203
		Technical: Support	-2.21576	.78086		0.157
		Manager/Supervisor	-6.99275*	1.22254		0.000**
	Technical: Frontline (TO)	Non-Technical	-1.53023	1.02224		0.814
		Technical: Frontline (STO)	-2.14618	1.09526		0.574
		Technical: Frontline (PTO)	-3.90705*	1.09526		0.028*
		Technical: Support	-3.74599*	1.01798		0.021*
		Manager/Supervisor	-8.52299*	1.38605		0.000**
	Technical: Frontline (STO)	Non-Technical	.61594	.87925		0.992
		Technical: Frontline (TO)	2.14618	1.09526		0.574
		Technical: Frontline (PTO)	-1.76087	.96317		0.648
		Technical: Support	-1.59982	.87428		0.647
		Manager/Supervisor	-6.37681*	1.28422		0.000**
	Technical: Frontline (PTO)	Non-Technical	2.37681	.87925		0.203
		Technical: Frontline (TO)	3.90705*	1.09526		0.028
		Technical: Frontline (STO)	1.76087	.96317		0.648
		Technical: Support	.16105	.87428		1.000
		Manager/Supervisor	-4.61594*	1.28422		0.026*
	Technical: Support	Non-Technical	2.21576	.78086		0.157
		Technical: Frontline (TO)	3.74599*	1.01798		0.021
		Technical: Frontline (STO)	1.59982	.87428		0.647
		Technical: Frontline (PTO)	-.16105	.87428		1.000
		Manager/Supervisor	-4.77700*	1.21898		0.010*
Spatial	Technical: Frontline (TO)	Non-Technical	-1.42729	.95146	3.010	0.813
		Technical: Frontline (STO)	-1.79685	1.01942		0.684
		Technical: Frontline (PTO)	-2.57946	1.01942		0.272
		Technical: Support	-2.32686	.94749		0.306
		Manager/Supervisor	-4.52874*	1.29007		0.033*

Table 8.4 Differences in psychological factors among groups differing in nature of work (continued)

Verbal	Non-Technical	Technical: Frontline (TO)	3.64668	1.32158	7.806	0.183
		Technical: Frontline (STO)	.33333	1.13671		1.000
		Technical: Frontline (PTO)	-1.29710	1.13671		0.934
		Technical: Support	-2.47377	1.00952		0.309
		Manager/Supervisor	-6.09662*	1.58053		0.012*
	Technical: Frontline (TO)	Non-Technical	-3.64668	1.32158		0.183
		Technical: Frontline (STO)	-3.31334	1.41598		0.363
		Technical: Frontline (PTO)	-4.94378*	1.41598		0.035*
		Technical: Support	-6.12045*	1.31606		0.001**
		Manager/Supervisor	-9.74330*	1.79192		0.000**
	Technical: Frontline (STO)	Non-Technical	-.33333	1.13671		1.000
		Technical: Frontline (TO)	3.31334	1.41598		0.363
		Technical: Frontline (PTO)	-1.63043	1.24520		0.887
		Technical: Support	-2.80710	1.13029		0.294
		Manager/Supervisor	-6.42995*	1.66027		0.012*
Safety Consciousness	Non-Technical	Technical: Frontline (TO)	.76262	5.07393	3.844	1.000
		Technical: Frontline (STO)	-10.20290	4.36416		0.364
		Technical: Frontline (PTO)	-9.31159	4.36416		0.475
		Technical: Support	-14.48459*	3.87584		0.018*
		Manager/Supervisor	-11.53623	6.06812		0.607
Stress Tolerance	Non-Technical	Technical: Frontline (TO)	-1.91404	1.66928	3.475	0.933
		Technical: Frontline (STO)	-4.49275	1.43577		0.085
		Technical: Frontline (PTO)	-3.88406	1.43577		0.202
		Technical: Support	-4.65809*	1.27512		0.022*
		Manager/Supervisor	-3.02899	1.99636		0.806
Quality Orientation	Technical: Frontline (TO)	Non-Technical	2.66817	1.51004	5.097	0.681
		Technical: Frontline (STO)	4.84933	1.61790		0.114
		Technical: Frontline (PTO)	6.06672*	1.61790		0.017*
		Technical: Support	6.13745*	1.50373		0.006**
		Manager/Supervisor	6.32759	2.04744		0.093

* $p \leq 0.05$ mean difference is statistically significant
** $p \leq 0.01$ mean difference is statistically significant

The results in Table 8.4 reveal that the non-technical group differs significantly from the technical frontline (STO) on the burnout exhaustion scale, as does the technical frontline (STO) with the technical frontline (PTO) group. On the cognitive constructs abstract, numerical, spatial, and verbal reasoning, significant differences were found between the different categories/nature of work. On abstract reasoning, the non-technical group differs significantly from the manager/supervisor group, between technical frontline (TO) and technical frontline (PTO), technical support, and manager/supervisor, and technical frontline (STO) and manager/supervisor. On numerical reasoning, 1) the non-technical group differs significantly from the manager/supervisor group, 2) between technical frontline (TO) and technical frontline (PTO), technical support, and manager/supervisor, 3) between technical frontline (STO) and manager/supervisor, 4) between technical frontline (PTO) and manager/supervisor, and 5) technical support and manager/supervisor. On spatial reasoning a significant difference was found between technical frontline (TO) and manager/supervisor. Lastly, significant differences were observed between 1) non-technical and manager/supervisor, 2) technical frontline (TO) and technical frontline (PTO), technical support, and manager/supervisor, and 3) technical frontline (STO) and manager/supervisor on verbal reasoning.

Furthermore, Table 8.4 shows that the non-technical group differs significantly from the technical support group on total safety consciousness and stress tolerance. In addition, the technical frontline (TO) differs from the technical frontline (PTO) and technical support on the quality orientation scale.

In the following table the results of the testing for differences comparing psychological factors based on self-reported average business kilometres driven per month are shown

Table 8.5 Differences in psychological factors among various groups differing based on based on average business kilometres driven per month

Dependent Variable	(I) Average business kilometres driven per month	(J) Average business kilometres driven per month	Mean Difference (I-J)	Std Error	F value	Sig (p-value)
Numerical	0 - 1000km	1001 - 2000km	-.79599	.90197	3.141	0.854
		2001 - 4000km	-2.61725*	.88247		0.034*
		More than 4000km	-1.04186	.97457		0.767
Spatial	1001 - 2000km	0 - 1000km	-.05152	.79778	3.631	1.000
		2001 - 4000km	-2.22567*	.77393		0.043*
		More than 4000km	-.74772	.85603		.858

* $p \leq 0.05$ mean difference is statistically significant

Table 8.5 shows that participants who reported driving an average of 0 – 1000km business kilometres per month differ significantly from those who reported driving an average of 2001 – 4000km on the variable numerical reasoning. On spatial reasoning, those individuals who reported driving an average of 1001 – 2000 business kilometres per moth differ significantly from those driving an average of 2001 – 4000 business kilometres per month. No statistically significant differences were found between average business kilometres driven per month and the other dependent variables (psychological factors).

The differences between psychological factors based on self-reported traffic violations/offences are shown in Table 8.6.

Table 8.6 Differences in psychological factors among various groups based on self-reported traffic violations/offences

Dependent variable	Traffic offences	N	Mean rank	Sum of rank	Mann-Whitney U	Z	p-value
Cynicism	Yes	180	131.51	23671.00	7381.000	-2.251	0.024*
	No	98	154.18	15110.00			
Abstract	Yes	180	149.70	26946.00	6984.000	-2.871	0.004**
	No	98	120.77	11835.00			
Numerical	Yes	180	156.24	28124.00	5806.000	-4.718	0.000**
	No	98	108.74	10657.00			
Verbal	Yes	180	153.98	27717.00	6213.000	-4.076	0.000**
	No	98	112.90	11064.00			
Spatial	Yes	180	148.31	26695.50	7234.500	-2.484	0.013*
	No	98	123.32	12085.50			
OPP External	Yes	180	126.17	22711.00	6421.000	-3.753	0.000**
	No	98	163.98	16070.00			
OPP Phlegmatic	Yes	180	152.88	27517.50	6412.500	-3.764	0.000**
	No	98	114.93	11263.50			
OPP Contesting	Yes	180	131.99	23759.00	7469.000	-2.113	0.035*
	No	98	153.29	15022.00			
Driver Attitude	Yes	180	150.47	27084.00	6846.000	-3.085	0.002**
	No	98	119.36	11697.00			

* $p \leq 0.05$ statistically significant
** $p \leq 0.01$ statistically significant

The question posed to the participants was: Have you ever committed a traffic offence? From Table 8.6 it can be observed that a statistically significant difference exists between participants who responded positively compared to those who responded in the negative on the burnout scale cynicism. Also, between the four cognitive variables (abstract, numerical, verbal and spatial reasoning) a statistically significant difference is shown between responses yes and no on the question as to whether the respondent had committed a traffic offence. Table 8.6 also shows significant differences between the personality dimensions OPP external (external locus of control), OPP phlegmatic (emotional stability), and OPP contesting between participants who respond yes or no on committing a traffic offence. Lastly, a significant difference is also noticeable between responses yes and no on the driver attitude variable. No statistically significant differences were found between traffic offences and the other dependent variables (psychological factors).

In the following table, differences between psychological factors based on self-reported involvement in a vehicle accident are shown.

Table 8.7 Differences in psychological factors among various groups based on self-reported involvement in a vehicle accident

Dependent variable	Vehicle accident	N	Mean rank	Sum of rank	Mann-Whitney U	Z	p-value
Conscientiousness	Yes	223	134.38	29967.00	4991.000	-2.138	0.0338*
	No	55	160.25	8814.00			

*$p \leq 0.05$ statistically significant

To the question, have you ever been involved in a vehicle accident (private or business-related), responses differed significantly on the personality factor conscientiousness between those who answered positively compared to those who answered negatively. No statistically significant differences were found between vehicle accident involvement and the other dependent variables (psychological factors).

The results of comparing differences between psychological factors based on self-reported involvement in vehicle accidents (at fault, not at fault and not sure) are presented next.

Table 8.8 Differences in psychological factors among various groups based on self-reported vehicle accidents (at fault, not at fault and no sure)

Dependent Variable	I) Fault	(J) Fault	Mean Difference (I-J)	Std Error	F value	Sig. (p-value)
Cynicism (Revised)	At fault	Not at fault	2.13187*	.82449	3.385	0.037*
		Not sure	1.74091	.93618		0.179
OPP Gregarious	At fault	Not at fault	-2.44734*	.87776	4.072	0.022*
		Not sure	-1.28814	.99666		0.435

* $p \leq 0.05$ mean difference is statistically significant

The above table reflects the differences between participants' responses whether they were at fault, not at fault or unsure when they were involved in a vehicle accident (see Table 8.7). It is evident from Table 8.8 that a statistically significant difference exists between at fault and not at fault responses on the burnout scale cynicism. Significant differences also exist on the personality dimension OPP gregarious between at fault and not at fault responses. No statistically significant differences were found between at fault, not at fault and unsure variables on the other dependent variables (psychological factors).

In the next table, results of differences comparing psychological factors based on participants self-reported workplace incidents are shown.

Table 8.9 Differences in psychological factors among various groups based on self-reported workplace incidents

Dependent variable	Workplace Incidents	N	Mean rank	Sum of rank	Mann-Whitney U	Z	p-value
SOC	Yes	201	132.25	26581.50	6280.500	-2.578	0.010**
	No	78	159.98	12478.50			
OPP Pragmatic	Yes	201	146.72	29491.00	6488.000	-2.238	0.025*
	No	78	122.68	9569.00			

* $p \leq 0.05$ statistically significant
** $p \leq 0.01$ statistically significant

According to the organisation safety incident data register all 279 respondents were involved in a workplace incident or vehicle-related accident. However, on the biographical questionnaire 78 respondents indicated no knowledge of being involved in any form of incident or accident at the workplace. Nevertheless, Table 8.9 shows a significant difference between yes and no responses regarding workplace incidents on the SOC variable. Another statistically significant difference was found between yes and no responses regarding workplace incidents on the personality dimension OPP pragmatic. No statistically significant differences were found between yes and no responses on the other dependent variables (psychological factors).

The following table highlights the differences between psychological factors based on below and above average scores by participants on the safety consciousness construct.

Table 8.10 Differences in psychological factors among various groups based on below and above average scores on safety consciousness

Dependent variable	**Safety Consciousness (Safety Attitude)**	**N**	**Mean**	**Standard Deviation**	**t-value**	**p-value**	**Effect size**
Agreeableness	Below Average	131	135.2519	17.76182	-2.614	0.048*	-0.312
	Above Average	148	140.2905	14.40156			
Dedication	Below Average	131	23.3511	5.57594	-2.876	0.013*	-0.344
	Above Average	148	25.1554	4.90275			
Engagement	Below Average	131	40.6718	9.31949	-3.088	0.011*	-0.369
	Above Average	148	43.8649	7.94766			
Numerical	Below Average	131	6.5649	5.34516	-1.983	0.047*	-0.237
	Above Average	148	7.7432	4.57756			
Verbal	Below Average	131	11.1221	6.76305	-3.448	0.033*	-0.411
	Above Average	148	13.6892	5.66869			
OPP Trusting	Below Average	131	28.8473	5.44550	-5.850	0.003**	-0.705
	Above Average	148	33.0135	6.33958			
Risk Avoidance	Below Average	131	71.6412	10.32701	-17.256	0.000**	-2.039
	Above Average	148	88.8851	6.03676			
Safety Control	Below Average	131	47.0000	7.20790	-15.838	0.000**	-1.874
	Above Average	148	58.2703	4.51241			
Quality Orientation	Below Average	131	25.8168	7.65587	8.522	0.002**	1.009
	Above Average	148	19.3716	4.80261			
Driver Attitude	Below Average	131	38.1756	9.14118	-9.327	0.000**	-1.110
	Above Average	148	47.1757	6.92989			

* $p \leq 0.05$ statistically significant
** $p \leq 0.01$ statistically significant

As explained in Section 9.1, extreme caution needs to be taken when making certain inferences based on the results of Table 8.10. From the mentioned table, differences of a medium effect were found between below and above average scores on agreeableness (Five Factor Model of Personality). A statistically significant difference (medium effect) was also found between below and above average scores on the work engagement variable as well as on dedication (sub-scale of the work engagement variable). On the cognitive constructs, significant differences were found between below and above average on numerical reasoning (small effect) and on verbal reasoning (medium effect). In addition, a difference of a large effect is shown between the below and above average scores on the personality dimension OPP trusting.

Table 8.10 provides evidence that a statistically significant difference (very large effect) exists between the below and above average scores on risk avoidance. Similar results are observed between the below and above average scores on the safety control, quality orientation, and driver attitude scales (very large effect). No statistically significant differences were found between the below and above average scores on the other dependent variables (psychological factors).

The following table compares scores of psychological factors based on below and above-average scores of participants on the driver attitude variable.

Table 8.11 Differences in psychological factors among various groups based on below and above average scores on levels of driver attitude

Dependent variable	**Driver Attitude**	**N**	**Mean**	**Standard Deviation**	**t-value**	**Sig (p-value)**	**Effect size**
SOC	Below Average	128	65.4219	11.83988	-1.820	0.013 *	-0.216
	Above Average	151	67.6821	8.86143			
Spatial	Below Average	128	8.1094	3.69557	-3.541	0.020*	-0.430
	Above Average	151	9.9338	4.73240			
OPP Trusting	Below Average	128	28.8125	5.48118	-5.811	0.004**	-0.702
	Above Average	151	32.9603	6.30437			
OPP Assertive	Below Average	128	30.5625	4.86147	0.420	0.003**	0.051
	Above Average	151	30.2980	5.55073			
OPP Contesting	Below Average	128	31.2500	5.75894	3.391	0.010*	0.410
	Above Average	151	28.6689	6.78599			
Safety Consciousness	Below Average	128	161.2734	23.58724	-8.971	0.004**	-1.066
	Above Average	151	183.6159	17.95768			
Risk Avoidance	Below Average	128	75.6328	12.47478	-7.199	0.000**	-0.856
	Above Average	151	85.1589	9.60354			
Safety Control	Below Average	128	48.7188	8.26427	-9.123	0.000**	-1.083
	Above Average	151	56.5894	6.11476			

* $p \leq 0.05$ statistically significant

** $p \leq 0.01$ statistically significant

Also in this case, extreme caution needs to be taken when making certain inferences based on the results from Table 8.11. It is evident from Table 8.11 that a statistically significant difference exists between below and above average scores on the fortigenic construct sense of coherence (small effect). Differences were also found between the cognitive construct spatial reasoning and below and above average scores (medium effect). It is further observed that participants with above average scores differed significantly from participants with below average scores on the personality dimension OPP trusting (large effect). Table 8.11 provides evidence that the below average group differs significantly from the above average group on the OPP assertive dimension, but the difference is of a small effect. The below average group also differs significantly from the above average group on the personality dimension OPP contesting (medium effect).

Table 8.12 shows that participants with above average scores on driver attitude differ significantly from those participants with below average scores in terms of the following safety attitude variables: overall safety consciousness index (very large effect), risk avoidance (large effect), and safety control (very large effect). No statistically significant differences were found between the below and above average scores on the other dependent variables (psychological factors).

In the following section the results of comparing differences between psychological factors based on participants' scores obtained on quality orientation are shown.

Table 8.12 Differences in psychological factors among various groups based on below and above average scores on quality orientation

Dependent variable	Quality Orientation	N	Mean	Standard Deviation	t-value	Sig (p-value)	Effect size
Exhaustion	Below Average	153	8.8170	6.43534	-2.765	0.030*	-0.335
	Above Average	126	10.8254	5.51373			
OPP Gregarious	Below Average	153	31.1699	6.39880	1.949	0.030*	0.238
	Above Average	126	29.8333	4.71211			
OPP Pragmatic	Below Average	153	30.3856	5.75272	-1.389	0.034*	-0.169
	Above Average	126	31.2619	4.55399			
Risk Avoidance	Below Average	153	85.2614	9.65440	7.531	0.001**	0.895
	Above Average	126	75.3571	12.30900			

Table 8.12 Differences in psychological factors among various groups based on below and above average scores on quality orientation (continued)

Dependent variable	Quality Orientation	N	Mean	Standard Deviation	t-value	Sig (p-value)	Effect size
Safety Control	Below Average	153	56.7582	6.18149	9.880	0.002**	1.174
	Above Average	126	48.3889	7.96289			
Driver Attitude	Below Average	153	44.8824	8.41751	3.966	0.040*	0.474
	Above Average	126	40.6032	9.59840			

* $p \leq 0.05$ statistically significant
** $p \leq 0.01$ statistically significant

With reference to section 9.1, extreme caution needs to be taken when making certain inferences based on the results from Table 8.12. In addition, lower scores on quality orientation are indicative of a higher quality awareness or orientation whereas a high score suggests a lower quality awareness or orientation. According to Table 8.12, participants who fall within the above average range on quality orientation differed significantly in terms of exhaustion (small effect). Those participants who fall within the below average range on quality orientation compared to those falling within the above average range differed significantly on the personality dimension OPP gregarious (small effect). However, on the OPP pragmatic dimension, participants within the above average range on quality orientation differed significantly compared to those within the below average range (small effect). Furthermore, Table 8.12 shows that participants who fall within the below average range on quality orientation differ significantly from those participants that fall within the above average range on the following safety attitude variables: risk avoidance (large effect), safety control (very large effect), and driver attitude (medium effect).

No statistically significant differences were found between the below and above average scores on the other dependent variables (psychological factors).

In the next section the correlations between the independent variables (predictors) and the dependent variables (safety consciousness, driver attitude, and quality orientation) are presented. In addition, the results of the multiple regression analysis are presented.

8.3 THE RELATIONSHIP BETWEEN THE INDEPENDENT VARIABLES (INTELLIGENCE, PERSONALITY, BURNOUT, WORK ENGAGEMENT, AND SENSE OF COHERENCE) AND ATTITUDE TOWARDS WORK PLACE SAFETY

The reporting of the correlation coefficients is guided by the first hypothesis in that statistically significant relationships are likely to exist between the psychological variables (predictors), namely intelligence (cognitive ability), personality, burnout, work engagement and sense of coherence, and the attitude towards workplace safety constructs, namely safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation. Regression analysis was then performed to determine which independent variable or group of variables explain the strongest variance in the dependent variables. The results of the correlations between the psychological factors (independent variables) and the attitude towards workplace safety variables (safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) are shown in Table 8.13.

Table 8.13 provides evidence that most of the predictor variables (psychological factors) are statistically significant (either positively or negatively) related with measures of attitude towards workplace safety, namely safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation. The results of the Pearson correlation coefficients as shown in Table 8.13 are presented as follows. Firstly, statistically significant correlations between the psychological factors (independent variables) with the dependent variable attitude towards workplace safety, namely safety consciousness, are discussed. Secondly, results of the correlations between safety control, risk avoidance, and stress tolerance with the psychological factors (independent variables) are explained. Thirdly, statistically significant correlations between driver attitude and the psychological factors (independent variables) are examined. Lastly, the relationship between quality orientation and the psychological factors (independent variables) are shown. Only statistically significant correlations ($p \leq 0.05$) with $r \geq 0.30$ (medium effect) are reported.

Table 8.13 Pearson correlation coefficients between psychological factors with the safety attitudinal variables

Psychological variables		Safety consciousness	Driver attitude	Safety control	Risk avoidance	Stress tolerance	Quality orientation	Extraversion Total	Neuroticism Total	Conscien Total	Openess Total	Agree Total
Safety consciousness	Pearson Correlation	1										
	Sig. (2-tailed)											
Driver attitude	Pearson Correlation	.599**	1									
	Sig. (2-tailed)	.000										
Safety control	Pearson Correlation	.871**	.604**	1								
	Sig. (2-tailed)	.000	.000									
Risk avoidance	Pearson Correlation	.894**	.505**	.687**	1							
	Sig. (2-tailed)	.000	.000	.000								
Stress tolerance	Pearson Correlation	.737**	.400**	.528**	.442**	1						
	Sig. (2-tailed)	.000	.000	.000	.000							
Quality orientation	Pearson Correlation	-.591**	-.271**	-.602**	-.518**	-.358**	1					
	Sig. (2-tailed)	.000	.000	.000	.000	.000						
Extraversion Total	Pearson Correlation	-.047	-.135*	.032	-.144*	.048	-.104	1				
	Sig. (2-tailed)	.439	.024	.597	.016	.429	.082					
Neuroticism Total	Pearson Correlation	-.441**	-.241**	-.365**	-.275**	-.530**	.258**	.015	1			
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.804				
Conscien Total	Pearson Correlation	.305**	.053	.317**	.222**	.249**	-.437**	.393**	-.219**	1		
	Sig. (2-tailed)	.000	.378	.000	.000	.000	.000	.000	.000			
Openess Total	Pearson Correlation	.171**	-.014	.233**	.124*	.082	-.292**	.481**	-.117	.605**	1	
	Sig. (2-tailed)	.004	.812	.000	.038	.169	.000	.000	.051	.000		
Agree Total	Pearson Correlation	.212**	.023	.260**	.189**	.077	-.345**	.399**	-.012	.655**	.600**	1
	Sig. (2-tailed)	.000	.703	.000	.001	.199	.000	.000	.840	.000	.000	
SOC (Revised_1F)	Pearson Correlation	.034	.094	.000	-.045	.174**	.042	.081	-.138*	.129*	.007	.069
	Sig. (2-tailed)	.571	.119	.994	.451	.004	.488	.178	.021	.031	.905	.248

Table 8.13 Pearson correlation coefficients between psychological factors with the safety attitudinal variables (continued)

Psychological variables		Safety consciousness	Driver attitude	Safety control	Risk avoidance	Stress tolerance	Quality orientation	Extraversion Total	Neuroticism Total	Conscien Total	Openess Total	Agree Total
AR2	Pearson Correlation	.209**	.429**	.243**	.135*	.170**	-.158**	-.085	-.195**	-.101	-.080	-.112
	Sig. (2-tailed)	.000	.000	.000	.025	.004	.008	.157	.001	.092	.180	.061
NR2	Pearson Correlation	.165**	.373**	.196**	.074	.179**	-.139*	-.046	-.167**	-.114	-.115	-.115
	Sig. (2-tailed)	.006	.000	.001	.217	.003	.020	.447	.005	.057	.054	.055
SRT2	Pearson Correlation	.075	.244**	.107	.005	.105	-.024	.047	-.192**	-.085	-.026	-.072
	Sig. (2-tailed)	.214	.000	.073	.930	.079	.688	.433	.001	.157	.670	.232
VR2	Pearson Correlation	.264**	.511**	.301**	.180**	.207**	-.184**	-.041	-.201**	-.039	-.023	-.074
	Sig. (2-tailed)	.000	.000	.000	.003	.000	.002	.497	.001	.512	.702	.217
OPP FLEX	Pearson Correlation	-.169**	.017	-.144*	-.210**	-.037	.266**	-.082	-.066	-.260**	-.134*	-.257**
	Sig. (2-tailed)	.005	.778	.016	.000	.534	.000	.173	.269	.000	.025	.000
OPP PERS	Pearson Correlation	-.215**	-.261**	-.123*	-.230**	-.168**	.095	.493**	.001	.117	.268**	.092
	Sig. (2-tailed)	.000	.000	.041	.000	.005	.113	.000	.986	.050	.000	.125
OPP GREG	Pearson Correlation	.249**	.126*	.225**	.190**	.227**	-.135*	.300**	-.271**	.024	.192**	.032
	Sig. (2-tailed)	.000	.036	.000	.001	.000	.024	.000	.000	.692	.001	.599
OPP TRUST	Pearson Correlation	.309**	.359**	.249**	.236**	.311**	-.138*	-.041	-.380**	.023	.024	-.018
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.021	.496	.000	.699	.695	.762
OPP EXT	Pearson Correlation	-.398**	-.447**	-.377**	-.282**	-.374**	.211**	.082	.346**	-.052	-.046	-.006
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.170	.000	.388	.440	.926
OPP PHLEG	Pearson Correlation	.405**	.342**	.334**	.250**	.492**	-.150*	.024	-.544**	.064	.038	-.098
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.012	.684	.000	.284	.531	.101
OPP ASSER	Pearson Correlation	.006	-.070	.060	-.012	-.027	-.050	.318**	-.091	.142*	.239**	.065
	Sig. (2-tailed)	.925	.243	.318	.838	.650	.406	.000	.130	.018	.000	.282
OPP CONT	Pearson Correlation	-.360**	-.278**	-.267**	-.289**	-.366**	.188**	.175**	.236**	.023	.023	.034
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.002	.003	.000	.706	.696	.572

Table 8.13 Pearson correlation coefficients between psychological factors with the safety attitudinal variables (continued)

Psychological variables		Safety consciousness	Driver attitude	Safety control	Risk avoidance	Stress tolerance	Quality orientation	Extraversion Total	Neuroticism Total	Conscien Total	Openness Total	Agree Total
OPP CONF	Pearson Correlation	.138*	-.126*	.089	.120*	.139*	-.063	.045	-.132*	.247**	.119*	.251**
	Sig. (2-tailed)	.021	.036	.137	.045	.020	.293	.455	.028	.000	.048	.000
OPP PRAG	Pearson Correlation	-.046	.092	-.036	-.013	-.082	.030	-.331**	-.040	-.140*	-.323**	-.185**
	Sig. (2-tailed)	.445	.127	.547	.832	.174	.613	.000	.508	.020	.000	.002
CY (R)	Pearson Correlation	-.458**	-.339**	-.376**	-.363**	-.433**	.310**	.091	.337**	-.164**	-.009	.020
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.130	.000	.006	.885	.741
EX	Pearson Correlation	-.339**	-.100	-.180**	-.241**	-.468**	.196**	.013	.246**	-.160**	-.035	-.075
	Sig. (2-tailed)	.000	.096	.002	.000	.000	.001	.828	.000	.007	.561	.210
BURN (R)	Pearson Correlation	-.471**	-.253**	-.325**	-.356**	-.539**	.298**	.059	.344**	-.193**	-.027	-.037
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.323	.000	.001	.656	.537
ENG (R)	Pearson Correlation	.207**	.004	.159**	.164**	.208**	-.189**	.178**	-.079	.337**	.251**	.247**
	Sig. (2-tailed)	.000	.941	.008	.006	.000	.002	.003	.191	.000	.000	.000
VIG (R)	Pearson Correlation	.185**	.001	.140*	.118*	.232**	-.164**	.235**	-.055	.325**	.237**	.219**
	Sig. (2-tailed)	.002	.984	.019	.049	.000	.006	.000	.362	.000	.000	.000
DED	Pearson Correlation	.199**	.006	.154**	.180**	.162**	-.186**	.113	-.088	.306**	.232**	.239**
	Sig. (2-tailed)	.001	.916	.010	.003	.007	.002	.060	.143	.000	.000	.000

Note: AR2= Abstract reasoning, NR2= Numerical reasoning, SRT2= Spatial reasoning, VR2= Verbal reasoning, OPP FLEX= OPP Flexible, OPP PERS= OPP Persuasive, OPP GREG= OPP Gregarious, OPP TRUST= OPP Trusting, OPP EXT= OPP External, OPP ASSER= OPP Assertive, OPP CONT= OPP Contesting, OPP CONF= OPP Conform, OPP PRAG= OPP Pragmatic, CY (R)= Cynicism revised, EX= Exhaustion, BURN (R)= Burnout, ENG (R)= Work engagement, VIG (R)= Vigour revised, and DED= Dedication

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

*. Correlation is significant at the 0.05 level (2-tailed).

Table 8.13 Pearson correlation coefficients between psychological factors with the safety attitudinal variables (continued)

Psychological variables		SOC (Revised_1F)	AR2	NR2	SRT2	VR2	OPP FLEX	OPP PERSE	OPP GREG	OPP TRUST	OPP EXT
SOC (Revised_1F)	Pearson Correlation	1									
	Sig. (2-tailed)										
AR2	Pearson Correlation	.041	1								
	Sig. (2-tailed)	.493									
NR2	Pearson Correlation	.070	.745**	1							
	Sig. (2-tailed)	.245	.000								
SRT2	Pearson Correlation	.044	.647**	.590**	1						
	Sig. (2-tailed)	.465	.000	.000							
VR2	Pearson Correlation	.064	.737**	.722**	.464**	1					
	Sig. (2-tailed)	.286	.000	.000	.000						
OPP FLEX	Pearson Correlation	.101	.194**	.239**	.205**	.203**	1				
	Sig. (2-tailed)	.092	.001	.000	.001	.001					
OPP PERS	Pearson Correlation	.087	-.195**	-.212**	-.073	-.244**	.082	1			
	Sig. (2-tailed)	.146	.001	.000	.221	.000	.171				
OPP GREG	Pearson Correlation	-.005	.159**	.121*	.138*	.166**	.093	.308**	1		
	Sig. (2-tailed)	.932	.008	.044	.021	.006	.123	.000			
OPP TRUST	Pearson Correlation	.108	.207**	.209**	.129*	.276**	.270**	.036	.289**	1	
	Sig. (2-tailed)	.073	.001	.000	.032	.000	.000	.552	.000		
OPP EXT	Pearson Correlation	-.085	-.248**	-.275**	-.210**	-.374**	-.133*	.251**	-.097	-.431**	1
	Sig. (2-tailed)	.156	.000	.000	.000	.000	.026	.000	.106	.000	
OPP PHLEG	Pearson Correlation	.066	.232**	.208**	.222**	.257**	.151*	.012	.448**	.513**	-.401**
	Sig. (2-tailed)	.269	.000	.000	.000	.000	.012	.843	.000	.000	.000
OPP ASSER	Pearson Correlation	.034	-.100	-.099	.025	-.090	-.021	.491**	.182**	.116	.049
	Sig. (2-tailed)	.573	.094	.100	.681	.133	.724	.000	.002	.052	.419

Table 8.13 Pearson correlation coefficients between psychological factors with the safety attitudinal variables (continued)

Psychological variables		SOC (Revised_1F)	AR2	NR2	SRT2	VR2	OPP FLEX	OPP PERSE	OPP GREG	OPP TRUST	OPP EXT
OPP CONT	Pearson Correlation	-.050	-.080	-.045	-.019	-.098	-.056	.327**	-.162**	-.401**	.487**
	Sig. (2-tailed)	.402	.185	.449	.749	.103	.350	.000	.007	.000	.000
OPP CONF	Pearson Correlation	.086	-.239**	-.194**	-.097	-.249**	.030	.204**	.125*	.175**	.086
	Sig. (2-tailed)	.152	.000	.001	.105	.000	.616	.001	.036	.003	.151
OPP PRAG	Pearson Correlation	-.121*	.181**	.201**	.151*	.163**	.091	-.286**	-.062	.037	.126*
	Sig. (2-tailed)	.043	.002	.001	.012	.006	.130	.000	.301	.539	.036
CY (R)	Pearson Correlation	.008	-.203**	-.200**	-.074	-.285**	.053	.180**	-.180**	-.268**	.305**
	Sig. (2-tailed)	.893	.001	.001	.216	.000	.379	.003	.003	.000	.000
EX	Pearson Correlation	-.091	-.004	.042	.092	-.012	.104	.132*	-.115	-.233**	.163**
	Sig. (2-tailed)	.128	.953	.482	.124	.844	.082	.027	.055	.000	.006
BURN (R)	Pearson Correlation	-.054	-.116	-.085	.017	-.166**	.096	.185**	-.173**	-.298**	.274**
	Sig. (2-tailed)	.371	.053	.156	.775	.005	.110	.002	.004	.000	.000
ENG (R)	Pearson Correlation	.090	-.192**	-.123*	-.126*	-.151*	-.220**	.149*	.010	.001	-.013
	Sig. (2-tailed)	.133	.001	.041	.036	.011	.000	.013	.862	.989	.824
VIG (R)	Pearson Correlation	.132*	-.181**	-.116	-.109	-.136*	-.186**	.192**	-.003	.011	-.005
	Sig. (2-tailed)	.027	.002	.053	.068	.023	.002	.001	.956	.852	.935
DED	Pearson Correlation	.046	-.177**	-.113	-.123*	-.145*	-.221**	.097	.021	-.007	-.018
	Sig. (2-tailed)	.442	.003	.059	.040	.015	.000	.106	.728	.903	.761

Note: AR2= Abstract reasoning, NR2= Numerical reasoning, SRT2= Spatial reasoning, VR2= Verbal reasoning, OPP FLEX= OPP Flexible, OPP PERS= OPP Persuasive, OPP GREG= OPP Gregarious, OPP TRUST= OPP Trusting, OPP EXT= OPP External, OPP ASSER= OPP Assertive, OPP CONT= OPP Contesting, OPP CONF= OPP Conform, OPP PRAG= OPP Pragmatic, CY (R)= Cynicism revised, EX= Exhaustion, BURN (R)= Burnout, ENG (R)= Work engagement, VIG (R)= Vigour revised, and DED= Dedication

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 8.13 Pearson correlation coefficients between psychological factors with the safety attitudinal variables (continued)

Psychological variables		OPP PHLEG	OPP ASSER	OPP CONT	OPP CONF	OPP PRAG	CY (R)	EX	BURN (R)	ENG (R)	VIG (R)	DED
OPP PHLEG	Pearson Correlation	1										
	Sig. (2-tailed)											
OPP ASSER	Pearson Correlation	.144*	1									
	Sig. (2-tailed)	.016										
OPP CONT	Pearson Correlation	-.347**	.266**	1								
	Sig. (2-tailed)	.000	.000									
OPP CONF	Pearson Correlation	.173**	.214**	.157**	1							
	Sig. (2-tailed)	.004	.000	.009								
OPP PRAG	Pearson Correlation	.096	-.076	.121*	-.059	1						
	Sig. (2-tailed)	.111	.204	.044	.324							
CY (R)	Pearson Correlation	-.303**	-.014	.236**	-.048	-.025	1					
	Sig. (2-tailed)	.000	.812	.000	.426	.681						
EX	Pearson Correlation	-.277**	.000	.350**	-.077	-.004	.399**	1				
	Sig. (2-tailed)	.000	.998	.000	.198	.944	.000					
BURN (R)	Pearson Correlation	-.345**	-.008	.354**	-.077	-.017	.813**	.859**	1			
	Sig. (2-tailed)	.000	.895	.000	.203	.779	.000	.000				
ENG (R)	Pearson Correlation	.078	.188**	.000	.192**	-.113	-.239**	-.287**	-.316**	1		
	Sig. (2-tailed)	.196	.002	.994	.001	.058	.000	.000	.000			
VIG (R)	Pearson Correlation	.124*	.216**	.031	.156**	-.143*	-.135*	-.263**	-.244**	.910**	1	
	Sig. (2-tailed)	.039	.000	.603	.009	.017	.024	.000	.000	.000		

Table 8.13 Pearson correlation coefficients between psychological factors with the safety attitudinal variables (continued)

Psychological variables		OPP PHLEG	OPP ASSER	OPP CONT	OPP CONF	OPP PRAG	CY (R)	EX	BURN (R)	ENG (R)	VIG (R)	DED
DED	Pearson Correlation	.032	.144*	-.023	.197**	-.077	-.289**	-.270**	-.334**	.947**	.730**	1
	Sig. (2-tailed)	.590	.016	.696	.001	.202	.000	.000	.000	.000	.000	

Note: AR2= Abstract reasoning, NR2= Numerical reasoning, SRT2= Spatial reasoning, VR2= Verbal reasoning. OPP FLEX= OPP Flexible, OPP PERS= OPP Persuasive, OPP GREG= OPP Gregarious, OPP TRUST= OPP Trusting, OPP EXT= OPP External, OPP ASSER= OPP Assertive, OPP CONT= OPP Contesting, OPP CONF= OPP Conform, OPP PRAG= OPP Pragmatic, CY (R)= Cynicism revised, EX= Exhaustion, BURN (R)= Burnout, ENG (R)= Work engagement, VIG (R)= Vigour revised, and DED= Dedication

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Firstly, safety consciousness correlates significantly (medium effect) negatively with burnout, emotional exhaustion, cynicism, neuroticism, external locus of control, and Type A personality (OPP contesting). A significant (medium effect) positive correlation exists between safety consciousness and verbal reasoning, emotional stability (OPP phlegmatic), trusting and conscientiousness. In addition, the primary scales namely safety control, risk avoidance, and stress tolerance correlate significantly (large effect) with safety consciousness. Also, driver attitude (large effect) and quality orientation (large effect) correlate significantly with safety consciousness.

Secondly, safety control correlates significantly (medium effect) negatively with neuroticism, external locus of control, Type A personality (OPP contesting), burnout, and cynicism whereas a significant (medium effect) positive correlation exists between safety control and conscientiousness, agreeableness, verbal reasoning, and emotional stability (OPP phlegmatic). The safety attitudinal variables risk avoidance, stress tolerance, driver attitude and quality orientation also correlate significantly (large effect) with safety control.

The following psychological factors correlate significantly (medium effect) negatively with risk avoidance, namely neuroticism, external locus of control, Type A personality (OPP contesting), burnout, and cynicism. A significant (medium effect) positive correlation exists between risk avoidance and emotional stability (OPP phlegmatic). Stress tolerance, driver attitude and quality orientation correlate significantly (large effect) with risk avoidance.

It is further observed that neuroticism (large effect), external locus of control (medium effect), Type A personality (OPP contesting) (medium effect), burnout (large effect), emotional exhaustion (large effect) and cynicism (medium effect) are significantly negatively correlated with stress tolerance, whereas trusting (medium effect) and emotional stability (OPP phlegmatic) (large effect) are significantly positively correlated with stress tolerance. In addition, driver attitude and quality orientation are significantly (medium effect) associated with stress tolerance.

Thirdly, driver attitude correlates significantly (medium effect) negatively with persuasiveness, external locus of control, Type A personality (OPP contesting), burnout, and cynicism. A significant (medium effect) positive correlation exists between driver attitude and abstract reasoning, numerical reasoning, verbal reasoning (large effect), trusting and emotional stability (OPP phlegmatic). A statistically significant (medium effect) relationship exists between driver attitude and quality orientation.

Lastly, quality orientation is significantly (medium effect) negatively correlated with conscientiousness, openness to experience, and agreeableness. Significant (medium effect) positive correlations are observed between neuroticism, sense of coherence (large effect), flexible, burnout and cynicism with quality orientation. As reported in Table 8.12, lower scores on quality orientation are indicative of a higher quality awareness or orientation, whereas a high score suggests a lower quality awareness or orientation. For example, in this study, higher levels of neuroticism relate to poor quality and high conscientiousness is associated with higher quality awareness.

It is observed that statistically significant ($p \leq 0.05$) ($r < 0.30$) correlations exist between the independent variables and dependent variables, for example the work engagement sub-scale vigour correlates positively (0.23) with stress tolerance, but according to Guilford (cited in Tredoux et al., 2002) the correlation is definite but small. It is observed that no association exists between the personality dimensions OPP assertive and OPP pragmatic with any of the safety attitudinal constructs. The SOC factor is only positively related (0.17) to the stress tolerance scale, but the relationship is very small. In addition, the relationship between spatial reasoning (STR2) and driver attitude is significant (0.24), but small.

On the basis of these results, it is possible to continue reporting statistical evidence of the multiple regression analysis to determine how much of the variance in the dependent variables (safety consciousness, driver attitude and quality orientation) are explained by the over 30 predictors used in this study. In other words it is important to identify the strongest predictors that are likely to significantly influence attitude towards workplace safety, namely safety consciousness, driver attitude and quality orientation.

The results of the stepwise multiple regression analysis for safety consciousness (safety control, risk avoidance, stress tolerances scales) is presented next.

Table 8.14 Model summary for safety consciousness

R	R Square	Adjusted R Square	Std. Error of the Estimate
.817a	.667	.656	13.78274

a. Predictors: (Constant), Driver attitude, Quality orientation, Neuroticism, Exhaustion (burnout), Abstract reasoning, OPP Gregarious, OPP Persuasive, OPP Pragmatic, Vigour (work engagement)

Table 8.15 ANOVA results for safety consciousness

	Sum of Squares	df	Mean Square	F	Sig.
Regression	102510.419	9	11390.047	59.959	.000[a]
Residual	51100.291	269	189.964		
Total	153610.710	278			

a. Predictors: (Constant), Driver attitude, Quality orientation, Neuroticism, Exhaustion (burnout), Abstract reasoning, OPP Gregarious, OPP Persuasive, OPP Pragmatic, Vigour (work engagement)
b. Dependent Variable: Safety Consciousness

Table 8.16 Beta coefficients for safety consciousness

Safety consciousness	Unstandardised coefficients		Standardised coefficients	t	Sig.
	B	Std Error	Beta		
(Constant)	184.601	12.030		15.345	.000
Driver attitude	1.104	.106	.432	10.422	.000**
Quality orientation	-1.216	.128	-.366	-9.534	.000**
Neuroticism	-.226	.046	-.193	-4.954	.000**
Exhaustion	-.461	.149	-.120	-3.089	.002**
Abstract reasoning	-.362	.159	-.093	-2.281	.023*
OPP Gregarious	.558	.165	.136	3.389	.001**
OPP Persuasive	-.706	.196	-.153	-3.596	.000**
OPP Pragmatic	-.399	.167	-.089	-2.392	.017*
Vigour	.474	.223	.083	2.122	.035*

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed).

It is evident from Table 8.14, Table 8.15, and Table 8.16 that driver attitude, quality orientation, neuroticism, exhaustion (burnout), abstract reasoning, OPP gregarious, OPP persuasive, OPP pragmatic, and vigour (work engagement) are significant predictors of safety consciousness (sum total of safety control, risk avoidance, and stress tolerance). In addition, these predictors collectively explain 67% of the variance in predicting change (e.g. either negatively or positively) in a person's attitude in regard to safety consciousness. In addition, this model of 9 predictors is statistically significant.

Table 8.17 shows the results of the multiple regression analysis conducted for driver attitude.

Table 8.17 Model summary for driver attitude

R	R square	Adjusted R square	Std error of the estimate
.726[a]	.527	.518	6.38876

a. Predictors: (Constant), Safety consciousness, Verbal reasoning, OPP External, Quality orientation, Exhaustion (burnout)

Table 8.18 ANOVA results for driver attitude

	Sum of Squares	df	Mean Square	F	Sig.
Regression	12408.459	5	2481.692	60.802	.000[a]
Residual	11142.838	273	40.816		
Total	23551.297	278			

a. Predictors: (Constant), Safety consciousness, Verbal reasoning, OPP External, Quality orientation, Exhaustion (burnout); b. Dependent Variable: Driver Attitude

Table 8.19 Beta coefficients for driver attitude

Driver attitude	Unstandardised coefficients		Standardised coefficients	t	Sig.
	B	Std error	Beta		
(Constant)	-1.414	5.837		-.242	.809
Safety consciousness	.222	.022	.566	9.897	.000**
Verbal reasoning	.487	.066	.334	7.338	.000**
OPP External	-.233	.079	-.141	-2.955	.003**
Quality orientation	.178	.067	.137	2.646	.009**
Exhaustion	.139	.067	.092	2.078	.039*

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed).

Table 8.17, Table 8.18, and Table 8.19 provide statistically significant evidence that a person's overall safety consciousness (safety control, risk avoidance, and stress tolerance), verbal reasoning ability, external locus of control (OPP external), quality orientation, and exhaustion (burnout) account for 53% of the variance influencing a person's attitude towards driving. In addition, this model with 5 predictor variables is statistically significant.

The following tables provide evidence of those variables influencing quality orientation.

Table 8.20 Model summary for quality orientation

R	R square	Adjusted R square	Std error of the estimate
.591[a]	.349	.332	5.77714

a. Predictors: (Constant), Conscientiousness, Driver attitude, OPP Flexible, Cynicism (burnout), OPP Flexible, Numerical reasoning, OPP Contesting, Sense of Coherence (Revised_1F)

Table 8.21 ANOVA results for quality orientation

	Sum of squares	Df	Mean square	F	Sig.
Regression	4852.108	7	693.158	20.769	.000[a]
Residual	9044.731	271	33.375		
Total	13896.839	278			

a. Predictors: (Constant), Conscientiousness, Driver attitude, OPP Flexible, Cynicism (burnout), OPP Flexible, Numerical reasoning, OPP Contesting, Sense of Coherence (Revised_1F)
b. Dependent Variable: Quality Orientation

Table 8.22 Beta coefficients for quality orientation

Quality orientation	Unstandardised coefficients		Standardised coefficients	t	Sig.
	B	Std error	Beta		
(Constant)	33.629	4.906		6.855	.000
Conscientiousness	-.139	.019	-.394	-7.496	.000**
Driver attitude	-.092	.044	-.120	-2.103	.036*
Cynicism	.168	.071	.128	2.361	.019*
OPP Flexible	.319	.086	.195	3.703	.000**
Numerical reasoning	-.228	.079	-.161	-2.899	.004**
OPP Contesting	.155	.057	.142	2.721	.007**
Sense of Coherence (Revised_1F)	.069	.034	.101	2.019	.044*

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed).

Based on the results provided in Table 8.20, Table 8.21, and Table 8.22, seven predictor variables, namely conscientiousness, driver attitude, cynicism (burnout), OPP flexible, numerical reasoning, Type A personality (OPP Contesting), and sense of coherence were found to significantly influence or change (variance explained of 35%) a person's quality awareness or orientation towards work. This model is also statistically significant.

The next phase was to determine which personality constructs should be used for inclusion in the PLS model, as 13 personality characteristics were measured in this study. Five personality factors were measured by the Basic Traits Inventory (Taylor & De Bruin, 2006) and eight by the Occupational Personality Profile (Psytech International, 2002). It is critical that the constructs used for the PLS outer model meet acceptable reliability and validity levels before the structural/theoretical model (inner model) can be evaluated. To understand whether the combination of these personality indicators demonstrates acceptable reliability and validity as a predictor in the total measurement model (outer model), the PLS approach was used to conduct the evaluation. The loading estimates between the different personality indicators and the total personality construct are presented in Table 8.23.

Table 8.23 Round 1 personality constructs analysed for PLS modelling

Personality constructs measured	Personality
Agreeableness	0.0493
Conscientiousness	0.0823
Extraversion	0.0308
Neuroticism	-0.1836
Openness	0.0889
OPP Assertive	0.0828
OPP External	-0.5537
OPP Flexible	0.0881
OPP Gregarious	0.3866
OPP Persuasive	-0.0636
OPP Phlegmatic	0.5501
OPP Pragmatic	-.0.0532
OPP Trust	0.4952

The fit statistics (reliability and validity) of the personality measurement model (outer model) with all 13 personality constructs are shown in Table 8.24.

Table 8.24 Round 1 SMART PLS fit statistics for the personality measurement model (all 13 personality constructs)

Personality measurement model	AVE	Composite reliability	Cronbach's alpha
Personality (13 latent predictors)	0.20	0.16	0.45

Unfortunately, the combination of these indicators (13 personality constructs) resulted in a very low reliability and average variance extracted for the personality measurement model. Hence, the personality indicators were removed with loadings less than 0.30, namely agreeableness, conscientiousness, extraversion, neuroticism, openness, OPP assertive, OPP flexible, OPP persuasive, and OPP pragmatic. The fit statistics of the personality measurement model after the nine latent personality constructs were removed is shown in Table 8.25.

Table 8.25 Round 2 SMART PLS fit statistics for the personality measurement model (after deleting 9 personality constructs)

Personality measurement model	AVE	Composite reliability	Cronbach's alpha
Personality (4 latent predictors)	0.53	0.54	0.19

It is evident from Table 8.25, that after the removal of the nine personality constructs the average variance extracted (AVE) is acceptable, measuring above 0.50, but the composite reliability and Cronbach's alpha values are well below the acceptable reliability value of 0.70. Thus, in order to improve on the reliability of the personality measurement model, a final round of evaluation between the four personality constructs and model variables were conducted. The fit statistics for the personality measurement model after deleting OPP external is shown in Table 8.26.

Table 8.26 Final round SMART PLS fit statistics for the personality measurement model (after deleting OPP external)

Personality measurement model	AVE	Composite reliability	Cronbach's alpha
Personality (3 latent predictors)	0.61	0.82	0.68

The fit statistics of the personality measurement model as shown in Table 8.26 indicate acceptable average variance extracted and internal consistency reliability. The final three personality constructs that represent the personality variable in the total measurement model (outer model) and theoretical model (inner model) are OPP gregarious (measure aspects of extraversion), OPP phlegmatic (measure emotional stability), and OPP trusting.

The results above provide substantial evidence to continue reporting statistical evidence of the measurement model (outer model) and theoretical model (inner model) used in explaining the path relationship/strength (as per Figure 6.1) between the different variables influencing attitude towards workplace safety, namely safety consciousness, driver attitude and quality orientation. These results are presented in the next section.

8.4 STATISTICAL RESULTS EVALUATING THE MEASUREMENT MODEL (OUTER MODEL) AND THEORETICAL MODEL (INNER MODEL)

In evaluating the results relating to the process or paths depicting the variables influencing attitude towards workplace safety, the following hypothesis guides the reporting of the results:

- Hypothesis (H_2): Statistically significant paths exist which confirm that attitude towards workplace safety can be predicted/influenced by intelligence, personality traits, work wellness (burnout, work engagement and sense of coherence) in a public electricity company in South Africa.

In the following section the statistical results of the measurement model (outer model) that are used in the evaluation of the theoretical model (inner model) are reported.

8.4.1 Fit statistics of the measurement model (outer model)

According to Henseler et al. (2009), the measurement model (outer model) should be evaluated with regard to its reliability and validity before the analysis can proceed in evaluating the structural model (inner model). In Table 8.27 a summary of the fit statistics for the measurement model to be used in evaluating the structural model depicting the psychological factors influencing attitude towards workplace safety (safety consciousness, driver attitude, and quality orientation) is shown.

Table 8.27 Summary of the goodness of fit (reliability and validity) statistics for the measurement model

Variable	AVE	Composite reliability	R square	Cronbach's alpha
General intelligence	0.7351	0.9167	0.0000	0.8817
Personality	0.6101	0.8223	0.0000	0.6819
Burnout	0.6731	0.8041	0.2487	0.5199
Work engagement	0.8068	0.8928	0.7723	0.7723
Sense of coherence	0.5588	0.8835	0.1219	0.8418
Driver attitude	0.6291	0.8347	0.3420	0.7019
Quality orientation	0.5697	0.8407	0.1957	0.7514
Safety consciousness	0.7037	0.8764	0.6492	0.7875

It is evident from Table 8.27 that all the latent variables demonstrate an internal consistency reliability (see column: composite reliability) value above 0.7 as proposed by Werts et al. (1974). In addition, Table 8.27 shows that the average variance extracted (AVE) values of all the latent variables are above 0.5 (Henseler et al., 2009).

Therefore, the above results provide acceptable levels of reliability and validity to proceed with the evaluation of the structural model (inner model). The statistical results of the structural model (inner model) are presented next.

8.4.2 Evaluation of the theoretical model (inner model)

According to Henseler et al. (2009), the reliability and validity value estimations of the measurement model (outer model) allow for the evaluation of the theoretical model (inner path model) estimates. The evaluation of the theoretical model (inner model) includes all the paths as indicated in Figure 6.1. The following table provides a summary of the path fit statistics for the theoretical model of the psychological variables (intelligence, personality, burnout, work engagement, and sense of coherence) influencing attitude (safety consciousness, driver attitude, and quality orientation) towards work place safety.

Table 8.28 Summary of the path coefficients for the theoretical model (inner model) as per Figure 6.1

Latent variable: Path direction	**Path coefficient**	**Standard error**	**t- value**
General intelligence → Safety consciousness	-0.10	0.07	1.45
General intelligence → Driver attitude	0.35	0.08	**4.59****
Personality → Burnout	-0.27	0.09	**2.96****
Personality → Work engagement	-0.06	0.11	0.58
Personality → SOC	0.35	0.12	**3.04****
Personality → Safety consciousness	0.15	0.06	**2.32****
Personality → Driver attitude	0.16	0.10	1.67
Burnout → Work engagement	-0.16	0.13	1.23
SOC → Burnout	-0.34	0.09	**3.87****
SOC → Work engagement	0.25	0.11	**2.31***
Burnout → Safety consciousness	-0.14	0.08	1.63
Burnout → Driver attitude	-0.11	0.10	1.09
Burnout → Quality orientation	0.14	0.10	1.38
Work engagement → Safety consciousness	0.06	0.06	0.94
Work engagement → Driver attitude	-0.02	0.09	0.26
Work engagement → Quality orientation	-0.09	0.11	0.86
SOC → Safety consciousness	0.09	0.08	1.13
SOC → Driver attitude	0.13	0.11	1.20
SOC → Quality orientation	-0.32	0.10	**3.38****
Driver attitude → Safety consciousness	0.42	0.08	**5.00****
Quality orientation → Safety consciousness	-0.39	0.09	**4.24****
Quality orientation → Driver attitude	-0.12	0.10	1.21

** p<0.01 (critical t-value = ≥ 2.58)
* p<0.05 (critical t-value = ≥ 1.95)

Figure 8.1 summarises these findings of the theoretical model (as presented in Figure 6.1) in visual form with the non-significant pathways removed. The path coefficients with the *t*-values are shown in brackets. A *t*-value of 1.96 and above is indicative of a significant path coefficient.

It is evident from Table 8.28 that no significant path coefficients exist between burnout and all three safety attitudinal latent variables, namely safety consciousness, driver attitude and quality orientation. Similarly, the work engagement variable also shares no direct relationship with any of the three safety attitudinal latent variables safety consciousness, driver attitude and quality orientation. Only one, although a strong and significant positive, relationship was found between intelligence and driver attitude. Another observation is that the personality characteristics (OPP gregarious, OPP phlegmatic, and OPP Trusting) showed a strong and significant negative path relationship with burnout, positively with sense of coherence and safety consciousness (safety control, risk avoidance and stress tolerance). No significant path relationship is observed between personality and driver attitude. Also, sense of coherence shares a strong and significant negative path relationship with burnout and quality orientation, and positively with work engagement. It is further observed that no significant path relationship exists between sense of coherence with safety consciousness and driver attitude. The safety attitudinal variables, driver attitude (positive) and quality orientation (negative) showed evidence of a strong and significant path relationship with safety consciousness. In addition, the path relationship between quality orientation and driver attitude is not significant.

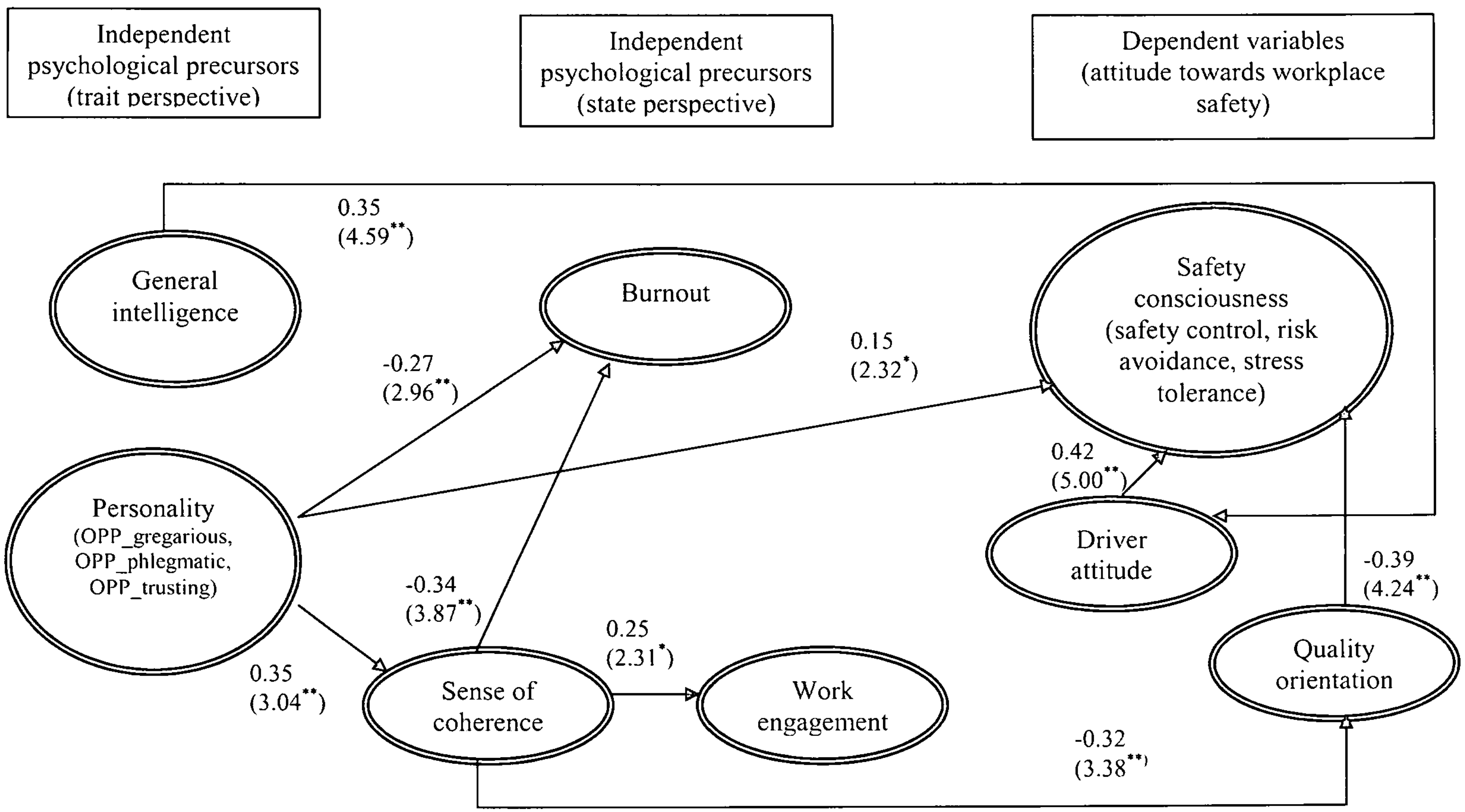

Figure 8.1 The theoretical model of psychological factors influencing attitude towards workplace safety (statistically significant paths only)

In the next section a brief summary of Chapter 8 is presented.

8.5 SUMMARY

The aim of Chapter 8 was to present the reader with the results of the following statistical analyses: 1) results of statistically significant mean differences between the psychological variables and biographical data obtained from the participants; 2) evidence of statistically significant correlations between the independent and dependent variables as well as the strength of the association; 3) through multiple regression analysis, the number of predictor variables which were found to influence safety consciousness, driver attitude and quality orientation significantly; 4) statistical evidence of the reliability and validity of the measurement model (outer model); and 5) the evaluation of the statistical/theoretical model (inner model) indicating which variables were found to have significant path coefficients/relationship. The final chapter (Chapter 9) provides an in-depth discussion on the results of the study and whether the hypothesis that was set in Chapter 1 was fully, partially or not supported. Any limitations related to this study as well as recommendations are presented in Chapter 9.

CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

The aim of this chapter is to draw certain conclusions from the theoretical and empirical information obtained from the study and to propose recommendations for future research which could facilitate a more holistic understanding of those factors (individual and organisational) influencing employees' attitudes towards work place safety. The outline of this chapter focuses on nine aspects.

Conclusions are made firstly regarding the literature study and secondly regarding the research methodology used in this study. Thirdly, conclusions are made on the factorial structures of the variables measured in the current study. Fourthly, conclusions are made on the significant findings among different groups (psychological variables, biographical and safety data) as they relate to the study sample. Fifthly, conclusions are made on the relationship between the different independent and dependent variables, but specifically those variables that predict attitude towards work place safety (safety consciousness, driver attitude and quality orientation). This aspect also addresses the question as to whether hypothesis one, as presented in Chapter 1, is fully, partially or not supported. Sixthly, and perhaps most importantly, conclusions are made on the evaluation of the path relationship (path coefficients) as projected by the theoretical model in Figure 8.1. From the evaluation, conclusions are put forward as to whether hypothesis two, as presented in Chapter 1, is fully, partially or not supported.

The seventh aspect addressed in Chapter 9 focuses on any limitations or shortcomings of the current study. The eighth aspect provides recommendations based on the conclusions as they relate to the overall objectives of this study, and finally the value or contribution of this study is discussed. This chapter concludes with a brief summary and conclusion.

In the next section, conclusions are made regarding the literature study and research methodology of the current study.

9.2 CONCLUSIONS REGARDING THE LITERATURE STUDY

An abundance of research evidence exists regarding the influence of psychological factors such as intelligence, personality and attitudinal factors on work place incident/accident causation, with even more evidence relating to driver behaviour and vehicle accidents (e.g. Barling & Frone, 2004; Buffardi et al., 2000; Carty et al., 1999; Glendon et al., 2006; Hansen, 1989; Lawton & Parker, 1998; Schultz & Schultz, 1990; Smith & Kirkham, 1982; Stuhlmacher & Cellar, 2001). Disappointing, however, is the scarcity of similar studies done (although perhaps simply unpublished) within a South African context. Therefore, most studies have focused on the direct cause-and-effect relationship, for example, lower intelligence may affect a person's ability to identify work place hazards (e.g. Arthur et al., 1991; Buffardi et al., 2000; Carty et al., 1999; Gottfredson, 1997, 2007; Smith & Kirkham, 1982) or emotional instability (e.g. Frone, 1998; Hansen, 1989; Lawton & Parker, 1998) may cause work place incidents/accidents.

Research on the variables influencing attitude towards work place safety focus mostly on organisational or situational factors, such as job satisfaction (e.g. Gyekye, 2005; Gyekye & Salminen, 2006) and attitudinal or perceptual measurements of the organisation's safety culture/climate, such as leadership in safety, importance of adherence to safety procedures and individual responsibility (e.g. Cheyne, Cox, Oliver, & Tomás, 1998; Cox & Cox, 1991; Donald & Canter, 1994). Furthermore, Langford et al. (2000) found that organising for safety supervision and equipment management, industry norms and culture, risk-taking, and management behaviour significantly influence employees' attitudes in the UK construction industry.

Surprisingly, during the literature study, only a few studies could be found focusing on the influence on a person's attitude of psychological factors such as intelligence and personality (see Chapter 2, section 2.4.4). The direct or indirect link between biographical factors such as intelligence on attitude formation is projected in Ajzen and Fishbein's (1980) and Fishbein and Ajzen's (1975) theories of reasoned action and planned behaviour. However, the emphasis is more on the influence or formation of new behavioural, normative, and control beliefs (Ajzen & Fishbein, 2005; Marsh & Wallace, 2005) and affect (e.g. Clore & Schnall, 2005) on attitude.

Thus, based on the above, it can be concluded that three schools of thought are evident in attitude research firstly: the influence of beliefs and affect on attitude, secondly the structure of attitude, and thirdly, the influence of attitude on behaviour (and visa versa). In addition, specifically regarding work place safety research, limited research could be found suggesting a clear link from psychological factors influencing employees' attitudes towards work place safety.

9.3 CONCLUSIONS REGARDING THE RESEARCH METHODOLOGY

In this section, conclusions are made on the selection of the study sample, the measuring instruments used, and the statistical techniques used in this study.

9.3.1 Conclusions regarding the selection of the sample for this study

As presented in section 7.3, the study sample consists of employees' who were involved in work place incidents/accidents from April 2006 to November 2008, of which a large part (87%) of the sample represents involvement in vehicle incidents (e.g. damages to vehicles) and accidents (e.g. injuries sustained by the driver). Thus, the distribution of the sample according to the safety performance data is highly skewed suggesting that the psychological factors influencing attitude towards work place safety of the current study may be biased towards involvement in vehicle related incidents/accidents. Rightfully, the majority of studies (e.g. Carty et al., 1998; Glendon et al., 2006; Iversen, 2004; Jashua & Garber, 1992) suggest that the most common work place incident/accident types are related to driver/vehicle incidents/accidents (e.g. attitude towards safe driving behaviour), which outweigh other reported forms of work place incidents/accidents (e.g. falling from heights, etc.).

Therefore, based on the above, it can be concluded that the results of the current study may be biased towards participants who have been involved in work place vehicle incidents/accidents.

In addition, the representation regarding gender is rather skewed (male = 82.1% and female = 17.9%) which indicates that the results of this study may be biased towards males. This is also true regarding the representation regarding race (African = 70.3%, Coloured = 6.1%, Indian = 0.4%, and White = 23.3%). Thus, it can be concluded that the results of this study maybe biased towards specific gender and race groups.

9.3.2 Conclusions regarding the measuring instruments used in this study

The construct intelligence is made up of a wide combination of interrelated factors such as general intelligence (as measured by psychometric instruments), practical intelligence, emotional intelligence, creative intelligence and many others (e.g. Gardner, 1993, 1998; Morgan, 1996; Myers, 2008; Neisser et al., 1995; Sternberg, 1999, 2003). In this study, intelligence (see Chapter 3 and Chapter 7) is referred to as psychometric intelligence (e.g. Neisser et al., 1995; Psytech International, 1998) measured by psychometric instruments as an indicator of a participant's level of general intelligence. Most studies on safety behaviour that have included intelligence as a variable made use of specific psychometric measurement instruments in measuring aspects of intelligence, such as verbal reasoning, abstract reasoning, spatial reasoning, memory (e.g. Arthur et al., 1991; Carty et al., 1998; Lawton & Parker, 1998; Vickers & Villaseñor, 2006). Thus, other aspects of intelligence such as the effect of emotional intelligence on attitude towards work place safety have not been explored. Thus, it can be concluded that for the purpose of this study the variable intelligence refers to participant's general level of intelligence (*g*) as measured by psychometric measurement instruments.

As shown in Chapters 2 and 4, the influence of personality on attitude formation and behavioural outcomes in any study cannot be ignored. Therefore, it is critical to use a reliable and valid measurement of personality that captures or assesses an African theory of personality and not one that relies only on the universal applicability of Western theories and instruments (e.g. Cheung et al., 2003; Laher, 2008). The current measurement instruments used to measure participants' personality characteristics (OPP and BTI) in this study show acceptable reliability values, but need more refinement in terms of specific items with values of $\alpha < 0.70$. Therefore, it can be concluded that the measurement instruments of personality as they relate to this study require more refinement.

In the measurement of aspects of participants' work wellness, the burnout and work engagement items were randomly combined in one questionnaire to avoid answering bias (Schaufeli & Bakker, 2004), and focusing only on the two primary scales of burnout (exhaustion and cynicism) and work engagement (vigour and dedication) (e.g. Rothmann, 2003; Schaufeli & Bakker, 2004). Thus, the professional efficacy scale of burnout and the absorption scale of work engagement were excluded from the analysis. Schaufeli and Bakker (2004) found in their study that professional efficacy is more strongly related to aspects of work engagement, suggesting that work engagement is likely to consists of four factors, namely vigour, dedication (the primary scales), absorption and professional efficacy. In addition, work engagement could be regarded as a relatively new or unique concept in industrial organisational psychology, including the measurement thereof (Bakker & Leiter, 2010). The most frequently used instrument to measure engagement is the Utrecht Work Engagement Scale (UWES; Schaufeli & Bakker, 2003; Schaufeli et al., 2002). Although quite a number of articles have been published on the use of the UWES in South Africa (e.g. Coetzer & Rothmann, 2007; Rothmann et al., 2005; Storm & Rothmann, 2003b), much more research is needed on its (work engagement's) influence on attitude, specifically attitude towards work place safety.

For the first time, the CARMS measurement instrument was introduced to measure participants' levels of attitude towards work place safety within a South African context. As the owners of the CARMS measurement instrument suggest the measurement instrument has shown promising psychometric properties for further research in measuring employees' attitudes towards work place safety in a public electricity company in South Africa. Furthermore, Fogarty and Shardlow (no date) also mention that the driver attitude scale needs further refinement as a result of its low reliability value ($\alpha < 0.70$) which could be attributed to the multidimensional nature of the scale. Thus, it can be concluded that the CARMS measurement instrument measures aspects of the individual's attitude towards work place safety, but more reliability and validity studies are needed within a South African context (e.g. bigger sample, reliability and validity across different gender and cultural groups).

9.3.3 Conclusions regarding the statistical techniques used in this study

In earlier research on work place incident/accident causation, including vehicle accidents, predictions in terms of cause and effect were based on single statistical associations (correlation analysis) between variables, for example Smith and Kirkham's (1982) study on the relationship between intelligence test scores with vehicle accidents and traffic violation records. In addition, Arthur et al. (1991), for example, used multiple regression analysis to determine which variables were significant predictors of vehicle accidents. More recently, in their understanding of the factors causing work place incidents/accidents, including vehicle accidents, researchers turned their attention to the influence of a combination of factors (e.g. organisational and psychological variables) related to at-risk behaviour (e.g. Barling, Loughlin & Kelloway, 2002; Carty et al., 1998; Christian et al., 2009; Hansez & Chmiel, 2010; Neal & Griffen, 2006; Tomás et al., 1999). Furthermore, most of these studies support the suggestion of work place incidents/accidents, including vehicle accidents, as the result of a sequence of events (Chhokar, 1990). To assess or evaluate the sequence or path relationship of this complexity, structural equation modelling (SEM) approaches using the EQS program and LISREL program have been suggested in safety behavioural research (e.g. Hansez & Chmiel, 2010; Tomás et al., 1999). For the first time in safety behavioural research, the SEM partial least squares (PLS) path-modelling approach was used in this study to explore/evaluate and predict the significance of the path relationships between the different variables on attitude towards work place safety (see section 7.7.2.5.1. regarding the motivation for using PLS modelling in this study). Thus, based on the above, it can be concluded that the SEM partial least squares (PLS) path-modelling approach proved to be a reliable statistical methodological tool to explore/evaluate and predict the sequence or path relationship between variables in influencing employees' attitudes towards work place safety in a public electricity company in South Africa.

In the next section, conclusions (based on theory/empirical evidence) are made on the factor structures and reliability of the measurement instruments used in this study to measure intelligence, personality, burnout, work engagement, sense of coherence and the attitude towards work place safety variables safety control, risk avoidance, stress tolerance (the safety consciousness construct), driver attitude, and quality orientation.

9.4 CONCLUSIONS REGARDING THE FACTORIAL STRUCTURES OF THE VARIABLES MEASURED IN THE THIS STUDY

As mentioned in Chapter 7, before any specific statistical technique such as correlation or regression analysis can be performed in order to reach the research objectives, the reliability of the underlying factor structures of the constructs needs to be confirmed by means of exploratory and confirmatory factor analysis. In this section, conclusions are made on the results of the factor structures of the different constructs used in this study and comparisons are made against the results found in the literature.

9.4.1 Conclusions about the reliability of the independent variable used in this study, namely, intelligence

As indicated in Chapter 7 the analysis of reliability for the measurement instruments that were used to measure intelligence, namely the General Reasoning Test (GRT2) and Spatial Reasoning Test (SRT2) was done by the test provider, Psytech South Africa. The reliability coefficients obtained in this study from the sub-tests of the GRT2, namely verbal reasoning (0.87), numerical reasoning (0.86), and abstract reasoning (0.88) compared favourably with the findings reported by Psytech International (verbal, 0.83; numerical, 0.84; abstract, 0.83), reliabilities for the South African population (verbal, 0.86; numerical, 0.86; abstract, 0.81), and those reported by Venter et al. (2004) (verbal, 0.78; numerical, 0.85; abstract, 0.84).

Therefore, it is clear that the GRT2, with the verbal, numerical and abstract reasoning, sub-tests had alphas greater than 0.70 as proposed by Nunnaly and Bernstein (1994). Thus, it can be concluded that the GRT2 measurement of general intelligence consistently measures each underlining ability (verbal, numerical and abstract reasoning) and is a valid representation of the constructs being measured. Therefore, any inferences made as they relate to the current sample and prediction of influencing employees' attitudes towards work place safety in a public electricity company in South Africa can be viewed as accurate.

The reliability coefficient obtained for the spatial reasoning test (0.71) also compared favourably with findings reported by Psytech International (0.84), Psytech South Africa (0.60 to 0.91), and Venter et al. (2004) (0.74). Although the reliability coefficient in this study is above the value of 0.70 as proposed by Nunnaly and Bernstein (1994), a suggested value of reliability in excess of 0.80 for measuring an aspect of mental reasoning is more advisable.

Conclusions about the reliability for the scales that measured aspects of participants' personality are presented next.

9.4.2 Conclusions about the reliability of the independent variable used in this study, namely personality

With regard to the construct intelligence, the different service providers performed the analysis for reliability of the personality constructs as measured by the Occupational Personality Profile (OPP) (Psytech, 2002) and Basic Traits Inventory (BTI) (Taylor & De Bruin, 2006). Firstly, conclusions are made on the OPP dimensions and are graphically illustrated in Table 9.1.

Table 9.1 Comparisons between current and other studies on the reliability coefficients for the OPP dimensions

OPP dimension	**Reliability coefficient of current study (N=278) (revised items)**	**UK sample (N=942) (Psytech International, original items)**	**SA sample (N=852) (Psytech SA, original items)**	**SA sample (N=88) (revised items) (Venter et al., 2004)**
Assertive	**0.56**	0.71	**0.65**	**0.61**
Flexible	**0.51**	0.77	**0.69**	**0.53**
Trusting	**0.68**	0.83	0.72	**0.67**
Phlegmatic	0.70	0.75	0.71	0.77
Gregarious	**0.58**	**0.67**	**0.64**	**0.68**

Table 9.1 Comparisons between current and other studies on the reliability coefficients for the OPP dimensions (continued)

OPP dimension	**Reliability coefficient of current study (N=278) (revised items)**	**UK sample (N=942) (Psytech International, original items)**	**SA sample (N=852) (Psytech SA, original items)**	**SA sample (N=88) (revised items) (Venter et al., 2004)**
Persuasive	**0.62**	0.75	0.71	**0.59**
Contesting	0.73	0.75	0.72	**0.68**
Pessimistic External locus of control	0.73	0.71	0.73	**0.62**
Pragmatic	**0.52**	0.70	**0.68**	0.76

As may be observed from Table 9.1, the reliability coefficient for the dimensions phlegmatic, contesting and external locus of control (pessimistic) compares favourably with the alphas ($\alpha \geq 0.70$, Nunnaly & Bernstein, 1994) found in previous studies, though the alphas reported by Venter et al. (2004) on contesting and external locus of control are a bit lower. Six dimensions show lower values ($\alpha < 0.70$) (highlight in bold) compared to the UK sample, but consistent alpha values compared with the two South African studies. The variation in the different values may be attributed to true differences between the different sample participants on the trait being measured, or to measurement error (e.g. English reading comprehension ability). Therefore, the dimensions with a low reliability coefficient (lower than 0.70) may be situation-specific and thus the items may need to be improved.

Secondly, conclusions are made on the BTI Five Factor of personality and are graphically illustrated in Table 9.2.

Table 9.2 Comparisons between current and other studies on the reliability coefficients for the BTI Five Factor of personality

BTI Five Factor (number of items in parenthesis)	**Reliability coefficient of current study (N=278)**	**SA Sample (N=5352) (Taylor & De Bruin, 2006)**
Extraversion (36 items)	0.87	0.87

Table 9.2 Comparisons between current and other studies on the reliability coefficients for the BTI Five Factor of personality (continued)

BTI Five Factor (number of items in parenthesis)	Reliability coefficient of current study (N=278)	SA Sample (N=5352) (Taylor & De Bruin, 2006)
Neuroticism (34 items)	0.93	0.93
Conscientiousness (41 items)	0.94	0.93
Openness to experience (32 items)	0.89	0.87
Agreeableness (37 items)	0.90	0.89

It is evident from Table 9.2 that the reliability of the Big Five factors is very high ($\alpha \geq 0.70$, Nunnaly & Bernstein, 1994) in the current study and in those reported by Taylor and De Bruin (2006).

It is evident that despite certain reservations on the reliability of various dimensions of the OPP measurement, the predictability of all the dimensions in influencing a person's attitude towards work place safety as it bears on the current study sample was evaluated through correlation and multiple regression analysis as well as their loading on the personality construct to be included in the measurement model (outer model) and evaluation of the theoretical model (inner model) (see Chapter 8). The BTI Five Factor scales (Table 9.2) for this study can be regarded as an accurate reflection of the underlining personality trait being measured as proposed by Taylor and De Bruin (2006). It can be therefore concluded that the rationale for the inclusion of both the OPP and BTI personality measurement instruments can be used independently in making decisions about people and more specifically as predictors of influencing people's attitude towards work place safety in a public electricity company in South Africa. However, the concerns (see Chapter 4) raised by Laher (2008) regarding the representation (e.g. culture and gender sensitivities) of personality in a South African context should not be ignored.

Conclusions on the factor structure and reliability of the burnout, work engagement and sense of coherence constructs are presented next.

9.4.3 Conclusions about the reliability of the independent variables used in this study, namely burnout, work engagement and sense of coherence

For the purpose of this study, three measures were used to assess participants' level of work wellness, namely the Maslach Burnout Inventory – General Survey (MBI-GS), the Utrect Work Engagement Scale (UWES), and the Orientation to Life Questionnaire, which was used to measure the salutogenic construct sense of coherence as a psychological strength factor. The factor structure of the three constructs was determined through exploratory factor analysis, and confirmatory factor analysis was used to determine their validity. Conclusions on the factor structure (determine the reliability of the items) and goodness-of-fit analysis (determine the reliability and validity of the measurement instrument) of the burnout construct are presented first, thereafter work engagement, and lastly sense of coherence.

Based on the literature review in Chapter 5 on the pathogenic construct burnout, Maslach et al. (1996) refer to burnout as a crisis in one's relationship with work in general and not necessarily as a crisis in one's relationship with people at work. The MBI-GS measures three burnout dimensions namely exhaustion, cynicism and professional efficacy (Maslach et al., 1996). For the purpose of this study, the two key dimensions of burnout, namely exhaustion and cynicism, were used to measure the burnout construct. The inclusion of the two primary scales of burnout in this study were guided by other studies (e.g. Rothmann et al., 2005; Schaufeli 2003; Schaufeli et al., 2001) confirming that burnout consists of a two-factor structure, namely exhaustion and cynicism. Furthermore, according to Lee and Ashforth (1996), professional efficacy is the weakest burnout scale in terms of significant relationships with other variables. However, researchers such as Schaufeli et al. (2001) and Rothmann et al. (2005) report that professional efficacy loaded more strongly on an extended work engagement dimension (vigour/dedication/absorption/professional efficacy).

Therefore, exploratory factor analysis on the two primary scales of burnout (exhaustion and cynicism) for the current sample was based on the original factor structure as measured by the MBI-GS. A comparison between the reliability coefficients of the two primary burnout scales obtained for this study and those reported by other researchers are presented in Table 9.3.

Table 9.3 Comparison of the reliability coefficient of the exhaustion and cynicism scale obtained in this study and other studies

Burnout primary scales	**Reliability coefficient of current study (N=278)**	**Schaufeli et al., 1996**	**Schaufeli & Bakker, 2004**			**Storm & Rothmann, 2003a**	**Rothmann, 2008**
			Sample 1	Sample 2	Sample 3		
Exhaustion	0.82	0.87 to 0.89	0.89	0.90	0.86	0.88	0.86
Cynicism	0.71 (Revised 4 items)	0.73 to 0.84	0.80	0.76	0.77	0.79	0.74

Based on Table 9.3 above, it is evident that the factor structure of the exhaustion scale by means of its reliability coefficient compares favourably ($\alpha \geq 0.70$, Nunnaly & Bernstein, 1994) with the alpha values found in previous studies. The factor structure of the cynicism scale, after deleting item 25 "I just want to do my job and not be bothered", compares favourably ($\alpha \geq 0.70$, Nunnaly & Bernstein, 1994) with the findings reported by the researchers mentioned above. In addition, item 25 (item 13 on the original MBI-GS) on the cynicism scale continues to be unsound (e.g. Rothmann et al., 2005; Storm & Rothmann, 2003a; Schutte et al., 2000) and should be removed from the MBI-GS. Nonetheless, the factor structure and reliability coefficient obtained in this study for the two primary scales of the burnout construct provided sound psychometrical properties and the MBI-GS measures what it is suppose to measure, namely burnout (Maslach et al., 1996). Therefore, it can be concluded that the exhaustion and cynicism scales are valid representations of the burnout construct and its two-dimensional structure, with an acceptable reliability for the current sample.

From a positive psychology perspective, work engagement is referred to as a positive, fulfilling, work-related state of mind characterised by vigour, dedication and absorption, characterised by a more persistent and pervasive affective-cognitive state that is not focused on any particular object, event, individual or behaviour (Schaufeli, et al., 2001). Similarly, as in the case of burnout, the emphasis was on the two primary scales of work engagement, namely vigour and dedication (e.g. Schaufeli & Bakker, 2004), and the exploratory factor analysis on vigour and dedication in this study was based on the original factor structure (Schaufeli et al., 2001). A comparison between the reliability coefficients of the two primary engagement scales obtained for this study and those reported by other researchers are presented in Table 9.4.

Table 9.4 Comparison of the reliability coefficient of the vigour and dedication scale obtained in this study and previous studies

Engagement primary scales	**Reliability coefficient of current study (N=278)**	**Schaufeli & Bakker (2003) (N=2,313)**	**Storm & Rothmann, (2003b) (N=2,396)**	**Coetzer & Rothmann, (2007) (N=1,100)**
Vigour	0.67 (Revised 4 items)	0.83	0.78	0.80
Dedication	0.79	0.92	0.89	0.69

It is observed form Table 9.4 that even after deleting two problematic items (item loading less than 0.30), namely "I always persevere at work, even when things do not go well" (item 3) and "I am very resilient, mentally, in my job" (item 7) the reliability coefficient for the vigour scale in this study is still below the suggested value of $\alpha \geq 0.70$ (Nunnaly & Bernstein, 1994), compared to the alpha values reported by the abovementioned researchers. Possible causes may be: (1) all the burnout and engagement items were randomly put together in one questionnaire and differences in terms of understanding the content of the items by the different language groups of the study sample could have contributed to the problems experienced with the indicated items: (2) participants' basic understanding of English words and concepts could have led to inconsistent interpretation of the items: and (3) Coetzer and Rothmann (2007), and Storm and Rothmann (2003b) also found the item "I am very resilient, mentally, in my job" (item 15 on the 17 item original UWES) to be problematic. Thus, the items measuring vigour may need further refinement as they relate to this study. Furthermore, the reliability coefficient of the second engagement scale, dedication, obtained in this study compares favourably ($\alpha \geq 0.70$, Nunnaly & Bernstein, 1994) with the other studies as shown in Table 9.4. Therefore, the factor structure and reliability coefficient obtained in this study for the two primary scales of the work engagement construct provided acceptable psychometrical properties and the UWES measures what it is supposed to measure, namely, work engagement (Schaufeli, et al., 2001). In conclusion, the construct work engagement, with its two-dimensional structure (sub-scales vigour and dedication) provides a valid representation of the construct with acceptable reliability for the current sample.

A number of researchers (e.g. Coetzer, 2004; Coetzer & Rothmann, 2007; Schaufeli, 2003; Schaufel & Bakker, 2004) propose that burnout and work engagement are separate but related indicators of affective well-being of employees in the work place and may therefore be combined in a model of wellness at work. In this study, through the structural equation modelling (SEM) method as implemented by LISREL (Jöreskog & Sörbom, 1993), the four latent constructs exhaustion, cynicism, vigour and dedication seem to suggest acceptable overall levels of fit ($x^2/df = 2.17$; RMSEA = 0.06; SRMR = 0.090; GFI = 0.86; CFI = 0.94) except for the GFI that is below the recommended value of 0.95. The correlation coefficient reported in Chapter 8 confirms that exhaustion (0.86) and cynicism (0.81) correlate significantly ($p \leq 0.01$) with burnout (large effect), and vigour (0.91) and dedication (0.95) with work engagement (large effect). Furthermore, significant ($p \leq 0.01$) negative correlations exist between burnout and work engagement (-0.32) as well as between exhaustion and vigour (-0.26), exhaustion and dedication (-0.27), cynicism and vigour (-0.14), and cynicism and dedication (-0.30). In addition, exhaustion correlates significantly ($p \leq 0.01$) with cynicism (0.40) and vigour with dedication (0.73). Therefore, based on the current study sample, it can be concluded that burnout and work engagement are independent states that are negatively, moderately related (e.g. Demerouti et al., 2001; Schaufeli & Bakker, 2004). In addition, vigour and dedication are the direct positive opposites of exhaustion and cynicism (e.g. Coetzer & Rothmann, 2007; González-Romá et al., 2006). This further supports the argument by Schaufeli and Bakker (2004) that for this study, burnout and work engagement are indicators of employee wellness at work as they have a bearing on employees' attitudes towards work place safety in a public electricity company in South Africa.

Sense of coherence is an important component of one's health and well-being (Antonovsky, 1987; Rothmann, 2003). Therefore, it is important for this study that this construct meets the acceptable limit of psychometric properties to be included in the theoretical model (see Figure 6.1). The sense of coherence construct consists of three subscales, namely (1) comprehensibility, (2) manageability and (3) meaningfulness. A unidimensional structure for the salutogenic construct sense of coherence (29-item questionnaire) was obtained in this study through exploratory factor analysis and the latter provided acceptable levels of fit ($x^2/df = 1.45$; RMSEA = 0.04; SRMR = 0.032; GFI = 0.98; and CFI = 1.00) with a reliability of 0.83. The reliability of the current instrument compares favourably ($\alpha \geq 0.70$, Nunnaly & Bernstein, 1994) with results reported by researchers for example Rothmann (2000) (0.89), Steyn et al. (2004) (0.86), and Eriksson and Lindström, (2005) (0.70 to 0.95). Although Eriksson and Lindström (2005) suggest that the factor structure of SOC seems rather to be multidimensional than unidimensional, Antonovsky (1987) insists that the SOC scale must be viewed as a single unit. This gives support to the unidimensional structure of the SOC scale in the current study.

Therefore, the SOC scale can be viewed as an accurate and reliable representation of how participants from the current study manage stressful situations and stay well. Subsequent interpretations related to participants' sense of coherence in the current study are thus valid and reliable in the context of the development and evaluation of a theoretical model influencing attitude towards work place safety in a public electricity company in South Africa.

It can be concluded that the measurement instruments used to measure burnout, work engagement and sense of coherence are a valid representation of the constructs being measured, and any inferences made as they relate to the current sample of influencing employees' attitudes towards work place safety in a public electricity company in South Africa can be viewed as valid and reliable.

Conclusions on the factor structure and reliability of the safety consciousness construct (namely safety control, risk avoidance, stress tolerance), driver attitude and quality orientation measuring attitude towards work place safety are presented next.

9.4.4 Conclusions about the reliability of the dependent variables used in this study, namely safety control, risk avoidance, stress tolerance (safety consciousness), driver attitude and quality orientation measuring attitude towards work place safety

The aim of this study (see Chapter 1) is to investigate the influence or prediction of individual psychological factors on employees' attitudes towards work place safety in a public electricity company in South Africa. Therefore, it was essential to select specific safety attitudinal variables that have a positive identification with the nature and kind of operational business of the organisation under study. It is one thing to select the appropriate attitudinal variables, but most importantly, they should demonstrate sound internal consistency reliability and factorial validity. As presented in section 7.7.2.1.1.3.3 the internal consistency reliability of the safety control (0.74), risk avoidance (0.86), stress tolerance (0.73), driver attitude (0.75) and quality orientation (0.75) scales (after deleting items loading below 0.30) compares favourably ($\alpha \geq 0.70$, Nunnaly & Bernstein, 1994) to what has been reported by Forgarty and Shardlow (no date), namely safety control (0.81), risk avoidance (0.87), stress tolerance (0.88) driver attitude (0.62), and quality orientation (0.80) scales. In addition, only two of the revised items (item 3 and 30 – see Table 7.15) as well as the two additional items (item 99 and 100) loaded below 0.30. Based on the above, the safety attitudinal scales included in this study as measured by the CARMS showed acceptable internal consistency reliability applicable to this study. However, much more research is needed regarding their factor structure, item or wording semantics (e.g. construction of the items, meaning of certain concepts) as well as a bigger sample from different work environments including across different gender, cultural and language groups in South Africa.

The confirmatory factor analysis (through the structural equation modelling (SEM) method as implemented by LISREL (Jöreskog & Sörbom, 1993) performed on the three-factor safety consciousness construct (safety control, risk avoidance and stress tolerance) ($x^2/df = 1.55$; RMSEA = 0.05; SRMR = 0.036; NFI = 0.98; GFI = 0.96; and CFI = 0.99), and one factor quality orientation ($x^2/df = 1.38$; RMSEA = 0.04; SRMR = 0.06; NFI = 0.93; GFI = 0.94; and CFI = 0.98) in this study as measured by the CARMS instrument showed acceptable overall goodness-of-fit statistics.

In contrast, the overall fit statistics of the one-factor driver attitude scale ($x^2/df = 4.13$; RMSEA = 0.11; SRMR = 0.08; NFI = 0.82; GFI = 0.90; and CFI = 0.86) provided a relatively mediocre overall fit. Nonetheless, the internal consistency reliability, factor reliability and validity of the safety attitudinal variables as measured by the CARMS in this study provide enough statistical confidence to be included in the theoretical model as dependent variables as they bear on employees' attitudes towards work place safety in a public electricity company in South Africa. Therefore, it can be concluded that any interpretations of on the use of the CARMS instrument to measure employees' attitudes towards work place safety in a public electricity company in South Africa is accurate and reliable.

In the next section, conclusions are made on the significant differences observed between the psychological factors based on the biographical and employee safety data of the current sample.

9.5 CONCLUSIONS BASED ON DIFFERENCES IN PSYCHOLOGICAL FACTORS AMONG VARIOUS GROUPS BASED ON THE BIOGRAPHICAL AND SAFETY PERFORMANCE DATA OF PARTICIPANTS

The results of the mean differences between psychological factors based on the biographical and employee safety data of the current sample are presented in detail in section 8.2.1. This section highlights only those significant mean differences that could provide more insight into or explain certain phenomena as they bear on employees' attitudes towards work place safety or possible predictors of work place incidents or accidents of the current sample.

9.5.1 Conclusions based on differences in psychological factors among various groups with various job/task grades

It is evident from Table 8.3 that statistically significant differences exist between task grade sT4-T7 and T9-T13 on numerical (t-value = -7.57, p-value = 0.001, effect size = -0.94) and spatial (t-value = -4.12, p-value = 0.004, effect size = -.051) reasoning. This result, together with a lower driver attitude (t-value = -6.18, p-value = 0.001;

effect size = -0.77), supports the arguments made by researchers, such as Arthur et al. (1991), Carty et al. (1999), and Lawton and Parker (1998), that a positive relationship exists between intelligence (e.g. information-processing capacity, lower perceptual and spatial awareness) and vehicle accidents. In addition, participants with task grade T4-T7 who have lower safety consciousness scores (t-value = -3.35, p-value = 0.001; effect size = -0.42) and inability to see a cause-and-effect relationship between their actions and safety outcomes (safety control dimension) (t-value = -4.36, p-value = 0.000; effect size = -0.54) are indicators of possible counter-productive behaviour such as work place incidents including vehicle accidents (e.g. Fogarty & Shardlow, no date; Jones & Wuebker, 1985; Lawton & Parker, 1998; Reams, 2007). Although lower mean scores, though statistically significant at the 0.05 level, are evident for T4-T7s on the other psychological factors (sense of coherence, OPP assertive, OPP contesting, stress tolerance, risk avoidance, and quality orientation), their effect is rather low to medium.

9.5.2 Conclusions based on differences in psychological factors among various groups in terms of average business kilometres driven per month

The one-way ANOVA results of the average business kilometres driven per month (see Table 8.5) suggest that both numerical reasoning and spatial reasoning are important intellectual requirements for this study sample when driving on average in excess of 2000 business kilometres per month. Garty et al. (1999) report in their study that respondents who performed better perceptually and recorded higher spatial awareness reported fewer work-related driving accidents. In addition, numerical ability as a form of logical reasoning to solve problems (e.g. attention and focused concentration, and correctly identify logical relationships between entities and drawing conclusions and inferences) could in this instance relate to speed awareness according to the situation (e.g. weather/road conditions), deciding on the best possible solution in a possible dangerous/threatening situation (e.g. overtaking a truck, driving on a gravel road, etc.) or adherence/follow to traffic rules (e.g. to understand road instructions). In addition, in this study, numerical ability correlate significantly with driver attitude (r = .37), spatial reasoning ability (r = .59), verbal reasoning ability (r = .72) and external locus of control (-.26). Therefore, the result of this finding and results from the correlation analysis suggest that participants from this study who drives on average in access of 2000 business kilometres per month may be at a higher risk of being involved in a motor vehicle accident.

9.5.3 Conclusions based on differences in psychological factors among various groups based on self-reported traffic violations/offences

A number of psychological factors are found to be positively related (see Table 8.6) with participants from this study who reported to have committed a traffic offence of which speeding fines account for 53.4% of the overall fines listed. The z-value (the equivalent of the t-value) is above the suggested range of 1.95, therefore the statistical significance of this mean difference. These psychological factors, namely cynicism (refers to the attitudinal dimension of burnout) (e.g. Maslach et al., 1996; Schaufeli et al., 2002; Rothmann et al., 2005), intelligence (verbal, numerical, abstract, and spatial reasoning) (e.g. Arthur, Jr. & Graziano, 1996; Arthur et al., 1991; Carty et al., 1999; Lawton & Parker, 1998; Smith & Kirkham, 1982), external locus of control (OPP_External) (e.g. Jones & Wuebker, 1985; Lawton & Parker, 1998), emotional stability (OPP_Phlegmatic) (e.g. Frone, 1998; Hansen, 1989), Type A behaviour (OPP_Contesting) (e.g. Beirness & Simpson, 1988; Cooper & Sutherland, 1987), driver attitude (e.g. Yilmaz & Celik, 2004) have been found to be positively associated with driver violations and vehicle accidents.

Therefore, it can be concluded that participants from this study who have committed a traffic offence, especially speeding, and display a combination or all of the following latent behaviours or abilities, namely (1) their cognitive interpretation of the situation, (2) experiencing a negative attitude towards work, (3) with an external locus of control, (4) ineffective emotional coping strategies, (5) having a tough-minded hard-driving working nature, and (6) lower driver attitude, could further influence their overall attitude towards safe driving behaviours negatively, thus increasing the likelihood of being involved in a motor vehicle accident.

9.5.4 Conclusions based on differences in psychological factors among various groups based on self-reported involvement in a vehicle accident

In addition, participants in this study who reported involvement in a vehicle accident compared to those not involved in a vehicle accident differ significantly (t value of = -2.138) on the personality factor, conscientiousness (as measured by the Basic Traits Inventory), suggesting that those participants who were involved in a vehicle accident tend to be more relaxed in their approach towards work, easily distracted and impulsive. Similar findings have shown a significant inverse relationship between conscientiousness and at-fault driving accident involvement (1 sample $r = -.14$, $p = < .05$, and 2 sample $r = -.19$, $p < .01$) (Arthur et al., 1991), and between conscientiousness and combined total at-fault and not at-fault accidents ($r = -.16$, $p \leq .05$) (Cellar et al., 2001). It can be concluded that based on the above, the significance of the personality factor conscientiousness in contributing to the overall aim of this study, namely psychological factors that predict an influence on employees' attitudes towards work place safety, specifically as it bears on driving behaviour, cannot be ignored within the current sample.

9.5.5 Conclusions based on differences in psychological factors among various groups based on self-reported vehicle accidents (at fault, not at fault and no sure)

The next question in the biographical questionnaire asked participants to indicate whether they had been involved in a vehicle incident/accident, and if so, whether they believed that they were at-fault, not at-fault or not sure. As per Table 8.8 a statistically significant mean difference exists between participants who reported at-fault and not-fault on two psychological variables, namely cynicism (sub-scale of burnout) and OPP gregarious (the extraverted, outgoing personality dimension). Although a statistically significant difference in mean scores between at-fault and not at-fault on the psychological factors cynicism and OPP gregarious exists, no inferences can be made that these two factors contributed to their vehicle accident because no indication was made when the vehicle accident occurred (e.g. timeframe of being involved in a vehicle accident and participating in this study). Porter (1988) points out that one needs to be careful of interpreting single statistical approaches in studying human characteristics that may have caused accidents, and that one should rather focus more on a combination of factors and circumstances as in the case of participants in this study who reported to have contravened a traffic ordinance (as per Table 8.6). However, individual behavioural factors such as negative employment attitudes (LeShan, 1952) and the personality trait extraversion (e.g. Arthur & Graziano, 1996; Clarke & Robertson, 2005; Smith & Kirkham, 1981) were significantly related to vehicle accident involvement.

9.5.6 Conclusions based on differences in psychological factors among various groups based on participants self-reported work place incidents

Another significant finding (see Table 8.9) (t value = -2.58) is the higher levels of sense of coherence amongst those participants who reported not being involved (n= 78) in a work place incident or accident compared to those who were (n= 201). This finding may suggest that those participants who reported not being involved in a work place incident or accident are coping quite well and staying healthy, despite being bombarded by multiple stressors in everyday life (Antonovsky, 1979). In addition, the way they see the world and stimuli from the environment as being under their control and motivationally meaningful is significant. Such people welcome challenges that are worth investing in and they engage in positive safety behaviours, such as avoiding unsafe working or driving practices. Participants who reported not being involved in a work place incident or accident are inclined to have a more practical, hands-on (the personality dimension OPP pragmatic) orientation towards solving work related problems (statistically significant t-value = -2.24) compared to the other group (those participants who were involved in a work place incident or accident) and who may be more imaginative, creative, abstract and theoretical in their approach towards solving work related problems (e.g. Venter et al., 2004).

The findings reported in sections 9.3.3 to 9.3.6 support various studies indicating the statistically significant correlations between reported work place incidents/accidents (including vehicle accidents) and intelligence, personality and factors related to burnout (e.g. distress). For example Arthur, Jr and Graziano (1996) (sample of college students N = 227) found the following statistically significant correlations between indictors of ability variables (cognitive ability, spatial working memory, and spatial processing speed) and at-fault accidents (raw accident data) ($r = -.15$; $p < .05$) and at-fault accidents per year driven ($r = -.12$; $p < .05$). In addition, emotional stability correlated negatively with at-fault accidents ($r = -.14$; $p < .05$). In another sample (temporary employment agency $N = 250$) from the same article, the researchers reported the following statistically significant correlations between indictors of ability variables (cognitive ability, spatial working memory, and spatial processing speed) and raw accident data, namely total accidents ($r = -.15$; $p < .05$), at-fault accidents ($r = -.18$; $p < .01$), and moving violation tickets ($r = -.15$; $p <.05$). Arthur et al. (1991) found relatively low sample-weighted mean correlations between level of distress ($r = .02$) and locus of control ($r = .20$) with vehicle accident involvement.

9.5.7 Conclusions based on differences in psychological factors among various groups based on below and above average scores on safety consciousness (safety control, risk avoidance and stress tolerance).

It is important to mention again (results discussed from Table 8.10) that any interpretation made regarding the differences between safety consciousness (below and above average scores) and psychological factors needs to be treated with caution. The below and above average-mean scores on the safety consciousness construct are based on the current study sample and have not been compared with a specific norm group. Nonetheless, the results from Table 8.10 provide information that demonstrates statistically significant differences between below and above average scores on safety consciousness with certain psychological variables. It is observed that 131 respondents scored below average on safety consciousness (total index score of safety control, risk avoidance, and stress tolerance scales) and 148 above average. In terms of differences between mean scores, ten psychological factors were found to be statistically significantly related to below or above average scores on safety consciousness. The safety attitudinal scales, namely risk avoidance, safety control, quality orientation and driver attitude had the strongest effect (very large effect) on the safety consciousness of participants in this study and support the findings of Forgarty and Shardlow (no date), Forcier et al. (2001) and Reams (2007) that the safety consciousness construct provides an overall indication of a person's work safety attitudes and could be measured through psychological assessment.

Two intellectual factors, namely verbal reasoning (medium effect) and numerical reasoning (low to medium effect) provide evidence of a predictive value between below and above average scores of being safety conscious (e.g. Gottfredson, 1997, 2007; Schultz & Schultz, 1990). A more comprehensive explanation of the influence of intellectual abilities on attitude towards work place safety (safety consciousness and driver attitude) follows under the discussion and conclusions made on the path relationships between the different variables influencing attitude towards work place safety.

It seems as if employees who are able to get along with other people, and have compassion (Big Five personality factor – agreeableness) (medium effect) for others and also believe in the trustworthiness of other people (OPP trust) (large effect) are likely to be more safety conscious (e.g. Cellar et al., 2001; Clarke & Robertson, 2005; Davids & Mahoney, 1957).

Interestingly, participants in this study with below average scores on safety consciousness may be disengaged from their work and may experience a negative, unfulfilled work-related state of mind (medium effect). In addition, they may not be strongly involved in their work and may not experience a sense of significance, enthusiasm, inspiration, pride and challenge regarding the work (dedication scale of work engagement) (medium effect) (Schaufeli et al., 2001). This result, for the first time, provides some empirical evidence of the importance of engaged employees with a positive attitude towards work place safety.

It can be concluded that measures of intelligence, personality, work engagement and specific work place safety attitudinal constructs could be used to measure an employees' overall safety awareness or consciousness in a public electricity company in South Africa.

9.5.8 Conclusions based on differences in psychological factors among various groups based on below and above average scores on the driver attitude scale.

Concerning the results on the driver attitude scale (results discussed from Table 8.11), any interpretation made regarding the differences between driver attitude (below and above average scores) and psychological factors needs to be treated with caution. The below and above average mean scores on the driver attitude construct is based on the current study sample and not compared with a specific norm group. Nonetheless, some statistically significant mean differences are noteworthy.

Firstly, it is evident that employees' (from the study sample) overall safety consciousness (very large effect), but specifically two of the primary scales that measure safety consciousness, namely safety control (very large effect) and risk avoidance (large effect), bears strongly on individuals' (from the study sample) attitude towards safe driving practices and serves as an indication of a decrease or increase in the likelihood of being involved in a motor vehicle accident (e.g. Fogarty & Shardlow, (no date); Lawton & Parker, 1998; Trimpop et al., 2000).

Secondly, spatial reasoning ability (one of the intelligence variables) as a measure of a person's ability to see objects in space and to visualise varying arrangements of those objects (Thurstone, 1938), has been found to be significantly (medium effect) related to the driver attitude of participants in this study. This, further supports the finding of Carty et al. (1999) that respondents who scored better perceptually and recorded higher spatial awareness reported fewer work related driving accidents.

Thirdly, two personality traits, namely trusting (large effect) and Type A personality (OPP contesting) (medium effect), show predictive significance (participants from this study) in influencing a person's attitude towards safe driving practices and the likelihood of avoiding driver accidents (e.g. Cellar et al., 2001; Clarke & Robertson, 2005; Cooper & Sutherland, 1987; Davids & Mahoney, 1957). A more comprehensive explanation of the influence of psychological factors on attitude towards work place safety (driver attitude) is featured under the heading, "discussion and conclusions made on the path relationships between the different variables influencing attitude towards work place safety."

It can be concluded that measures of intelligence, personality and specific work place safety attitudinal constructs could be used to measure an employees' attitudes towards safe driving behaviour in a public electricity company in South Africa.

9.5.9 Conclusions based on differences in psychological factors among various groups based on below and above average scores on the quality orientation scale

Similar to the safety consciousness and driver attitude constructs, any interpretation made regarding the differences between quality orientation (below and above average scores) and psychological factors (Table 8.12) needs to be treated with caution. The below and above average mean scores on the quality orientation construct is based on the current study sample and not compared with a specific norm group. Nonetheless, some statistically significant mean differences are noteworthy. In addition, lower scores on quality orientation are indicative of a higher quality awareness or orientation whereas a higher score suggest a lower quality awareness or orientation.

Statistically significant mean differences are evident between quality orientation (below and above average scores) with two primary scales measuring safety consciousness, namely safety control (very large effect) and risk avoidance (large effect). Specifically, the concept locus of control (e.g. internal locus of control) is anchored within an individual (participants in this study) to take responsibility for a positive attitude to the overall quality of work being performed and risk avoidance to detect and avoid errors (e.g. Jones, 1984; Lawton & Parker, 1998; Witt et al., 2002). It is further observed that a significant (medium to large effect) difference exists between driver attitude and quality orientation (below and above average scores), suggesting that when participants from this study demonstrate a positive attitude towards safe driving practices, avoid motor vehicle accidents by being careful and following all traffic regulations, this contributes to their attitude towards the quality of the work being performed including personal work habits (e.g. adherence to safe working practices and methods).

The effect of the two personality factors, OPP pragmatic and OPP gregarious (although statistically significant) with quality orientation was small. In addition, one of the sub-scales of the burnout construct, emotional exhaustion, proved to have a medium effect on participants' (in this study) attitude towards the relationship they have with their work. It can lead individuals to distance themselves emotionally and cognitively from their work, so that they become less involved with the demands of the task and the quality and effectiveness of the work being performed (Maslach, 1998; Rothmann, 2003; Steyn et al., 2004).

It can be concluded that measures of specific work place safety attitudinal constructs and burnout scales could be used to measure employees' attitudes towards the relationship a person has with his/her work, and the manner in which control/responsibility is taken over the quality and effectiveness of the work being performed in a public electricity company in South Africa.

Based on acceptable levels of fit and interpretable factor structures for each of the independent and dependent variables used in the current study, it is now possible to continue evaluating the factors that predict and influence employees' attitudes towards work place safety. The emphasis is on discussing the path relationships between the different variables as outlined in Figure 8.1.

9.6 CONCLUSIONS BASED ON THE RELATIONSHIP BETWEEN THE INDEPENDENT VARIABLES (PSYCHOLOGICAL FACTORS) AND DEPENDENT VARIABLES (ATTITUDE TOWARDS WORK PLACE SAFETY)

This section is guided by the study objectives in testing whether the hypothesis as described below is accepted, partially accepted or not accepted as it bears on employees' attitudes towards work place safety in a public electricity company in South Africa.

H_1: Statistically significant correlations exist between the predictor variables, intelligence, personality, burnout, work engagement and sense of coherence on the criterion variables, safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation in a public electricity company in South Africa.

H_2: Statistically significant path coefficients exist which confirm that employees' attitudes towards work place safety can be predicted by intelligence, personality traits, work wellness (burnout, work engagement and sense of coherence) in a public electricity company in South Africa.

Thus, the purpose of the next section is to explore the significance of the relationship (correlation coefficient) between the predictor variables, intelligence, personality, burnout, work engagement and sense of coherence and the criterion variables, safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude and quality orientation. As well as this, an exploration is done of which of the variables were found to significantly predict or explain (multiple regression) or influence employees' attitudes towards work place safety (safety consciousness, driver attitude, and quality orientation) in the current sample.

9.6.1 Conclusions based on the significance of the relationship between intelligence and attitude towards work place safety

In predicting (multiple regression) change in participants' overall safety consciousness, abstract reasoning contributed significantly ($\beta = -0.09$, $t = -2.281$; $p = p \leq 0.05$), suggesting that a person's inability to learn and apply new skills beyond previous experience may have a negative effect on a person's ability to (1) perceive that the consequences of their actions of safe work behaviours are within their control, (2) avoid hazardous tasks or situations, and (3) apply effective stress coping strategies. Verbal reasoning predicts a significant variance (($\beta = 0.334$, $t = 7.338$, $p = p \leq 0.01$) on participant's driver attitude, suggesting that a person's ability (1) to use English words in a rational way, (2) to correctly identify logical relationships between these entities, and (3) to draw conclusions and inferences contribute significantly to his/her attitudes towards safe driving practices and following traffic rules.

In addition, numerical reasoning ability was found to predict significantly ($\beta = -.161$, $t = -2.899$; p = $p \leq 0.01$) regarding a participants' quality orientation, suggesting that a person's ability (1) to use numbers in a rational way, (2) to correctly identify logical relationships between these entities, (3) to draw conclusions and inferences contribute significantly to an individual's attitude towards the overall quality of the work being performed and commitment to detecting and avoiding errors, such as incorrect capturing of customers electricity consumption for billing purposes, etc.

The significance of relationships between intelligence and dependent variables (safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) are evaluated. The results of the correlation analysis confirm that a statistically significant ($p \leq 0.05$) positive relationship exists between intelligence and most of the variables that measure safety consciousness, namely verbal (VR), numerical (NR) and abstract (AR) reasoning, correlating significantly with safety control (VR = 0.30; NR = 0.20; AR = 0.24), risk avoidance (VR = 0.18, AR = 0.14), stress tolerance (VR = 0.21, NR = 0.18, AR = 0.17) and safety consciousness (VR = 0.26, NR = 0.17, AR = 0.21). Only, numerical reasoning had no statistically significant relationship with risk avoidance. Although a statistically significant relationship exists, the effect size between the safety consciousness scales and latent variable, intelligence, can be considered weak according to the guidelines provided by Cohen (1988). Furthermore, is seems that spatial reasoning has no significant relationship and effect on the three scales measuring safety consciousness. It appears that based on the effect size of the relationship (correlation), intelligence (verbal, numerical, abstract, and spatial reasoning) has little effect on determining whether a participants' safety consciousness has been influenced. However, intelligence is associated with lower safety consciousness for participants in this study with above and below average scores on intelligence as well as between intelligence and job/task grades.

The opposite result is evident between intelligence and driver attitude. A statistically significant ($p \leq 0.05$) positive relationship between driver attitude and verbal (0.51), numerical (0.37), abstract (0.43), and spatial (0.24) were found. The effect of an individual's verbal, numerical and abstract reasoning ability is moderately significantly related to participants' attitude towards safe driving practices and serves as an indication of increased likelihood of being involved in a motor vehicle accident. The effect of spatial awareness on participants' driver attitude is rather weak, but does demonstrate a significant moderate effect on above and below average scores in relation to driver attitude.

The findings explained above support previous studies. Vickers and Villaseñor (2006), for example, argue that past research (e.g. Arthur et al., 1991; Ferguson et al., 1981; O'Toole, 1990) also found weak associations, with no practical or theoretical importance, of intelligence with accidents. They further acknowledge that intelligence is more strongly associated with lower risk for enlisted Navy personnel with well above average intelligence and for those individuals who are rarely assigned to hazardous job categories. However, according to the results of this study and previous studies (e.g. Carty et al., 1999; Herschel & Leibowitz, 1993; Shinar, 1990; Smith & Kirkham, 1982), general intelligence or types of information processing behaviours is of practical and theoretical importance in the context of the state (driver attitude) of a driver and his/her capabilities to avoid accidents or adherence to traffic rules. The result from the regression analysis also highlight the significant influence of abstract, verbal, and numerical reasoning on participant's attitude towards work place safety, namely safety consciousness, driver attitude, and quality orientation.

Therefore, it can be concluded that intelligence remains an important factor in influencing an individual's attitude (e.g. the cognitive component of attitude) towards work place safety in a public electricity company in South Africa.

The significance of the relationships between personality and the dependent variables (safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) are evaluated next.

9.6.2 Conclusions based on the significance of the relationship between personality and attitude towards work place safety

The results of the multiple regression analysis indicate that neuroticism (β = -.193, t = -4.954; p = p$\leq$0.01), gregariousness (β = .136, t = 3.389; p = p$\leq$0.01), persuasiveness (β = -.153, t = -3.596; p = p$\leq$0.01), and pragmatism (β = -.089, t = -2.398; p = p$\leq$0.05) significantly predict an influence on the safety consciousness attitudinal dimension of the current study sample. This result suggests the following negative influences on safety consciousness: (1) neuroticism, (2) high-self monitors, and (3) extreme pragmatic thinking style whereas an (4) outgoing people-orientated interpersonal style is likely to increase a person's level of safety consciousness.

Only one personality characteristic, locus of control, was found to significantly (β = -.141, t = -2.955; p = $p \leq 0.01$) influence participants' attitude towards safe driving practices and traffic rule adherence. This result is consistent with the findings reported by a number of previous studies (e.g. Jones & Wuebker, 1985, 1993; Klein & Helweg-Larsen, 2002; Lawton & Parker, 1998; Wuebker, 1986) in that locus of control is likely to influence an individual's attitude towards vehicle accidents according to the extent to which the person believes he/she has control over external events in avoiding the likelihood of being involved in a vehicle accident or not following traffic rules.

In predicting (regression analysis) which personality dimensions, amongst the other variables used in this study, showed a much stronger variance in influencing participants' attitude towards quality, conscientiousness (β = -.394, t = -7.496; p = $p \leq 0.01$), flexibility (β = .195, t = 3.703; p = ≤ 0.01), and Type A personality (β = .142, t = 2.721; p = $p \leq 0.01$) were found. By not discarding the significant associations found through the correlation analysis, the results of the regression analysis suggest that a conscientious (strongest predictor) employee who is self-disciplined in the planning, organising and carrying out of tasks as well as having a focused, determined and dependable orientation towards work is likely to influence his/her attitude towards the quality of work being performed and avoid errors positively. A less conscientious employee who has a particularly tense, competitive and hard-driving approach to work may influence his/her attitude towards work place safety negatively resulting in unproductive work behaviour such as less attention to detail, and non-adherence to safety rules and procedures.

The following personality dimensions were found to correlate statistically ($p \leq 0.05$) significant negatively (moderate effect) (neuroticism, -0.44; external locus of control, -0.40; and Type A personality, -0.36), and positively (moderate effect) (conscientiousness, 0.31; trusting, 0.31; and phlegmatic, 0.41) with safety consciousness. Correlations of a statistically significant ($p \leq 0.05$) negative relationship between safety control and neuroticism (-0.37) and external locus of control (-0.38) were found. Conscientiousness (0.32) and phlegmatism (0.33) were significantly ($p \leq 0.05$) positively associated with safety control. Statistically significant ($p \leq 0.05$) correlations were found in this study between various personality dimensions and risk avoidance, but the effect ($r = \leq 0.30$) was weak, suggesting a limited influence on an individual's tendency to engage in high-risk, thrill-seeking or dangerous activities (Forcier et al., 2001).

On the scale that measures an individual's ability to cope, work related stress and pressure (stress tolerance) correlate ($p \leq 0.05$) negatively with neuroticism (-0.53, large effect), external locus of control (-0.37, moderate effect), and Type A personality (-0.37, moderate effect). Personality dimensions that support effective (positive relationship) coping strategies of the current sample are trusting (0.31, moderate effect) and emotional stability (0.49, moderate effect). The correlations found in this study compare favourably with those in previous studies (e.g. Celsi et al., 1993; Clarke & Robertson, 2008; Frone, 1998; Hansen, 1991; Jones, 1984; Lawton & Parker, 1998) indicating that emotional stability or instability, external locus of control, and Type A personality characteristics are consistently found to be related to work place incidents and vehicle accidents.

Personality characteristics that showed a significant ($p \leq 0.05$ and $r = \geq .30$) negative correlation with participants' driver attitude are persuasiveness (-0.30) (moderate effect), external locus of control (-0.45) (moderate effect), and Type A personality (-0.30) (moderate effect), whereas trusting (0.36) (moderate effect) and emotional stability (0.34) (moderate effect) are significantly ($p \leq 0.05$) associated with a positive driver attitude. Statistically significant ($p \leq 0.05$) correlations were also found in this study between various personality dimensions and driver attitude, but the effect ($r = \leq 0.30$) was weak, suggesting a limited influence on an individual's attitude towards safe driving practices and adherence to traffic rules.

A number of personality characteristics were found to correlate significantly ($p \leq 0.05$) with participants' quality awareness/orientation, namely neuroticism (0.30) (moderate effect), conscientiousness (-0.44) (moderate effect), openness (-0.30) (moderate effect), agreeableness (-0.35) (moderate effect), and flexibility (0.30) (moderate effect). A number of other personality dimensions correlate significantly ($p \leq 0.05$) with quality orientation, but the effect of the association is weak. Apart from neuroticism, the influence or effect of the Five Factor personality dimensions (conscientiousness, openness, and agreeableness) on quality orientation were more pertinent. This finding supports similar results reported, for example by Christian et al. (2009), Clark and Robertson (2008), and Henning et al. (2009) for the applicability of the Five Factors of personality in safety behaviour research. In addition, this result suggests that an individual who struggles to cope with work pressure is likely to be less attentive to detail and to show a stronger intention to disregard set procedures and rules which could influence his/her attitude towards the overall quality of work being performed. However, a more conscientious individual who engages in new and unconventional ideas and who shows an eagerness to help others could enhance a positive attitude towards the overall quality of work being performed and adherence to safe work practices.

The correlations found in this study compare favourably with those found in previous studies (e.g. Celsi et al., 1993; Christian et al., 2009; Clarke & Robertson, 2005, 2008; Frone, 1998; Hansen, 1991; Jones, 1984; Judge & LePine, 2007; Lawton & Parker, 1998) that from a pathogenic perspective an individual who experiences negative effects, such as fear, sadness, embarrassment, anger, and nervousness may be prone to irrational ideas/thoughts, less able to control his/her negative emotions, and may cope poorly with stress. These negative effects combined with an external locus of control, being impatient, controlling, highly competitive and ambitious are likely to be the ideal recipe to influence participants' cognitive, affective, and behavioural component of their attitude towards work place safety in a public electricity company in South Africa negatively as it relates to the current sample of this study. The following section evaluates the significance of the relationship between burnout, work engagement, and sense of coherence and the prediction thereof on attitude towards work place safety.

9.6.3 Conclusions based on the significance of the relationship between burnout, work engagement, and sense of coherence and attitude towards work place safety

Firstly, the relationship between burnout and the criterion variables, safety consciousness (safety control, risk avoidance, and stress tolerance), driver attitude and quality orientation is evaluated. Secondly, the relationship between the criterion variables and work engagement are evaluated, and lastly between the criterion variable and sense of coherence.

9.6.3.1 Evaluation of the correlation and regression values between burnout and safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude, and quality orientation.

From the multiple regression analysis, emotional exhaustion was found to be one of the variables to significantly (β = -.120, t = -3.089; p = $\leq$0.01) predict a negative influence on participants' safety consciousness. From the correlation analysis, burnout showed to have a statistically significant (p$\leq$0.01) negative association with safety consciousness (-0.47) (moderate effect), safety control (-0.33) (moderate effect), risk avoidance (-0.36) (moderate effect), and stress tolerance (-0.54) (large effect). Furthermore, the sub-scales of burnout also correlate significantly (p$\leq$0.01) with safety consciousness (exhaustion, -0.34; cynicism -0.46), safety control (exhaustion, -0.18; cynicism, -0.38), risk avoidance (exhaustion, -0.24; cynicism, -0.36), and stress tolerance (exhaustion, -0.45; cynicism, -0.43). The effect of the relationships is also of theoretical significance (moderate to large) with the weakest between exhaustion and safety control, and exhaustion and risk avoidance.

Exhaustion was found to significantly (β = .092, t = 2.078; p = $\leq$0.05) predict a positive influence on participants' driver attitude. Although the prediction is less than 10%, the positive influence suggests that a depletion of emotional energy, which is a clear signal of distress in emotionally demanding work situations (Maslach et al., 1996), increases participant's attitudes towards safe driving practices. The path relationship (if any) between burnout and driver attitude is discussed in section 9.4.5.

In relation to driver attitude, a statistically significant ($p \leq 0.01$) negative correlation was found with burnout (-0.25) (weak effect) and cynicism (-0.34) (moderate effect). The relationship between exhaustion and driver attitude was not statistically significant.

Lastly, cynicism was found amongst other predictor variables to significantly (β = .128, t = 2.361; p = $\leq$0.05) influence participants' levels of quality awareness positively. A statistically significant ($p \leq 0.01$) positive association exists between quality orientation and burnout (0.30) and cynicism (0.31) (moderate effect). The relationship between quality and exhaustion is statistically significant ($p \leq 0.01$), but the effect is weak. As mentioned previously, high scores on quality are indicative of a lower level of quality awareness. Therefore, higher levels of burnout and a distant attitude (cynicism) towards work (e.g. Maslach et al., 1996) are likely to have a negative influence on participant's attitude towards the overall quality of the work being performed.

It is evident, based on the above, that burnout and the two sub-scales (emotional exhaustion and cynicism) have a moderate to large effect on participants' attitude towards work place safety, namely safety consciousness and stress tolerance. Noticeably, burnout and the cynicism scale have showed a stronger association with safety control, risk avoidance, driver attitude, and quality orientation compared to the weaker association with emotional exhaustion. Furthermore, it was expected that a strong and significant negative association would exist between stress tolerance and burnout and the two sub-scales emotional exhaustion and cynicism. Stress tolerance refers to a person's experience with stress and ability to cope with stress (e.g. Fogarty & Shardlow, no date; Forcier et al., 2001). On the other hand, burnout refers to the depletion of emotional energy and feelings of distress because of emotionally demanding work causing an attempt by employees to distances themselves from their work as a way of coping with exhausting demands (Maslach et al., 1996). Therefore, the levels of stress tolerance of the participants in this study may become depleted by high levels of burnout, because of an increase in job demands, role overload, higher levels of stress and distant attitude towards work, resulting in dysfunctional behaviour such as taking shortcuts in order to get work completed (e.g. Hoffman &

Stetzer, 1996; Lawton & Parker, 1998), increased fatigue, increased vulnerability to distraction on the job (Forgarty & Shardlow, no date), and an increase in mistakes and errors (Forcier et al., 2001).

It appears from this study, that based on the above evaluation of the significant relationship and regression values, the construct burnout (including exhaustion and cynicism) could be evaluated in a model of psychological factors influencing employees' attitudes towards work place safety in a public electricity company in South Africa.

The relationship between work engagement and the criterion variables safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation are discussed next.

9.6.3.2 Evaluation of the correlation and regression values between work engagement and safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude, and quality orientation

Vigour predicted a significant positive variance (less than 10%) on safety consciousness ($\beta = .083$, $t = 2.122$; $p = \leq 0.05$). The results of the relationship between work engagement and the safety attitudinal variables are less promising compared to the association between burnout and the safety attitudinal variables. The relationship between work engagement and safety consciousness (0.21) is statistically significant at the $p = \leq 0.01$ level, but the effect is weak. Similarly, a statistically significant ($p = \leq 0.01$) association, but also a weak effect, is observed between safety consciousness and vigour (0.19) and dedication (0.20). It is also evident that the effect of the relationship, although statistically significant, between work engagement (including the sub-scales vigour and dedication) and safety control, risk avoidance, and stress tolerance are on the weaker side ($r = \leq 0.30$).

No statistically significant relationship exists between work engagement and its subscales with driver attitude. Quality orientation and work engagement (including the sub-scales vigour and dedication) are significantly ($p = \leq 0.01$) negatively related, but the strength of the relationship is weak ($r = \leq 0.30$). Furthermore, work engagement (including the sub-scales vigour and dedication) did not have any effect on predicting a certain amount of variance on participants' attitude towards the quality of work being performed or the quality of their personal work habits.

The evaluation of the influence of work engagement on the safety attitudinal variables is rather disappointing and a more favourable relationship was expected if it was considered that work engagement refers to a positive, fulfilling, work related state of mind, characterised by high levels of energy (vigour) and strong involvement in one's work (dedication) (e.g. Schaufeli & Bakker, 2004; Schaufeli et al., 2002).

The relationship between sense of coherence and the criterion variables safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation are evaluated next.

9.6.3.3 Evaluation of the correlation and regression values between sense of coherence and safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude, and quality orientation

Surprisingly, according to the regression analysis, sense of coherence was found amongst other psychological factors to predict a small variance ($\beta = .101$, $t = 2.019$; $p = \leq 0.05$) on participants' levels of quality orientation, suggesting that participants' weaker sense of coherence is likely to influence their attitude toward the quality of work being performed negatively. No statistically significant relationship exists between sense of coherence and safety consciousness including safety control, risk avoidance, driver attitude and quality orientation. However, sense of coherence correlated significantly ($p = \leq 0.01$) positively with stress tolerance (0.17), although the strength of the association was rather weak ($r = \leq 0.30$).

Although the relationship between sense of coherence and stress tolerance in this study is weak, the significance thereof still supports the argument by Antonvsky (1987) that a person with a strong sense of coherence selects the most effective coping strategy (stress tolerance) that seems most appropriate to deal with the stressor being confronted.

The next section evaluates the relationship between the safety attitudinal variables and the prediction thereof on safety consciousness, driver attitude, and quality orientation (attitude towards work place safety).

9.6.4 Conclusions based on the significance of the relationship between the safety attitudinal variables on safety consciousness, driver attitude, and quality orientation (attitude towards work place safety)

This study supports the findings of Fogarty and Shardlow (no date), and Forcier et al. (2001), that the safety consciousness model or construct is made up of three key attitudinal measures, namely safety locus of control, risk avoidance and stress tolerance. In evaluating the prediction of the safety attitudinal factors on safety consciousness, participants' driver attitude (β = .432, t = 10.422; p = $\leq$0.01) and their orientation towards the quality of work being performed (β = -.366, t = -9.534; p = $\leq$0.01) explains a significant amount of variance (56%) on the overall safety consciousness of the individual. Similarly, safety consciousness (β = .566, t = 9.897; p = $\leq$0.01) and participants' attitude towards personal work habits and compliance with the organisation's safety procedures (quality orientation) (β = .137, t = 2.646; p = $\leq$0.01) predicted a significant amount of variance (49%) on participants' attitude towards safety driving behaviour. Lastly, participants' attitude towards safe driving habits (driver attitude) also predicted a significant (β = -.120, t = -2.103; p = $\leq$0.05) amount of variance (6%) on participants' attitude towards the quality of work being performed.

With regard to the correlation analysis in this study, safety control (0.87), risk avoidance (0.89) and stress tolerance (0.74) correlate significantly (p = $\leq$ 0.01) positively with safety consciousness (large effect) and are in line with the correlations reported by Fogarty and Shardlow (no date), and Forcier et al. (2001). In addition, all three attitudinal measures are intercorrelated and each measure contributes significantly to the overall safety consciousness of the participants in this study.

The secondary measurements, driver attitude (0.60) and quality orientation (-0.59) also correlate significantly (p = $\leq$ 0.01) positively with safety consciousness (large effect) and are in line with the correlations reported by Fogarty and Shardlow (no date). According to Fogarty and Shardlow (no date), the three key attitudinal measures of safety consciousness are related to aspects of an individual's attitude towards safe driving behaviours, such as locus of control, stress and sensation seeking. In this study, safety control (0.60), risk avoidance (0.51), and stress tolerance (0.40) correlate significantly ($p = \leq 0.01$) positively with driver attitude (moderate effect). Similarly, safety control (-0.60), risk avoidance (-0.52), stress tolerance (-0.36), and driver attitude (-0.27) correlate significantly with participants' attitude towards personal work and driver habits as well as with the level of commitment of the individual to detect and avoid errors at work.

In support of previous research (e.g. Fogarty & Shardlow, no date; Forcier et al., 2001; Lawton & Parker, 1998; Jones & Wuebker, 1985; Verschuur & Hurts, 2008), the key measures of safety consciousness, namely safety control, risk avoidance and stress tolerance are significant attitudinal variables that cannot be excluded as a measurement of employees' attitudes towards work place safety (including driver attitude and quality orientation) in a public electricity company in South Africa.

Therefore, based on the evaluation of the relationship between the independent and dependent variables it can be concluded that hypotheses 1 is supported, in that:

"Statistically significant correlations exist between the predictor variables intelligence, personality, burnout, work engagement and sense of coherence, and the criterion variables, safety consciousness, safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation in a public electricity company in South Africa."

The next section focuses on the core aspect of this study to evaluate the significance of the path coefficients as presented by the theoretical model (inner model).

9.6.5 Conclusions based on the fit statistics of the measurement model (outer model) and significance of the path relationships between the study variables as presented by the theoretical model (inner model)

This section relates to hypothesis 2 in evaluating whether statistically significant paths exist to confirm that attitude towards work place safety can be influenced by intelligence, personality traits, work wellness (burnout, work engagement, and sense of coherence) in a public electricity company in South Africa.

Firstly, a brief discussion follows on the fit statistics of the measurement model (outer model), and secondly, there is an explanation on the significance of the path relationships between the different variables as outlined in Figure 8.1.

9.6.5.1 Conclusions based on the reliability and validity of the measurement model (outer model)

Based on the overall results of the goodness of fit statistics for the measurement model of this study (as presented in Table 8.27), it can be concluded that the average variance explained (AVE), composite reliability, R square, and Cronbach's alpha of all the latent variables (intelligence, personality, burnout, work engagement, sense of coherence, driver attitude, quality orientation, and safety consciousness) included in the theoretical model are valid and reliable as proposed by Henseler et al. (2009).

In addition, the final measurement model (outer model) that was used in the analysis of the inner model involved 17 manifest variables loading on to the eight latent constructs. The reliability (composite reliability) of these constructs ranged from 0.80 to 0.92 and the amount of variance explained (AVE) ranged from 56% to 81%. Therefore, it can be concluded that the measurement model appeared to be quite satisfactory and provided good estimates of the constructs, which were in line with the hypothesised relationships.

The evaluation of the theoretical model of relationships between latent variables as presented in Figure 8.1 is presented next.

9.6.5.2 Conclusions based on the significance of the path relationships between the latent variables as presented by the theoretical model (inner model)

The path relationships between the latent variables as evaluated by utilising Partial Least Squares (PLS) regression are discussed as follows: (1) intelligence and safety consciousness, driver attitude and quality orientation: (2) personality and burnout: (3) personality and work engagement: (4) personality and sense of coherence: (5) sense of coherence and burnout and work engagement: (6) personality and safety consciousness, driver attitude and quality orientation: (7) burnout and safety consciousness, driver attitude and quality orientation: (8) work engagement and safety consciousness, driver attitude and quality orientation: (9) sense of coherence and safety consciousness, driver attitude and quality orientation: (10) burnout and work engagement: (11) safety consciousness and driver attitude and quality orientation.

9.6.5.2.1 Conclusions based on the path relationship between intelligence and safety consciousness, driver attitude and quality orientation

The path relationship between intelligence and driver attitude is significant ($t = 4.59$, $p = \leq 0.01$). Interestingly, there is no significant path relationship between intelligence and safety consciousness and quality orientation, although the t-value of the relationship between intelligence and safety consciousness ($t = 1.45$) is slightly below the cut-off value set at 1.95. This finding is supportive of the results obtained through the multiple regression and correlation analysis according to which verbal reasoning significantly predicts a positive influence on participants' attitude towards positive driver behaviours, and verbal, numerical, and abstract reasoning correlated significantly with driver attitude. It is important to note that regardless of the strength of the effect, a statistically significant correlation was found to exist between intelligence and safety consciousness.

The significant path relationship between intelligence and driver attitude obtained in this study supports the findings of previous research (e.g. Arthur et al., 1991; Buffardi et al., 2000; Carty et al., 1999; Gottfredson, 1997, 2007; Lawton & Parker, 1998; O'Toole, 1990; Schmidt & Hunter, 2004; Smith & Kirkham, 1982) that intelligence is the best predictor of motor vehicle accidents and violation of traffic rules.

Carty et al. (1998) argue that participants in their study who performed better perceptually and who recorded higher spatial awareness tended to report fewer work related driving accidents. Furthermore, Gottfredson (2007) argues that accident prevention is a highly cognitive process in spotting and managing hazards in dealing with the unexpected.

9.6.5.2.2 Conclusions based on the path relationship between personality and burnout

From a positive psychology perspective, a significant ($t = 2.96$, $p = \leq 0.01$) negative path relationship is observed between personality and burnout in this study. This relationship suggests that participants who have an outgoing interpersonal style (OPP gregarious), know how to manage their emotions (OPP phlegmatic) and generally believe in the trustworthiness of others (OPP trusting) are likely to minimise the effect of burnout. This result supports the findings of Bakker et al. (2006) that amongst other personality traits, extraversion and emotional stability may help to protect individuals from the known risk of developing burnout in volunteer human services.

However, the positive effect of personality traits such as neuroticism, Type A personality and external locus of control on experiences of burnout should not be ignored as significant relationships ($p = \leq 0.05$) were found in this study between personality and burnout (e.g. Storm & Rothmann, 2003; Schaufeli & Enzmann, 1998).

9.6.5.2.3 Conclusions based on the path relationship between personality and work engagement

Interestingly, no statistically significant path relationship exists between personality and work engagement ($t = 0.58$) in this study. However, statistically significant ($p = \leq 0.05$, $r = \leq 0.30$) correlations were found between work engagement and a number of personality dimensions of the Five Factor Model (extraversion, conscientiousness, openness, and agreeableness) and Occupation Personality Profile (flexibility, persuasiveness, and assertiveness). The findings of this study are in line with the argument made by Wildermuth (2008) in that current research on the relationship between personality and work engagement are indicative of a low to moderate effect.

It could be that work engagement is more strongly influenced by situational factors (e.g. job resources, supervisory support, etc.) or a combination of psychological strengths, such as sense of coherence, hardiness, learned resourcefulness, potency, internal locus of control, self-efficacy, hope, optimism and resiliency (e.g. Antonovsky, 1979; Strümpfer, 1990, 1995, 2001b).

9.6.5.2.4 Conclusions based on the path relationship between personality and sense of coherence

According to the theoretical model as presented in Figure 8.1, a statistically significant positive path relationship ($t = 3.04$, $p = \leq 0.01$) exists between personality and sense of coherence. Thus, the personality dimensions extraversion (OPP gregarious), emotional stability (OPP phlegmatic), and trusting (OPP trust) contribute significantly in enhancing participants' sense of coherence to employ effective cognitive, affective, and instrumental strategies to improve coping and overall well-being (Erikson & Lindström, 2005). In addition, neuroticism, conscientiousness and OPP pragmatic were found to correlate significantly ($p = \leq 0.05$, $r = \leq 0.30$) with sense of coherence (Feldt et al., 2007).

9.6.5.2.5 Conclusions based on the path relationship between sense of coherence with burnout and work engagement

Consistent with previous research (e.g. Albertsen, 2001; Basson & Rothmann, 2001; Rothmann, et al., 2005; Söderfeldt et al., 2000; Feldt et al, 1997), a statistically significant ($p = \leq 0.01$) negative relationship exists between sense of coherence and burnout ($t = 3.87$). In addition, a statistically significant ($p = \leq 0.05$) positive path relationship is observed between sense of coherence and work engagement ($t = 2.31$) which are in line with the findings reported by Bakker et al. (2008), Redelinghuys and Rothmann (2004), and Strümpfer and Wissing (1998). However, an inconsistent result of this study, compared with previous research, (e.g. Albertsen, 2001; Bakker et al., 2008; Basson & Rothmann, 2001; Redelinghuys & Rothmann, 2004; Rothmann et al., 2005; Söderfeldt et al., 2000; Feldt et al, 1997) indicates the absence of a statistically significant correlation between sense of coherence with burnout (including exhaustion and cynicism) and work engagement (including dedication), but only with the sub-scale vigour (r = ≤0.30, weak effect).

Therefore, it can be concluded that the salotogenic construct sense of coherence is indicative of minimising the effect of burnout, but also of maximising levels of work engagement relating to the study sample.

9.6.5.2.6 Conclusions based on the path relationship between personality and safety consciousness, driver attitude and quality orientation

Most of the research (e.g. Arthur et al., 1991; Beirness & Simpson, 1988; Carty et al., 1998; Clarke & Robertson, 2005; Hansen, 1989; Henning et al, 2009; Jones & Wuebker, 1985; Lawton & Parker, 1998; Venter et al., 2004) on work place incident/accidents or driver accident causation has focused on a combination of personality factors, namely neuroticism, conscientiousness, extraversion, sensation seeking, agreeableness, locus of control, and Type A personality as significant predictors. The path coefficient between personality dimensions, extraversion (OPP gregarious), emotional stability (OPP phlegmatic), and trustworthiness (OPP trusting) with safety consciousness obtained in this study is statistically significant (t = 2.32; p = ≤0.01). This path relationship suggests that participants with an outgoing interpersonal style, ability to manage their emotions and belief in the trustworthiness of others are likely to have a positive effect on their attitude towards work place safety (safety consciousness).

In addition, high levels of neuroticism, a persuasive manipulative interpersonal style (OPP persuasive), and high pragmatic problem solving style were found to predict a negative influence on participant's attitude towards work place safety (safety consciousness), but conversely an extraverted (OPP gregarious) interpersonal style is likely to maximise the individual's safety consciousness. In addition, a number of personality dimensions correlate significantly (p = ≤0.05, 0.30≤ r ≤0.30) with safety consciousness and the three key measures of safety consciousness, namely safety control, risk avoidance, and stress tolerance. Therefore, it can be concluded that the construct safety consciousness used in the development of the theoretical model consists of personality and attitudinal variables that could be associated with a higher risk of accident involvement (Forcier et al., 2001).

As indicated above, ample studies have reported significant correlations between personality and driver attitude. However, in evaluating the path relationship between personality and driver attitude no statistically significant ($t = 1.67$, cut-off value of significance $t = 1.95$) relationship was found. Nevertheless, external locus of control was found to predict a significant amount of variance influencing participants' attitude towards safe driving behaviour negatively. Although only external locus of control was found to be a significant predictor of driver attitude, a number of personality dimensions correlated significantly such as extraversion (-.14), neuroticism (-.24), persuasiveness (-.26), gregarious (.13), trusting (.36), phlegmatic (.34), contesting (-.28) with participants' driver attitude.

Although no path relationship was anticipated between personality and quality orientation, the results of the regression analysis indicated that conscientiousness, OPP flexible, and Type A personality predict a significant amount of variance on participants' attitude towards the quality of work being performed, following safety procedures, and avoiding errors. In addition, a number of personality dimensions correlated significantly ($p = \leq 0.05$, $0.30 \leq r \leq 0.30$) with participants' quality awareness.

Based on the above, it can be concluded that a combination of personality factors contribute significantly in either weakening or strengthening participants' attitude towards work place safety in a public electricity company in South Africa.

9.6.5.2.7 Conclusions based on the path relationship between burnout and safety consciousness, driver attitude and quality orientation

It is expected that a statistically significant path relationship ($t \geq 1.95$) should exist between burnout and safety consciousness, driver attitude, and quality orientation because burnout refers to the inability to cope effectively with job demands or specific work related stressors causing feelings of emotional exhaustion and resulting in a negative attitude towards work or the task being performed (Maslach et al., 1996). Surprisingly, no statistically significant path relationship (cut-off value t = 1.95) was found between burnout with safety consciousness (t = 1.63), driver attitude (t = 1.09), and quality orientation (t = 1.38) in the current study sample. Nevertheless, emotional exhaustion (sub-scale of burnout) predicted a significant amount of variance on participants' attitude towards work place safety (safety consciousness) and driver attitude. Cynicism (sub-scale of burnout), on the other hand, predicts a significant amount of variance on participants' attitude towards the quality of work being performed, following of safety procedures, and avoiding of errors. In addition, burnout and the two sub-scales exhaustion and cynicism correlate significantly ($p = \leq 0.05$, $0.30 \leq r \leq 0.30$) with participant's safety consciousness, driver attitude and quality awareness.

Therefore, it is anticipated that with the deletion of non-significant path coefficients ($t = < 1.0$) a statistically significant negative path relationship should emerge between burnout and safety consciousness.

Thus it can be concluded that based on the evaluation of the correlation and regression analysis, the negative effect of burnout (including exhaustion and cynicism) on participants' attitude towards work place safety including their driver attitude and quality orientation should not be ignored, because no statistically significant path relationship emerged between burnout and the three safety attitudinal constructs as hypothesised.

9.6.5.2.8 Conclusions based on the path relationship between work engagement and safety consciousness, driver attitude and quality orientation

From a positive psychology perspective, no statistically significant (cut-off t value 1.95) path relationship exists between work engagement and safety consciousness (t = 0.94), driver attitude (t = 0.26), and quality orientation (t = 0.86). Through regression analysis, only vigour (sub-scale of work engagement) was found to explain a significant ($p = \leq 0.05$) amount of variance in influencing participants' safety consciousness positively. In addition, the correlation between work engagement (including the two sub-scales vigour and dedication) and safety consciousness (safety control, risk avoidance and stress tolerance) are statistically significant ($p = \leq 0.05$), but the effect is weak (r = ≤ 0.30). A similar result is observed between work engagement and quality orientation, but not between work engagement and driver attitude.

The result of the non-significant path relationship between work engagement and the three safety attitudinal constructs (safety consciousness, driver attitude, and quality orientation) is rather disappointing in that, according to the theory (e.g. Schaufeli & Bakker, 2004), work engagement is an energetic state in which the employee is dedicated to excellent performance at work and is confident of his/her abilities to deal effectively with job demands. Furthermore, Wagner and Harter (2006) suggest that in organisations where employees feel a strong emotional bond (e.g. work engagement) to the organisation positive job attitudes and work behaviours are demonstrated such as reduced absenteeism, fewer accidents, and a willingness to invest energy and at the same time enjoy working hard and dealing with the tasks at hand. Therefore, based on this argument it was hypothesised that significant paths should exist between work engagement and participants' attitude towards work place safety such that higher work engagement will predict a positive effect on safety consciousness, safe driving behaviours, and the quality of work being performed.

In a recent study conducted by Hansez and Chmiel (2010), the researchers found statistically significant (p = ≤0.01) correlations between job engagement and job quality (0.37) (moderate effect), and situational violations (0.24) and routine violations (-0.19) (small effect). In addition, job engagement significantly explained lower situational violations (β = .25) and routine violations (β = -.18), and their model indicated significant path coefficients between work engagement and routine and situational violations behaviours. Two important aspects could have caused these significant findings compared to the findings obtained in this study, namely the sample size (N = 3506) and a different measurement of job engagement (Positive and Negative Occupational States Inventory by Barbier, Peters & Hansez, 2009) was used.

Therefore it can be concluded that the concept work engagement or the measurement of work engagement as it bears on employees' attitudes towards work place safety in a public electricity company in South Africa requires further investigation.

9.6.5.2.9 Conclusions based on the path relationship between sense of coherence and safety consciousness, driver attitude and quality orientation

The path from sense of coherence to safety consciousness ($t = 1.13$) and driver attitude ($t = 1.20$) is non-significant. As anticipated, the path relationship between sense of coherence and quality orientation is significant ($t = 3.38$, $p = \leq 0.01$). In addition, sense of coherence significantly explains higher quality awareness. Furthermore, the only significant correlation is found between sense of coherence and stress tolerance (low effect, ($r = \leq 0.30$). This finding supports the reasoning by Antonovsky (1987), that a strong sense of coherence contributes strongly to positive work behaviours in applying the appropriate coping strategy to deal with the stressor (e.g. job demands) being confronted, and at the same time experience feelings of confidence and motivation that things in life and work will work out as reasonably expected resulting in a positive attitude towards the quality of work being performed.

9.6.5.2.10 Conclusions based on the path relationship between burnout and work engagement

Surprisingly, the path relationship between burnout and work engagement is non-significant ($t = 1.23$). However, burnout correlates significantly negatively with work engagement (moderate effect) which is in line with the findings of most researchers (e.g. Demerouti et al., 2001; González-Romá et al., 2006; Rothmann et al., 2005; Schaufeli & Bakker, 2004; Van der Linde & Coetzer, 2004) that burnout and work engagement are independent states that are negatively related and that vigour and dedication are the direct opposite of the burnout scales, exhaustion and cynicism.

9.6.5.2.11 Conclusions based on the path relationship between safety consciousness, driver attitude, and quality orientation.

As expected, the path relationship between driver attitude ($t = 5.00$) and quality orientation ($t = 4.24$), and with safety consciousness is statistically significant ($p = \leq 0.01$). However, the path relationship between driver attitude and quality orientation is non-significant ($t = 1.21$). In addition, strong correlations were also found between the three key measures of safety consciousness (safety control, risk avoidance, stress tolerance) and driver attitude and quality orientation. Similarly, the three attitudinal constructs (safety consciousness, driver attitude and quality orientation) also significantly explain the strong positive variance between them. This result supports the findings by Fogarty and Shardlow (no date), Forcier et al, (2001) and Reams (2007) that the three scales making up the overall safety consciousness index taps into the secondary scales, namely driver attitude (e.g. locus of control, stress and traffic violations) and quality orientation (e.g. conscientiousness, risk avoidance).

Based on the above, the safety attitudinal constructs safety consciousness (safety control, risk avoidance and stress tolerance), driver attitude and quality orientation provide strong psychometric evidence to predict the level of employees' attitudes towards work place safety in a public electricity company in South Africa of the current sample.

Based on the significant path coefficients obtained from the statistical model (Figure 8.1) in this study, it can be concluded that: (1) participants' safety consciousness is significantly influenced by their attitude towards safe driving behaviour with intelligence contributing significantly: (2) an outgoing, extraverted interpersonal style, ability to manage their emotions and a trusting personality characteristic contributes significantly towards minimising experiences of burnout, enhancing levels of sense of coherence and maximising a positive attitude towards work place safety, positive driver behaviour, and positive attitude towards the quality of work being performed, (3) a stronger sense of coherence moderates the experience of burnout and strengthens the experience of work engagement: and lastly (4) a stronger sense of coherence assists with the effective coping of job demands resulting in a more positive attitude towards the quality of work being performed, contributing significantly to individual safety consciousness. Therefore, the theoretical model suggests that intelligence influences participants' safety consciousness (attitude towards work place safety) indirectly through driver attitude. Personality influences participants' attitude towards work place safety (safety consciousness) directly and indirectly through sense of coherence and quality orientation. Thus, the variables included in the theoretical model, namely, intelligence, personality, burnout, work engagement, sense of coherence, driver attitude, and quality orientation explain 65% of the variance (R^2 = 0.6492) on participants' safety consciousness (attitude towards work place safety).

This result is similar to the result obtained through regression analysis according to which driver attitude, quality orientation, neuroticism, exhaustion, abstract reasoning, gregariousness, persuasiveness, pragmatism, and vigour explain 67% of the variance (R^2 = 0.667) on participants' safety consciousness (attitude towards work place safety).

In the expanded job demands-resources model applied to safety behaviour, Hansez and Chmiel (2010) report that this model explains 20% of the variance in situational violations and 16% of the variance in routine violations. In addition, job resources explain 35% of the variance in perceived management commitment. Furthermore, the job demands-resources model explains 52% of the variance in job strain (aspect of burnout), and 34% of the variance in work engagement.

Therefore it can be concluded that, based on the results reported above, the theoretical model suggests that a combination of variables through different paths predicts a significant amount of variance/influence on participants' attitude towards work place safety in a public electricity company in South Africa.

The results obtained for the theoretical model therefore suggest that hypothesis 2 is partially supported.

The value and contribution of the study are presented below.

9.7 THE VALUE AND CONTRIBUTION OF THE STUDY

Contributions of this research are as follows:

- A sequential model of psychological factors has been developed, which gives empirical support to the broad hypothesis that a combination of psychological factors could influence employees' attitudes towards work place safety in a public electricity company in South Africa.
- Specific individual psychological factors have been identified as valid predictors of employees' attitudes towards work place safety. These psychological factors could

be utilised for the selection and training of staff members, especially in organisations where work place safety is at risk.

- The findings should assist organisations to gain insight into the effect of psychological factors on employees' attitudes towards work place safety.
- By virtue of the proposed model, organisations could design and implement specific interventions for improving employees' overall wellness at work creating a more positive attitude change towards work place safety and the minimising of work place incidents/accidents, including vehicle accidents.
- The model could pave the way for future research regarding the prediction/influence of other variables (individual and organisational) on employees' attitudes towards work place safety.

The limitations of the current study follow next.

9.8 STUDY LIMITATIONS

Several limitations of this study need to be considered. The reliance on self-reported measures may increase the possibility of the findings being distorted by the participants' desire to respond in a consistent manner. However, recent meta-analytic research by Crampton and Wagner (1994) indicates that while this problem continues to be cited regularly, the magnitude of distortions may be overestimated. Self-reported measures have been effectively used in work place safety accidents, safety culture, motor vehicle accidents and safety analyses (e.g. Gyekye, 2005; Iverson, 2004; Neal & Griffin, 2004, 2006). Nonetheless, objective measurement of psychological factors influencing attitude towards work place safety, using a new sample, is advisable to further validate the impact of perceptions of psychological factors on employees' attitudes towards work place safety in a public electricity company in South Africa.

Therefore, the results of the present study need to be considered as preliminary, and should not be generalised. In addition, the fact that no exploratory and factor analysis (e.g. deleting items loading lower than 0.30) could be performed on the intelligence tests (GRT2 and SRT2) and personality questionnaires (OPP and BTI), due to the demands of confidentiality and the intellectual property rights agreement, could have contributed to their weak alpha loadings.

Although PLS copes well with small sample sizes, and particularly provides stable estimates of path coefficients (Chin & Newsted, 1999), the current sample size (N = 279) in relation to the number of variables (32) investigated could have contributed to the non-significant path relationships. In addition, the study sample consisted only of employees who had been involved in work place incidents/accidents, predominantly vehicle incidents or accidents. Despite the strengths of the path coefficients of the sequential model of psychological factors influencing attitude towards work place safety, the fitted model is still incomplete in the sense that important (e.g. burnout, work engagement) variables are not significantly related to the other variables in the model. Nonetheless, the overall fit of the model is adequate, as indicated by the fit indices. In other words, the fitted model gives an accurate description of the "real" relationships holding among the model variables influencing employees' attitudes towards work place safety in a public electricity company in South Africa.

In the following section, recommendations are proposed regarding the literature study, research methodology, and results of the study, and suggestions for interventions are proposed.

9.9 RECOMMENDATIONS AND FUTURE DIRECTIONS

Based on the outcome of this study, the following recommendations are proposed.

9.9.1 Recommendations regarding the literature study

As indicated in section 9.2, a person's attitude and beliefs in regard to work place safety have been linked in most studies as a trigger for the occurrence of work place incidents/accidents, including vehicle accidents. In addition, mostly situational or organisational factors influencing employees' attitudes towards work place safety have been reported (e.g. Langford et al., 2000; Tam et al., 2001; Tomás et al., 1999) such as organisational policy, supervision and equipment management, industry norms, risk taking, communication, stress, and management behaviour. These factors, according to researchers such as Cox and Cox (1991), Lee (1994) and Williamson et al. (1997), are a reflection of the collective perceptions and attitudes of individuals towards the organisation as an indication of the organisation's safety climate or safety culture. In addition, limited research was found internationally, but more specifically in South Africa, on the influence of psychological factors on employees' attitudes towards work place safety.

Therefore, based on the assumption that a more positive attitude may lead to greater motivation to behave safely (e.g. Christian et al., 2009) and given research suggesting that attitudes are a distal and imperfect predictor of behaviour (e.g. Fazio & Williams, 1986), then it is most critical to conduct further research on the influence of individual psychological factors on a person's attitude towards work place safety and not only on the influence of situational or organisational factors.

Thus, based on the above, more research is encouraged, especially within a South African context, to investigate the influence of both individual psychological factors and situational/organisational factors on employees' attitudes towards work place safety.

9.9.2 Recommendations regarding the research methodology

Recommendations regarding the selection of the study sample, the measurement instruments and statistical techniques used in this study based on the conclusions reported in section 9.3 are presented next.

9.9.2.1 Recommendations regarding the selection of the study sample

Based on the conclusions reported in section 9.3.1, it is recommended that future studies investigating the influence of psychological factors on employees' attitudes towards work place safety include respondents who have been involved in incidents/accidents other than vehicle incidents/accidents. In addition, a study population consisting of individuals of both groups (involved and not involved in work place incidents/accidents, including vehicle accidents) should be selected. This could prevent a skewed representation regarding gender and race as experienced in this study.

9.9.2.2 Recommendations regarding the measuring instruments used in this study

Based on the conclusions presented in section 9.3.2, it is recommended that more research is needed to strengthen the internal consistency reliability of the spatial reasoning test (SRT2) to measure its influence on employees' attitudes towards work place safety in a public electricity company in South Africa. In addition, other aspects of intelligence such as emotional intelligence should be included in the study on psychological factors influencing employees' attitudes towards work place safety. Compas, Connor-Smith, Saltzman, Thomsen and Wadsworth (2001) and Goleman (1995), for instance report that deficiencies in managing one's emotions appropriately could be related to involvement in risk-taking behaviours.

Both of the personality measurement instruments (BTI and OPP) used in this study have been extensively researched across the diversity of cultures in South African. However, this study showed that some items measuring dimensions with a low reliability coefficient (lower than 0.70) still need further refinement, for example the construction of the items and meaning of certain concepts. Perhaps the South African Personality Inventory Project (SAPI) (Meiring, 2006, cited in Laher, 2008, p. 79) which aims to develop a single, unified personality inventory for South Africa that incorporates personality factors found across the diverse cultures could in future be included in a study of this nature. In addition it is also recommended that specific safety ability and personality measurement instruments, such as the Hogan's SafeSystem (Hogan Assessments, 2010) and/or Psytech's Health and Safety Indicator (Psytech International, 2009) be used in this kind of study to measure participants' cognitive and personality characteristics. Psytech's Health and Safety Indicator measures specific area's of cognitive ability (e.g. understanding of instructions and safety-related information, checking and attention to detail) and personality (e.g. safety motivation, safety diligence) that are very important aspects of organisational safety.

The burnout construct seems to be relevant in measuring negative experiences of job stress/demands, but the measurement of work/job engagement should be reviewed. In this study, only the primary scales of burnout (exhaustion and cynicism) and work engagement (vigour and dedication) were included in the analysis. Rothmann (2008) and Schaufeli and Bakker (2004) included professional efficacy (the positive scale of burnout) with the three scales of work engagement, namely vigour, dedication and absorption in measuring work-related wellbeing. Therefore, future studies on the influence of work-related wellbeing on employees' attitudes towards work place safety should include all dimensions/scales of the burnout (exhaustion and cynicism) and work engagement (vigour, dedication, absorption, and professional efficacy) scales. In addition, other measurement instruments of job/work engagement could be considered, for example the Positive and Negative Occupational States Inventory as well as the Job Demands-Resources (JD-R) model (Demerouti et al., 2001) used by Hansez and Chmiel (2010).

The CARMS measurement instrument measuring employees' attitudes towards work place safety provided sound psychometric properties. However, much more research is needed regarding the factor structure (e.g. the driver attitude scale), item or wording semantics (e.g. construction of the items, meaning of certain concepts) as well as a bigger sample from different work environments including across different gender, cultural and language groups in South Africa.

9.9.2.3 Recommendations regarding the statistical techniques used in this study

Based on the conclusions mentioned in section 9.3.3 it is recommended that when a combination of predictor variables is being investigated to determine their influence on employees' attitudes towards work place safety, structural equation modelling (SEM) techniques/approaches should be used. The SEM partial least squares (PLS) path modelling approach is especially recommended when the study aims to explore/evaluate and predict the significance of the path relationships between the different variables in a smaller sample. The PLS can be regarded (as shown in this study) as a powerful method of analysis because it makes minimal demands on measurement scales, sample size, and residual distributions (Chin, 1997). In addition, for social and behavioural scientists a real strength is that PLS approaches cope well with mixed levels of measurement in the same data set (Abdi, 2003, cited in Campbell & Ntobedzi, 2007, p. 40).

9.9.3 Recommendations regarding the statistical results obtained in this study

In this section, recommendations are presented based on the conclusions reported regarding the statistical results obtained in this study.

9.9.3.1 Recommendations regarding the differences in psychological factors among various groups based on the biographical and safety performance data of participants

It is not clear from this study whether participants who drive on average more than 2000 business kilometres per month are more at risk of experiencing a negative or positive attitude towards safe driving practices or increased likelihood of being involved in a vehicle incident/accident compared to those that drive on average less than 2000 business kilometres per month. However, significant differences between their spatial and numerical reasoning ability were obtained in this study. For example, Garty et al. (1999) argue that respondents who performed better perceptually and recorded higher spatial awareness reported fewer work related driving accidents. Perhaps what is important to take cognisance of is that this result suggests that these two underlying intellectual abilities should be included in any form of driver attitude or driver behaviour evaluation, irrespective of the number of business kilometres travelled per month.

Furthermore, studies have shown that violations of traffic rules (especially speeding) are related to a negative attitude towards driving behaviour which increases the likelihood of being involved in a motor vehicle accident (e.g. Trimpop et al., 2000). In this study, the following latent behaviours or abilities (cognitive interpretation of the situation, experiencing a negative attitude towards work, with an external locus of control, ineffective emotional coping strategies, a tough-minded hard-driving working nature, and lower driver attitude) could influence participant's driver attitude negatively resulting in the violation of traffic rules. Thus, the organisation under study could use traffic violation records (traffic violations committed whilst driving company-owned vehicles) to engage with individuals regarding the possible causes (e.g. high stress, work demands, etc.) as a proactive step in minimising vehicle incidents/accidents.

Although a statistically significant difference in mean scores between at-fault and not at-fault on the psychological factors cynicism and OPP gregarious exists, no inferences can be made that these two factors contributed to vehicle accidents because no indication was given regarding when the vehicle accident occurred (e.g. timeframe of being involved in a vehicle accident and participating in this study). Porter (1988) points out that one needs to be careful of interpreting single statistical approaches in studying human characteristics that may have caused accidents, and that one should rather focus more on a combination of factors and circumstances.

Based on the above, it is recommended that measures of intelligence, personality, burnout, work engagement, sense of coherence and specific work place safety attitudinal constructs (e.g. safety control, risk avoidance, stress tolerance, driver attitude, and quality orientation) should be used to measure employees' overall safety awareness or consciousness in a public electricity company in South Africa.

9.9.3.2 Recommendations regarding the relationship between the independent variables (psychological factors) and dependent variable (attitude towards work place safety)

Although the relationship between sense of coherence and stress tolerance in this study is weak, the significance thereof still supports the argument by Antonvsky (1987) that a person with a strong sense of coherence selects the most effective coping strategy (stress tolerance) that seems most appropriate to deal with the stressor being confronted. Therefore, it is recommended for future research that the SOC construct could be replaced by variables such as emotional intelligence or coping strategies and their influence on employees' attitudes towards work place safety.

9.9.3.3 Recommendations regarding the path relationship between the psychological factors and attitude towards work place safety

The evaluation of the theoretical/structural model of relationships between latent variables as illustrated in Figure 8.1 suggest that hypothesis 2 (as mentioned in Chapter 1) is only partially supported and should be further explored. For example, non-significant path relationships should be deleted from the model and the path relationships re-calculated. It is further recommended that after adjustments have been made on the measurement instruments (see section 9.8.2.2), the model be tested on a bigger sample from the current organisation under study or other industries (e.g. contractors employed by the current organisation). In addition, aspects of safety culture or leadership in safety (management attitude towards safety) could be added as an additional predictors in the model, thus investigating the influence of both individual and organisational/situational factors on employees' attitudes towards work place safety. Another consideration should be to link the individual psychological factors measured in this study plus the safety attitudinal data with objective measures of safety performance outcomes.

In the next section, recommendations are made regarding interventions as they relate to the overall findings obtained in this study.

9.9.4 Recommendations regarding interventions

The psychometric properties of all the measurement instruments used in this study provide support for their use in recruitment and selection drives. Furthermore, the measurement instruments could be used in annual safety behavioural evaluations on employees who are exposed to high-risk environments (e.g. field operators, live work operators and employees who have to drive long distances regularly) in support of specific legislation requirements (e.g. occupational health and safety act) or in support of the organisation's safety management campaigns.

Harvey et al. (2002) argue that stable predispositions such as personality and attitudes are the most comprehensive and useful indicators of at-risk behaviour. Thus, based on the assumption that attitudes may be changed whereas personality factors may not be, specific behaviour modification training interventions could be designed that are directed towards the individual beliefs about safety. An example of this would be training or on-site coaching on how to cope effectively with job-related demands/stress. Furthermore, cognitive-behavioural modification programmes could include modules that focus on a person's ability to take control and accept personal responsibility for his/her own and co-workers' safety through rational thinking and judgement. In addition, leaders and supervisors should engage more often with their staff on specific risk sources in their work environment (e.g. high job demands, lack of resources, high-driving personality behaviours, etc.), and as Hansez and Chmiel (2010) and Barling et al. (2002) rightly suggest, perceived management/leadership commitment result in greater experiences of work engagement which in turn enhance positive attitudes towards work place safety.

A summary of the chapter is presented below.

9.10 SUMMARY

The final chapter provides the reader with more insight into the inter-dependency of the different variables predicting change (either positive or negative) in employee attitude towards work place safety in a public electricity company in South Africa.

Specific conclusions were made on the interpretability, reliability and validity of the factor structures of the different measurement instruments used in this study. Thereafter, the effect of the psychological variables, biographical and safety data between different groups was explained. The next section focused on the primary aspect of this study, namely to investigate whether significant correlations exist between the different variables, and to make conclusions on those variables that have been found to best predict changes in individuals' attitude towards work place safety in the current sample. It was found that a number of the predictor variables showed to explained a significant amount of variance on participants' safety consciousness, driver attitude and quality orientation. The result provided evidence in support of hypothesis 1.

Through PLS path modelling, the goodness-of-fit of the measurement model (outer model) showed acceptable reliability and allowed for the evaluation of the theoretical/structural model (inner model). Conclusions were made on the paths that showed a significant relationship with the safety attitudinal variables as well as possible reasons for the non-significant path relationships. It was concluded that hypotheses 2 was partially supported, suggesting a need for refinement of the measurement instruments, deleting of non-significant paths and the testing of the model on a bigger sample.

The final part of this chapter highlighted certain limitations of the study. In addition, certain recommendations were proposed as well as possible directions for future research. The chapter is concluded by emphasising the importance of this study in predicting the influence of psychological factors on employees' attitudes towards work place safety in a public electricity company in South Africa and its contribution towards an enhanced understanding of the psychological factors influencing employees' attitudes towards work place safety.

9.11 CONCLUSION

It can be concluded that the aim of this study was achieved, providing new insights on combination of specific variables and their influence on attitude towards work place safety. For the first time, a model of psychological factors as predictor of employees' attitudes towards work place safety exists within in a public electricity company in South Africa. Furthermore, the model provides clear direction for future research in that intelligence, personality, burnout, work engagement and sense of coherence (through multiple pathways) predict 65% of the variance in employees' attitudes towards work place safety in a public electricity company in South Africa.

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Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents.

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Intelligence	**Safety consciousness (safety control, risk avoidance, stress tolerance) & Driver attitude**	Empirical / Conceptual	Intelligence test scores were related to the accident and violation records of a representative sample of 113 young male drivers. Low intelligence drivers were over-involved in intersection accidents and received a disproportionate number of speeding fines.	Smith & Kirkham, 1982
		Empirical / Conceptual	Below average intelligence appears to be significantly related to accidents only on jobs that require frequent judgments.	Schultz & Schultz, 1990
		Empirical / Conceptual	Selective attention and cognitive ability were significant predictors of vehicle accident causation	Arthur et al. 1991
		Empirical / Conceptual	IQ was found to be the best predictor of motor vehicle fatalities in an Australian veterans study. Other studies illustrates the importance of cognitive competence for preventing human error and argues strongly that all people make cognitive mistakes, but higher-*g* (IQ) individuals make relatively fewer cognitive mistakes when engaging in complex tasks, whether on mental tests or real life. In fact, accident prevention and control requires imagining the unseen, the emerging, and the "what-if?" which is a quintessentially cognitive process.	Buffardi et al. 2000; O'Toole, 1990; Schmidt & Hunter, 2004; Gottfredson, 1997, 2007, 2008

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Intelligence	**Safety consciousness (safety control, risk avoidance, stress tolerance) & Driver attitude**	Empirical / Conceptual	Respondents who performed better perceptually and recorded higher spatial awareness reported less work related driving accidents	Carty et al. 1999
		Empirical / Conceptual	Positive relationship exists between cognitive ability and vehicle / road accidents. Negative emotional states, such as stress, may (a) alter the way in which individuals allocate attention to tasks; (b) interfere with the representation of information in working memory; and (c) change the strategies individuals use to perform tasks (e.g. by causing a shift from accuracy to speed).	Lawton & Parker, 1998; Wickens, 1996
		Empirical / Conceptual	A significant relationship was found between conscientiousness and cognitive ability in relation to safety performance.	Wallace & Vodanovich, 2003b
		Empirical / Conceptual	At the occupational level, the researchers found that occupational hazards and intelligence explained 20% of the variance in accident rates.	Vickers & Villaseñor, 2006
Personality	**Driver attitude**	Empirical / Conceptual	High levels of neuroticism are positively related distractibility and lapses of attention	Hansen, 1989

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		Type of study	Brief description of the outcome of the study	Authors
Personality	**Driver attitude**	Empirical / Conceptual	Neuroticism, Type A behaviour, sensation seeking, and extraversion have been found to increase cognitive failures when exposed to stressors, which reduce individual's motivation to work safely and to adhere to companies' rules, procedures and attention to detail. Personality traits, such as extreme extraversion and sensation seeking are positively associated with risk taking or accident involvement.	Beirness & Simpson, 1988; Cooper & Sutherland, 1987; Dahlback, 1991; Hansen, 1989; Shaw & Sichel, 1971, Sutherland & Cooper, 1991; Lawton & Parker, 1998

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		Type of study	Brief description of the outcome of the study	Authors
Personality	**Driver attitude**	Empirical / Conceptual	High levels of neuroticism are characterised by negative emotional states such as anxiety, stress, and depression. Individuals with high levels of neuroticism are more distractible, than those with low levels and are likely to suffer from lapses of attention, which predispose them to making mistakes.	Frone, 1998; Hansen, 1989; Iverson & Erwin, 1997; Salminen et al. 1999; Shaw & Sichel, 1971; Sutherland & Cooper, 1991.
		Conceptual	Several studies have found that individuals with an internal locus of control are less likely to have accidents than individuals with an external locus of control.	Lawton & Parker, 1998; Jones & Wuebker, 1985
		Empirical	In a meta-analytic review of vehicle accident research, the researchers found four categories of variables or constructs that could be associated with vehicle accidents, namely personality, cognitive ability, information-processing, and demographic variables.	Arthur et al. 1991

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents (continued)

Path relationship		Type of study	Brief description of the outcome of the study	Authors
Personality	**Driver attitude**	Empirical / Conceptual	In examining the relationship between conscientiousness and driving accident involvement, the researchers found a significant inverse relationship between Conscientiousness and at-fault driving accident involvement.	Arthur, Jr & Graziano, 1996
Personality	**Safety consciousness (safety control, risk avoidance, stress tolerance)**	Conceptual	Some individuals were more prone to accidents than others were.	Greenwood & Woods, 1919
		Empirical / Conceptual	The safety locus of control scale was developed to identify those employees at risk for accidents, injuries, and unsafe behaviour in the workplace.	Jones, 1984
		Conceptual	High workplace accidents are related to extraversion, aggression, socially maladjusted, neuroticism, impulsiveness, and external locus of control	Hansen, 1991
		Conceptual	Attitudes are influenced by individual differences as well as environmental factors.	Mearns et al. 1998

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Personality	**Safety consciousness (safety control, risk avoidance, stress tolerance)**	Empirical / Conceptual	Cognitive failure moderated the relationship between conscientiousness and accidents and unsafe work behaviours.	Wallace & Vodanovich, 2003
		Empirical / Conceptual	Individual dispositions, such as locus of control is likely to influence people's attitude toward injuries via the extent to which an individual beliefs that they have control over external events in the safety domain.	Jones & Wuebker, 1985; 1993; Wuebker, 1986
		Empirical / Conceptual	Control has been associated with risk perception. The greater one's perception of control, the lower one's personal risk estimates. The feeling of control in a situation will most often lower stress, because a person feels they can control the outcome of the situation.	Celsi et al. 1993; Klein & Helweg-Larsen, 2002; Langer, 1975
		Empirical / Conceptual	A statistically significant relationship was found between conscientiousness and accidents.	Cellar et al. 2001

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Personality	**Safety consciousness (safety control, risk avoidance, stress tolerance)**	Empirical / Conceptual	The study reports a meta-analysis of the relationship between accident involvement and the Big Five personality dimensions (extraversion, neuroticism, conscientiousness, agreeableness, and openness). Low conscientiousness and low agreeableness were found to be valid and generalizable predictors of accident involvement, with corrected mean validities of .27 and .26, respectively. The context of the accident acts as a moderator in the personality–accident relationship, with different personality dimensions associated with occupational and non-occupational accidents. Extraversion was found to be a valid and generalizable predictor of traffic accidents, but not occupational accidents.	Clarke & Robertson, 2005
		Empirical / Conceptual	Extraversion, though having positive relations with many organisational criteria, may be related to increased levels of impulsive or risk-seeking behaviours, resulting in increased accident and absenteeism rates.	Judge & LePine, 2007; Judge et al. 2008

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Personality	**Safety consciousness (safety control, risk avoidance, stress tolerance)**	Empirical / Conceptual	The researchers performed a meta-analysis of the relationship between the Big Five traits and workplace accidents. They found that, except for openness, the Big Five traits were strongly associated with accidents, in particular those with high levels of openness and neuroticism, and those with low levels of agreeableness and conscientiousness. They also found, however, that with the exception of agreeableness, the variability in the correlations was quite high. One aspect of personality, low agreeableness, was found to be a valid and generalisable predictor of involvement in work accidents.	Clarke & Robertson, 2008
		Empirical / Conceptual	Indirect person-based factors (e.g., job attitudes and personality - conscientiousness) is likely to influence safety performance behaviours indirectly by way of safety knowledge and safety motivation and that safety performance behaviours, in turn, influence accidents and injuries.	Christian et al. 2009

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Personality	**Safety consciousness (safety control, risk avoidance, stress tolerance)**	Empirical / Conceptual	Employee attitudes toward safety have been shown to relate to safe workplace behaviour. In an effort to determine what contributes to stronger employee attitudes toward safety, the researchers examined the relationships between safety attitudes and a wide array of individual differences reflecting preferences and tendencies toward risk and control. Using a sample of 190 engineering and occupational safety students from two universities, the researchers found that agreeableness, conscientiousness, prevention regulatory focus, and fatalism related significantly to all six safety attitudes examined. Regression analyses demonstrated that agreeableness, prevention focus, and fatalism significantly related to safety attitudes when controlling for the other individual differences.	Henning et al. 2009
Personality	**Burnout**	Empirical / Conceptual	The following lower level personality factors were found in more than 100 burnout articles to be related to burnout, namely hardiness, locus of control, Type A behaviour, self-esteem, and achievement motivation.	Schaufeli & Enzmann, 1998

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Personality	**Burnout**	Empirical / Conceptual	The relationship between burnout and the 5 basic (Big Five) personality factors, namely extraversion, agreeableness, conscientiousness, emotional stability, and intellect/autonomy (openness to experience) were investigated. The results of three separate stepwise multiple regression analyses showed that (a) emotional exhaustion is uniquely predicted by emotional stability; (b) depersonalization (cynicism) is predicted by stability, extraversion, and intellect/autonomy; and (c) personal accomplishment is predicted by extraversion and emotional stability. The results suggest that personality may help to protect against known risk of developing burnout in volunteer human services work.	Bakker et al. 2006
Personality	**Sense of Coherence**	Empirical / Conceptual	Sense of Coherence (SOC) has been found to be correlated negatively with Neuroticism and positively with Extraversion.	Amelang, 1997; Cibson & Cook, 1996, Frommberger et al. 1999; Mlonzi & Strümpfer, 1998; Smits et al. 1995.

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Personality	**Sense of Coherence**	Empirical / Conceptual	The results of this study obtained from structural equation modeling (SEM) indicated that a high SOC was strongly associated with Neuroticism (-.85). In addition, SOC showed modest positive associations with extraversion, openness, conscientiousness, and agreeableness.	Feldt et al. 2007
Personality	**Work engagement**	Empirical / conceptual	In a sample of 572 Dutch employees the researchers found that the engaged group is characterised by low scores on neuroticism (r =-.049), paired with high scores on extraversion (r = 0.36)	Langelaan et al. 2006
		Empirical / conceptual	A positive correlation was found between conscientiousness and work engagement (r = 0.59)	Rich (2006)
		Empirical / conceptual	The results supported statistical significant correlations between engagement and neuroticism (r = -0.19), extraversion (r = 0.30), and conscientiousness (r = 0.16).	Wildermuth (2008)
Burnout	**Work engagement**	Empirical / Conceptual	Exhaustion and cynicism (core of burnout) and all three engagement scales (vigor, dedication, and absorption) plus professional efficacy (third scale of burnout) are negatively related and share between 22% and 38% of their variances in two sample studies.	Schaufeli et al. 2002

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Burnout	**Work engagement**	Empirical / Conceptual	Burnout and work engagement are separate, but related aspects of affective work-related well-being.	Coetzer & Rothmann, 2007
Burnout	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude, quality orientation**	Empirical / Conceptual	Risk perception, safety satisfaction and job stress are significantly predictive of injuries / near-misses at the individual level of analysis for employees working on offshore oil platforms (explaining 23% of the variance).	Rundmo, 1992b, 1995
		Conceptual	Hazardous working environments (e.g. high job demands) and experiencing an injury leads workers to perceive the environment to be more stressful.	Sutherland & Cooper, 1991
		Empirical / Conceptual	Perceived dangerousness was found to be a significant predictor of job stress in U.S. railroad workers.	Morrow & Crum, 1998
		Empirical / Conceptual	General vulnerability to stress was related to error-proneness and high levels of stress can increase the likelihood of human error.	Broadbent et al. 1982; Marshall, 1978
		Empirical	Perceptions of role overload were found to be significantly associated with safety behaviour at the individual level.	Hofmann & Stetzer, 1996

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Burnout	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude, quality orientation**	Empirical	Significant correlation was found between the effects of role / job overload on personal injury in groups where supervisors provided little support.	Zohar, 2000
		Empirical / Conceptual	The recently developed Job Demands-Resources model assumes that the two underlying psychological processes play a role in burnout: an effort-driven process in which excessive job demands lead to exhaustion and a motivation-driven process in which lacking resources lead to disengagement.	Demerouti et al. 2001, Schaufeli & Bakker, 2004.
		Empirical / Conceptual	Exhaustion and cynicism are the core symptoms of burnout, whereas exhaustion signifies low energy and cynicism signifies low identification (e.g. attitudinal component) with one's job.	Schaufeli, 2003
		Empirical / Conceptual	Working at high speed, to tight deadlines, and with less time to do the job reported more absences resulting from accidents at work	Paoli & Merllie, 2001

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Burnout	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude, quality orientation**	Empirical / Conceptual	Employees reporting high job demands defined their safety role with respect to their jobs more narrowly, and higher strain is associated with more accidents and near misses.	Turner, Chmiel & Walls, 2005; Goldenhar et al. 2003; Murray et al. 1997; Siu et al. 2004
		Conceptual	The cognitive effects of stress (e.g. reliance on inaccurate information and faulty processing of that information) can lead to errors in workers assessment of risk and doubting their control in hazardous situations.	Tversky & Kahneman, 1973; Cox, 1987
		Empirical / Conceptual	Workers physical and psychological states, such as burnout can condition the extent to which workers manifest effective safety behaviour (e.g. sense of control in managing occupational hazards). The researchers found that training are linking employee's experience of burnout and perception of risk at work.	Leiter & Robichaud, 1997

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		Type of study	Brief description of the outcome of the study	Authors
Burnout	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude, quality orientation**	Empirical / Conceptual	Three types of possible consequences of burnout have been investigated, namely ill health, negative job attitudes (e.g., job dissatisfaction, poor organisational commitment and intention to resign), and impaired organisational behaviour (e.g., absenteeism, job turnover and poor performance).	Schaufeli & Enzmann, 1998
		Empirical / Conceptual	Occupational stress is statistically significantly related to exhaustion and cynicism (burnout) which could result into dysfunctional behaviours.	Rothmann et al. 2005; Rothmann, 2008
Sense of coherence	**Burnout**	Empirical / Conceptual	Sense of coherence has been found as having a moderating effect between adverse characteristics of emotional exhaustion and psychosomatic symptoms, emotional job strain and burnout, conflicts at work and stress symptoms.	Feldt, 1997; Söderfeldt et al. 2000; Albertsen et al. 2001
		Empirical / Conceptual	Sense of coherence was found to correlate negatively with stress at work and the absence of burnout.	Barnard, 2001

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Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Sense of coherence	**Burnout**	Empirical / Conceptual	Sense of coherence is significantly related to emotional exhaustion, depersonalisation (cynicism), and personal accomplishment. Thus, individuals with a high level of burnout would be expected to have a weak sense of coherence.	Basson & Rothmann, 2001; Levert et al. 2000
		Empirical / Conceptual	Sense of coherence has been found to fulfil a moderating role between ill health (because of burnout) and wellbeing (as a personal resource facilitating work engagement).	Field et al. 2000
		Empirical / Conceptual	In this study, exhaustion, cynicism and low professional efficacy were associated with low scores regarding psychological strengths (sense of coherence, self-efficacy, and internal locus of control).	Rothmann, 2004
		Empirical / Conceptual	Path coefficient from sense of coherence to work wellness (burnout and engagement) and ill health was significant. Sense of coherence partially mediated the impact of burnout as part of work wellness on ill health. The path coefficient from sense of coherence to ill health was also found to be significant, indicating that higher levels of sense of coherence can result in less health problems.	Van der Linde & Coetzer, 2004

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Sense of coherence	**Work engagement**	Conceptual	Sense of coherence (and coping) can be utilised to predict work engagement (wellness).	Redelinghuys & Rothmann, 2004
		Conceptual	Sense of coherence can be regarded as an intrinsic motivational component or individual resource enhancing individual experience of salutogenic functioning influencing work engagement positively. Thus, personal resources, such as resilience (e.g. sense of coherence) are important antecedents of work engagement	Strümpfer & Wissing, 1998; Bakker et al. 2008
Sense of coherence	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation**	Conceptual	The stronger the sense of coherence implies that a person has a pervasive, enduring though dynamic feeling of confidence that one's internal, external environments are predictable, and that there is a high probability that things will work out as well as can reasonably be expected. Thus, the confidence in one's ability (cognitive-emotional strategies) to predict the outcome (quality) of one's work.	Antonovsky, 1979

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Sense of coherence	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation**	Conceptual	Quality Orientation refers to the likelihood of a person producing quality goods and services. Thus, people with higher Sense of Coherence can lead to productive performance (e.g. taking personal responsibility for the quality of their work, try to avoid errors and strive for continual improvement), because the work environment is likely to be regarded as predictable, manageable and meaningful.	Antonovsky, 1987; Strümpfer, 1990, 1998
Work engagement	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation**	Conceptual	Aspects such as organisational culture, managerial decision-making (job resources) are factors influencing employees' propensity for risk seeking or acceptability for risk taking behaviour.	Lawton & Parker, 1998
		Conceptual	Evidence suggest that intrinsic job hazards in high-risk jobs, such as police work, cause less psychological distress than do stressors such as organisational climate and structure (e.g. elements of job resources).	Hart et al. 1995

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Work engagement	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation**	Empirical / Conceptual	Safety climate, attitude towards risk, job tenure, knowledge, and training predicted self-reported compliance with safety procedures. Individuals are increasingly likely to be committed to safety and to engage in open communication regarding safety when they perceive the organisation to be supportive and they have high-quality relationships with their leaders.	Hoffmann & Morgeson, 1999; Morrow & Crum, 1998
		Conceptual	An evaluation of the work environment is likely to shape individuals attitude towards working safely.	Cox & Cox, 1991
		Empirical / Conceptual	Engaged employees report that their jobs make good use of their skills and abilities, are challenging and stimulating, and provide them with a sense of personal accomplishment.	Roberts & Davenport, 2002

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Work engagement	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation**	Empirical / Conceptual	Engagement, as a job resource, play both an intrinsic and extrinsic motivational role because they foster employee's growth, learning and development on the one hand, and the willingness to invest one's efforts and abilities to the work task on the other, thereby achieving work goals, tasks. Hence, a stronger dedication to one's work.	Schaufeli & Bakker, 2004
		Empirical / Conceptual	Changes in the work environment is likely to motivate people to actively participate is safety activities. Motivated employees are likely to cause work engagement resulting in employee's exhibit positive job attitudes and work behaviours (e.g. willingness to exert effort to enact safety behaviours), experience good mental health, and seem to perform better than those who are less engaged.	Neal & Griffen, 2006; Schaufeli & Bakker, 2004, 2010.
		Empirical / Conceptual	Engaged employees are likely to have a high-quality relationship with their employer leading them to have attitudes that are more positive, intentions, and behaviours.	Saks, 2006

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Work engagement	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation**	Conceptual	Organisations can try to ensure safety by creating an environment to enhance the motivation to engage in positive safety-related behaviours.	Ford & Tetrick, 2008
		Conceptual	Perceptions of safety-related situational constraints such as "incorrect instructions" and "improper work layout" predicted workplace injury severity, but this effect was buffered by higher control over safety, such as being able to modify work conditions to make them safer.	Snyder et al. 2008
		Conceptual	In ambiguous work settings, it is more difficult for employees to develop effective control.	Leiter et al. 2009
		Empirical / Conceptual	Engagement significantly explains lower situational violations and routine violations. Thus, significant paths exist between work engagement and routine and situational violations behaviours.	Hansez & Chmiel, 2010

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		**Type of study**	**Brief description of the outcome of the study**	**Authors**
Driver attitude	**Safety consciousness (safety control, risk avoidance, stress tolerance)**	Empirical / Conceptual	In a study of 2041 traffic accidents, human factors were contributing elements in 95% f the accidents.	Sabey & Taylor, 1980
		Empirical / Conceptual	Evidence from traffic studies suggests that violations, incidents, and crashes on the roads are strongly related to risk-taking behaviour.	Jonah, 1986; Iverson & Rundmo, 2002
		Empirical / Conceptual	In investigating whether or not attitudes toward traffic safety issues are predictors for future risky behaviours in traffic, found a high correlation between attitude toward rule violations and speeding, attitude toward the careless driving of others, attitude toward drinking and driving and risky	Iversen, 2004
		Empirical / Conceptual	Risky driver's attitudes are related to factors such as obedience to speed rules, risk-taking tendency in traffic and positive attitudes towards traffic.	Yilmaz & Celik, 2004

Annexure A Summary of the relationship between the independent variables (psychological factors) and dependent variables (attitude towards work place safety) (depicting from the literature) and work place incidents/accidents, including vehicle accidents (continued)

Path relationship		Type of study	Brief description of the outcome of the study	Authors
Driver attitude	**Safety consciousness (safety control, risk avoidance, stress tolerance)**	Empirical / Conceptual	Unsafe attitudes, physical precursors, and psychological precursors had the most impact and each explaining up to 9% of the variance in violations scores, error scores, and/or psychological precursor's scores.	Verschuur & Hurts, 2008
Quality orientation	**Safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude**	Empirical / Conceptual	People prone to cognitive failure are not able to handle interfering stimuli during task engagement and as a result fail to complete the task.	Reason, 1988
		Conceptual	Highly conscientious individuals tend to be more task-orientated, organises, diligent, methodical, and purposeful. They repeatedly check their progress, which is likely to lead to less errors and ultimately to less accidents.	Witt et al. 2002

SUMMARY

Research on the relationship between individual differences and work place incidents/accidents, including driver accident causation, originates from as early as 1917. In the 21st century this phenomenon continues to be a critical agenda for research internationally. In addition, a wide range of individual (e.g. intelligence, personality, stress) and organisational (e.g. leadership support, safety culture, job satisfaction) variables have been investigated as latent or observable predictors of causes of why employees engage in at-risk behaviour. Attitude towards work place safety is a well researched phenomenon in parts of the world other than South Africa. In addition, no research in South Africa has suggested a process depicting a combination of psychological factors that are related to employees' attitude towards work place safety. This study explored the influence of psychological factors on attitude towards work place safety. The aim of this study was two-fold: firstly to determine whether a statistically significant relationship exists between the predictor and criterion variables, and secondly through partial least square path modelling (PLS), to determine whether employees' attitude towards work place safety could be influenced by individual psychological factors. The study included intelligence, personality, burnout, work engagement, and sense of coherence as the predictor variables, and safety consciousness (safety control, risk avoidance, stress tolerance), driver attitude and quality orientation as the criterion variables measuring attitude towards work place safety. Based on the literature, the study suggested a model depicting a sequential process of interrelationship amongst the psychological factors and their relationship with safety consciousness, driver attitude, and quality orientation. To test the validity of the theoretical model, the current study used a sample of individuals that have been involved in a work place incident/accident or vehicle accident between 2006 and 2008. A sample of 279 employees from a public electricity company in South Africa participated in the study. The study applied both survey and statistical modelling methodologies to guide the research. Standardised questionnaires were used to measure the different psychological and safety attitudinal variables. The scoring and reliability analysis of the measurement instruments for intelligence and personality variables were conducted by service providers. Exploratory factor analysis was performed on the burnout, work engagement, sense of coherence, and safety attitudinal constructs to determine the applicability of the factor structures to the current sample. The suggested factor structures were confirmed through confirmatory factor analyses with acceptable levels of fit.

Hypothesis 1 was supported through correlation analysis, confirming that statistically significant path coefficients exist between the different variables. Furthermore, the results of the regression analysis suggested that 9 psychological factors explained 67% of the variance on safety consciousness, 5 psychological factors explained 53% on driver attitude, and 7 psychological factors explained 35% on quality orientation. The Partial Least Squares Modelling approach was used to evaluate the reliability of the psychological and safety attitudinal factors included in the measurement model (outer model), as well as the evaluation of the theoretical model (inner model) of the current study. Acceptable levels of fit were obtained which guided the process for the evaluation of the proposed model. In the evaluation of the pathways between latent constructs statistically significant path coefficients were found between (1) intelligence and driver attitude, (2) personality and burnout, (3) personality and sense of coherence, (4) personality and safety consciousness, (5) sense of coherence and burnout, (6) sense of coherence and work engagement, (7) sense of coherence and quality orientation, (8) driver attitude and safety consciousness, and (9) quality orientation and safety consciousness. Of importance is that only intelligence, personality and sense of coherence were found to significantly influence participant attitude towards workplace safety. Personality and sense of coherence moderated the effect of burnout experience, while sense of coherence contributed positively to experiences of work engagement. The path relationship between the safety attitudinal constructs with burnout and work engagement was non-significant. The study suggested that the theoretical model requires further refinement as well as the testing of the model on a larger sample.

Keywords: intelligence, personality, burnout, work engagement, sense of coherence, attitude, safety consciousness, driver attitude, quality orientation, work place safety, partial least squares

OPSOMMING

Die verhouding tussen individuele verskille en die oorsaak van werksplek insidente/ongelukke insluitend voertuigongelukke word reeds vanaf die jaar 1917 nagevors. Internasionaal word hierdie verskynsel steeds as 'n kritiese agenda vir navorsing in die 21ste eeu beskou. Benewens dit, is daar reeds ondersoek na 'n wye reeks latente of waarneembare individuele (bv. intelligensie, persoonlikheid, stres) en organisatoriese (bv. leierskapondersteuning, veiligheidskultuur, werkstevredenheid) veranderlikes as voorspellers vir die oorsake waarom werknemers by riskogedrag betrokke raak gedoen. Houdings teenoor werksplekveiligheid is in ander dele van die wêreld 'n weldeurdagte navorsingsverskynsel. Daarbenewens, kon geen vorige navorsing in Suid-Afrika wat 'n proses van 'n kombinasie van psigologiese faktore wat verband hou met werknemers se houding teenoor werksplekveiligheid gevind word nie. Die studie het die invloed van psigologiese faktore op houdings teenoor werksplekveiligheid verken. Die doel van die studie was tweeledig, eerstens om vas te stel of 'n statistiese betekenisvolle verband tussen die voorspeller- en kriterium veranderlikes bestaan, en tweedens deur middel van gedeeltelike minste vierkantige modellering "Path Least Square Modelling" te bepaal of 'n werknemer se houding teenoor werksplekveiligheid deur psigologiese faktore beinvloed kan word. Intelligensie, persoonlikheid, uitbranding, werksbegeestering, en koherensiesin was as die voorspeller-veranderlikes en veiligheid van bewussyn (veiligheidbeheer, risikovermyding, strestoleransie), voertuigbestuurder houding, en oriëntasie teenoor kwaliteit wat houdings teenoor werksplekveiligehid beinvloed, was as die kriterium veranderlikes in die studie gebruik. Uit die literatuur, het die studie 'n logiese volgorde wat die interverwantskap tussen die psigologiese faktore en hul verwanskap met veiligheid van bewussyn, voertuigbestuurder houding, en oriëntasie teenoor kwaliteit voorgestel. Om die geldigheid van die proses te bepaal, het die studie van 'n groep proefpersone wat tussen 2006 en 2008 in 'n werksplek insident/ongeluk of voertuig ongeluk betrokke was gebruik gemaak. 'n Groep van 279 werknemers in diens van 'n 'n publieke elektrisiteitsorganisasie in Suid Afrika, het aan die studie deelgeneem. Beide opname- en statistiese modelleringsmetodiek was gebruik. Gestandardiseerde vraelyste was gebruik om die verskillende psigologiese en veiligheidshoudings veranderlikes te meet. Die berekenings en geldigheidsontleding van die meetinstrumente wat intelligensie en persoonlikheid meet was deur die diensverskaffers

bereken. Die studie het van verklarende faktorontleding gebruik gemaak om die toepaslikheid van die faktorstruktuur van die uitbranding, werksbegeestering, koherensiesin, en veiligheidhoudings konstrukte op die steekproef te bepaal. Die voorgestelde faktorstruktuur van die meetinstrumente was deur bevestigende faktor ontleding bevestig met aanvaarbare passing statistiek. Hipotese 1 was deur korrelasie ontleding bevestig wat aangedui het dat daar wel ’n statistiese betekenisvolle verband tussen die verskillende veranderlikes bestaan. Verder het die resultate van die regressieontleding aangedui dat 9 psigologiese faktore 67% van die variansie op veiligheid van bewussyn voorspel het, 5 psigologiese faktore 53% van die variansie op voertuigbestuurder houding voorspel het, en 7 psigologiese faktore 35% van die variansie op oriëntasie teenoor kwaliteit voorspel het. Daar was van die minste vierkantige modellering “Path Least Square Modelling” benadering gebruik gemaak om die betroubaarheid van die psigologiese en veiligheidshoudingsfaktore wat in die meetingsmodel (buite model) ingesluit was te bereken, asook met die evaluering van die teoretiese model (binne model). Aanvaarbare passingsstatistiek was verkry wat die rigting aangedui het vir die evaluering van die teoretiese model. Tydens die evaluering van die verwantskappe tussen die latente konstrukte van die teoretiese model was die volgende statistiese betekenisvolle padkoeffisiënte verkry (1) intelligensie en voertuigbestuurder houding, (2) persoonlikheid en uitbranding, (3) persoonlikheid en koherensiesin, (4) persoonlikheid en veiligheid van bewussyn, (5) koherensiesin en uitbranding, (6) koherensiesin en werksbegeestering, (7) koherensiesin en oriëntasie teenoor kwaliteit, (8) voertuigbestuurder houding en veiligheid van bewussyn, en (9) oriëntasie teenoor kwaliteit en veiligheid van bewussyn. Van groot waarde was dat slegs intelligensie, persoonlikheid en koherensiesin die proefpersone se houding teenoor werksplekveiliheid betekenisvol beinvloed het. Persoonlikheid en ’n sterker koheresiesin het die effek op uitbranding gemodereer, terwyl koheresiesin ’n positiewe uitwerking op werksbegeestering getoon het. Die padverwantskap tussen die veiligheidhoudingskonstrukte met uitbranding en werksbegeestering was nie betekenisvol nie. Die studie het voorgestel dat die teoretiese model verder verfyn moet word asook die toetsing van die model op ’n groter steekproef.

Sleutelterme: intelligensie, persoonlikheid, uitbranding, werksbegeestering, koheresiesin, houding, veiligheid van bewussyn, voertuigbestuurder houding, oriëntasie teenoor kwaliteit, werksplekveiligheid, minste vierkantige modellering (PLS)