

WORK-RELATED WELL-BEING OF ENGINEERS IN SOUTH AFRICA

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SUMMARY

Topic: Work-related well-being of engineers in South Africa

Key terms: Work wellness, burnout, occupational stress, work engagement, commitment, positive psychology, optimism

With the introduction of positive psychology the aim with organisational psychology shifted to finding the 'happy/productive' worker and focusing more on work wellness. Working as an engineer has generally been considered challenging, but tough demands on today's engineers can cause exhaustion, which is due to a combination of personal stressors, job and organisational stressors. However, recently the world of work has started to change drastically – which also holds true for the engineering profession. One of the focus areas of redress is the work-related well-being of engineers, and specifically burnout, stress and work engagement.

This research focused on the total spectrum of wellness – from unwell-being (e.g. burnout and stress) to well-being (e.g. work engagement). The moderating effects of organisational commitment and dispositional optimism were investigated in order to establish a causal model for burnout and engagement. The objectives of this research were to standardise the MBI and the UWES for engineers, to determine the occupational stressors of engineers and to develop and test a causal models of work-related well-being of engineers.

The research findings are set out as four separate articles, each consisting of a brief literature overview and an empirical study. A cross-sectional research design with a survey as technique of data collection was used to achieve the objectives of this research. The study population consisted of 369 engineers. A biographical questionnaire, the Maslach Burnout Inventory – General Survey (MBI-GS), the Utrecht Work Engagement Scale (UWES), the Job Characteristics Scale (JCS), the Organisational Stress Screening Tool (ASSET), the Health subscales of the ASSET, the Organisational Commitment

subscale of the ASSET, and the Life Orientation Test-Revised (LOT-R) were used. Descriptive statistics, correlations, analysis of variance, factor analyses, multiple regression analysis and structural equation modelling were used to analyse the data.

A three-factor model of burnout, comprising exhaustion, cynicism and professional efficacy was confirmed. The internal consistencies of the scales were acceptable. The results obtained from comparing burnout levels of various demographic groups showed that practically significant differences existed between burnout of engineers with different levels of job satisfaction, age, years of experience and self-rated performance.

Compared to normative data, participants reported lower levels of physical ill-health and psychological outcomes of stress. The most important stressors identified were work-life balance, work demands and work overload. The results do not support previous findings that commitment has a protective effect against the negative consequences of workplace stress. The buffer hypothesis of organisational commitment is not supported by the data.

Structural equation modelling confirmed a model of work engagement, consisting of Vigour, Dedication and Absorption. These three factors had acceptable internal consistencies. The results showed that the self-rated performance and job satisfaction of engineers varied depending on their levels of work engagement. No demographic differences regarding engagement levels could be found between the different age groups, engineering environments, job levels and years of experience.

A good fit was found for a model in which exhaustion mediated the relationship between job demands and ill-health, and work engagement (vigour and dedication) mediated the relationship between job resources and organisational commitment. The results suggested that the effect of a lack of job resources on exhaustion and the effect of job resources on work engagement depends on the level of dispositional optimism.

Recommendations for future research were made.

OPSOMMING

Onderwerp: Werkwelstand van ingenieurs in Suid-Afrika

Sleutelwoorde: Werkwelstand, uitbranding, beroepstres, werksbegeestering, verbondenheid, positiewe sielkunde, optimisme

Met die bekendstelling van positiewe sielkunde het die doelwit van organisasiesielkunde verskuif na 'n soeke na die 'gelukkige/produktiewe' werker en werknemerwelstand. Die ingenieursprofessie beskik oor baie uitdagings. Poseise kan uitputting veroorsaak by ingenieurs. Uitputting is 'n kombinasie van persoonlike stressore, werk- en organisasie-stressore. Onlangs het die wêreld van werk egter drasties begin verander – en daarmee saam die ingenieursprofessie. Een van die navorsingsfokusareas is werksverwante welstand van ingenieurs, en meer spesifiek uitbranding, stres en werksbegeestering.

Hierdie navorsing het gefokus op die totale spektrum van welstand – van nie-welstand (bv. uitbranding en stres) tot welstand (bv. werksbegeestering). Daar is ook ondersoek ingestel na die verligtingseffek van verbondenheid en dispositionele optimisme ten einde 'n oorsaaklike model van uitbranding en begeestering te verkry. Die doelstellings van die studie was om die Maslach Uitbrandingsvraelys – Algemene Opname (MBI-GS), Utrecht-werksbegeesteringskaal (UWES) te standardiseer vir ingenieurs, organisasie-stressore te identifiseer en om 'n oorsaaklike model vir die welstand van ingenieurs daar te stel.

Die navorsingsbevindinge word weergegee in vier afsonderlike artikels wat elk bestaan uit 'n kort literatuuroorsig en 'n empiriese studie. 'n Dwarssnee-opname-ontwerp is gebruik en die opname van die populasie is op 'n spesifieke tydstip gemaak. Die steekproef het bestaan uit 369 ingenieurs. 'n Biografiese vraelys, die Maslach Uitbrandingsvraelys – Algemene Opname (MBI-GS), Utrecht-werksbegeesteringskaal (UWES), 'n Organisasiestresgraderingsinstrument (ASSET), die Gesondheidssubskaal van die ASSET, die Organisasieverbondenheid-subskaal van die ASSET, die

Taakmerkeskaal (JCS), en die Lewensoriëntasievraelys (LOT-R) is afgeneem. Beskrywende statistiek, faktoranalise, korrelasies, variansieanalise, meervoudige regressieanalise en strukturele vergelykingsmodellering is gebruik om die data te ontleed.

'n Driefaktormodel van uitbranding, bestaande uit uitputting, sinisme en professionele doeltreffendheid is bevestig. Die interne konsekwentheid van die skale was aanvaarbaar. Navorsingsresultate van die vergelyking van demografiese groepe dui daarop dat daar betekenisvolle verskille bestaan tussen uitbranding van ingenieurs met verskillende vlakke van werkstevredenheid, ouderdom, jare diens en selfbeoordeling van prestasie.

Deelnemers het beduidend laer vlakke van fisieke ongesondheid en psigologiese uitkomst van stres gerapporteer in vergelyking met normatiewe data. Werk-lewe-balans, werkseise en werkoormoed is as die belangrikste stressore geïdentifiseer. Die resultate het aangetoon dat organisasieverbondenheid nie 'n beskermende effek op negatiewe uitkomst van stres in die werkplek het nie. Die beskermingshipotese van organisasieverbondenheid word nie deur hierdie data ondersteun nie.

Strukturele vergelykingsmodellering het 'n model bestaande uit Energie, Toewyding en Absorpsie aangetoon. Hierdie faktore het aanvaarbare interne konsekwentheid getoon. Die resultate toon aan dat selfevaluering van werksprestasie en werkstevredenheid van ingenieurs verskil afhangend van die vlak van werksbegeestering. Geen demografiese verskille is aangetoon met betrekking tot die verskillende ouderdomsgroepe, verskillende ingenieursomgewings, werksvlakke en werkservaring nie.

'n Goeie passing is verkry vir 'n model waarin uitputting die verwantskap tussen poseise en swak gesondheid, en werksbegeestering (energie en toewyding) die verwantskap tussen werksbronne en organisasieverbondenheid, bemiddel het. Die resultate het aangetoon dat die effek van 'n gebrek aan werksbronne op uitputting en werksbegeestering afhang van die vlak van disposisionele optimisme.

Aanbevelings vir toekomstige navorsing is aan die hand gedoen.

CHAPTER 1

INTRODUCTION

This thesis is about the work-related well-being of engineers in South Africa.

In this chapter the problem statement is discussed. The research objectives are set out, which include the general objective and specific objectives. The research method is explained and the division of chapters given.

1.1 PROBLEM STATEMENT

Engineers are important for organisations to add value through the use of appropriate technology and processes. Engineers operate in a dynamic environment and they have to face the tough challenges in the workplace because the focus for organisations is on unleashing people capacity. The success of engineers will depend largely on both the extent and nature of their ability to adapt to, and work with, continual change and challenge. The major challenge for leaders in the twenty-first century will be to release the brainpower of their organisations. The dominant competitive weapon of the twenty-first century will be the education and skills of the workforce (Starkey, 1998). Engineers have to cope with the demands that arise from the nature of their work as well as from increased pressure to perform. These types of demands on today's engineers can lead to exhaustion due to a combination of personal stressors, job and organisational stressors (Kreitner & Kinicki, 1998). It has been claimed that everybody can experience stress, while burnout can only be experienced by those who entered their careers enthusiastically with high goals and expectations. Burnout includes the development of negative attitudes, and it occurs among initially motivated individuals (Schaufeli & Buunk, 2002).

The concept of burnout was a phenomenon that was originally observed primarily among people helpers such as nurses, social workers and police workers (Rothmann & Fourie, 2002). According to Maslach, Schaufeli and Leiter (2001), it is today acknowledged that people in almost any occupation can develop burnout. It appears to be a factor in job turnover, absenteeism and low morale in organisations. Secondly, recently there is an expansion of the burnout construct in research in the direction of a positive pole, work

engagement. Seen from this perspective, burnout happens if there is a mismatch between the job environment and the individual, and good fits between the individual and environment promote engagement with work (Ainsworth, 2001).

According to Carell, Kunzmits and Elbert (1992), the interest in burnout issues is a result of the effect of the problem on organisations. According to Worall, Cooper and Campbell-Jamison (2000), organisations have undergone a series of massive transformations. There have been massive changes in structures (Ferlie & Pettigrew, 1996), in styles of governance, in organisational culture, in everyday working relationships and, perhaps most importantly, in long-term career structures and the nature of the relationship between employer and employee (McKevitt & Lawton, 1995). Organisational stress occurs when job demands do not match the person's adaptive resources. Stress refers to the temporary adaptation process that is accompanied by mental and physical symptoms, which then leads to burnout that is considered as a final stage in a breakdown in adaptation that results from the long-term imbalance of demands and resources, thus from prolonged job stress (Brill, 1984). The effects include: low productivity, increased absenteeism, turnover, and an assortment of medical ills including alcoholism and cardiovascular problems. According to Schaufeli and Janczur (1994), work-related factors are more strongly associated with burnout than individual factors. Role conflict and role ambiguity indirectly influence burnout (Levert, Lucas & Ortlepp, 2000).

Schaufeli and Enzmann (1998, p. 36) define burnout as "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 and behaviours at work". In terms of health psychology burnout refers to the physical and mental exhaustion experienced by individuals who work intensively with other people, and who often give more than they receive from their clients, colleagues or supervisors (Bishop, 1998). Cinman (2001) defines burnout as a slow, almost invisible process that reduces one's energy levels, motivation, happiness and, most importantly, usefulness. Professionals experiencing burnout exhibit symptoms including physical and emotional exhaustion, the development of negative and callous attitudes towards the people they are working with, and reduced personal accomplishment. Even though they might put up a good front, burned-out professionals are experiencing weariness and despair

that may manifest itself through drug and alcohol abuse, increased smoking, or career changes (Maslach & Jackson, 1982; Pines & Aronson, 1981).

Burnout is a syndrome that consists of three essential characteristics (Maslach, Jackson & Leiter, 1996), namely Exhaustion, Cynicism and low Professional efficacy. Exhaustion refers to feelings of being overextended and depleted of one's emotional and physical resources. Cynicism refers to the interpersonal dimension of burnout and is a negative, callous or detached response to various aspects of the job. Professional efficacy refers to the self-evaluation dimension of burnout and is a feeling of competence, productivity and achievement at work.

According to Schaufeli and Buunk (2002), burnout can be reliably and reasonably validly measured, particularly with the MBI (Maslach Burnout Inventory). However, the MBI is not yet standardised for engineers in South Africa and little information is available on its reliability and construct validity, which makes it difficult to place the research results into context. Therefore, the first research problem is that the MBI is not validated and standardised for engineers in South Africa. This makes it difficult to assess the levels of burnout in various demographic groups.

The second research problem is that there is a lack of a causal model of work-related well-being of engineers in South Africa. The experience of stress reactions in the workplace is not an isolated phenomenon (Fletcher, 1988). According to Schaufeli and Bakker (2001), any occupation can be viewed from a stress perspective in terms of two elements, namely job demands and job resources. The occupational stress model most frequently used is that of demand-control. The original demand-control model was developed by Karasek (1979). Job demands refer to those aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs, e.g. work overload, personal conflicts and emotional demands (Demerouti, Nachreiner, Bakker & Schaufeli, 2001).

The job demands-control model is also referred to as the strain hypothesis (Pelfrene et al., 2002). Cooper, Dewe and O'Driscoll (2001) define strain as the individual's physical, psychological and behavioural response to stressors. The demand-control model predicts that the strongest aversive job-related strain reaction (such as depression, exhaustion and health

complaints) occurs when jobs are simultaneously high in job demands, low in decision latitude and low in workplace social support (Kitaoka-Higashiguchi et al., 2003). This is supplemented by the learning hypothesis, stating that high job demands in combination with high job control will favour learning, motivation and development of skills.

Job demands threaten one's resources and, therefore, trigger stress. Prolonged exposure to such job demands will result in strain (Taris, Schreurs & Van Iersel-Van Silfhout, 2001). Consequently, people could develop health problems. Stress has been associated with important occupational outcomes of job satisfaction, organisational commitment and employee withdrawal behaviour (Nieumann, 1993; Sullivan & Bhagat, 1992; Tett & Meyer, 1993). Moreover, occupational commitment has also been found to be a stress moderator (Begley & Cazjka, 1993). The identification of specific organisational stressors will form part of the causal model of burnout for engineers.

Schaufeli and Bakker (2004) also include positive work experiences in order to arrive at a more balanced picture of employee (un)well-being. Schaufeli and Bakker (2004) extended the JD-R model by including engagement and by adding health impairment and organisational withdrawal in their Comprehensive Burnout and Engagement (COBE) Model. The COBE model assumes two job-related psychological processes, namely an energetic and a motivational process. The energetic process links job demands with health problems via burnout. The motivational process links job resources via work engagement with organisational outcomes. Job resources may play either an intrinsic motivational role (by fostering the employee's growth, learning and development), or they may play an extrinsic motivational role (by being instrumental in achieving work goals). Schaufeli and Bakker (2004) confirmed the model in an empirical study in the Netherlands. Job demands were associated with exhaustion, whereas job resources were associated with work engagement. Burnout was related to health problems as well as to turnover intentions, and mediated the relationship between job demands and health problems, while work engagement mediated the relationship between job resources and turnover intentions.

Organisational factors which contribute to burnout are work overload (Schaufeli & Buunk, 2002) poor collegial support (Golembiewski & Munzenrider, 1988), role conflict and role ambiguity (Meltzer & Nord, 1981; Miller, Ellis, Zook & Lyles, 1990). Role conflict and role ambiguity occur when conflicting demands at the job have to be met (Schaufeli & Peeters,

1999). Role conflict is predominant in professional environments such as engineering. Individuals that enter this environment are generally very ambitious and competitive. Engineers seek challenging opportunities and equivalent fast-track career enrichment and recognition. Lack of promotion opportunities, inadequate recognition and vague career paths are commonly associated with stress among engineers. Engineers' performance is normally linked with company results and thus within this environment of high performance expectations and outputs, burnout can commonly be experienced. According to Bragg (2002), burnout comes from trying to do too much about the results of what we do.

Biographical factors that could relate to burnout are work experience, age, gender and education. Burnout is associated with higher levels of education (Maslach, Leiter & Jackson, 1996). Initially it was claimed that women report higher burnout levels than men (Etzion & Pines, 1986). According to Maslach et al. (1996), burnout seems to occur most frequently among young employees (i.e. younger than 40) who have relatively little work experience. There is currently a high demand for graduated and qualified engineers in the South African and international markets. These individuals receive competitive salaries and progress fairly rapidly to professional status and management positions. Many companies attract young talent to maintain impressive growth and a stimulating process of continuous improvement. In a complex, fast changing and highly competitive global business environment this unique combination of skills and experience is highly in demand. Business set high expectations on the performance of these sought-after resources. Cash (1988) found that individuals with a higher level of education were more prone to burnout than less educated employees. This could be attributed to the higher expectations of the more educated individuals.

Recently, the concept of work engagement has been introduced as the opposite pole of job burnout (Maslach et al., 2001). The focus is on human strengths and optimal functioning rather than weakness and malfunctioning. Researchers in positive psychology seek a detailed understanding of positive human experience at both individual and social levels. They are interested in individual attributes such as the ability to engage in satisfying and joyful activities, to maintain an optimistic outlook, and to live in accord with positive values (Miller, 2002). According to Schaufeli, Salanova and Bakker (in press) engagement refers to a more persistent and pervasive affective-cognitive state that is not focused on any particular job, event, individual or behaviour. Engagement has three components: energy (including vigour and resilience), involvement and dedication to the job, as well as personal efficacy and

pleasure with the job (Bragg, 2002). According to Ainsworth (2001), a good fit between the job environment and the individual promotes engagement, and mismatches lead to burnout.

The above-mentioned discussion shows that engineers' adaptation at work could be studied in a positive way by focusing on the concept of engagement. The third research problem is that the UWES (Utrecht Work Engagement Scale) is not yet standardised for engineers in South Africa and no information is available on its reliability and construct validity (Rothmann & Fourie, 2002), which makes it difficult to place the research results into context. This makes it difficult to assess the levels of engagement of engineers and to compare engineers in various demographic groups. No studies were found regarding the relationship between job stressors, biographical factors, personality traits and coping that might be related to burnout of engineers. No studies that include these factors in a causal model of engagement of engineers were found in the literature.

Burnout and engagement may be considered two prototypes of employee well-being that are part of a more complex taxonomy constituted by dimensions of activation and identification. Activation ranges from exhaustion to vigour, while identification ranges from cynicism to dedication. Burnout is characterised by a combination of exhaustion (low identification) and cynicism (low identification), whereas engagement is characterised by vigour (high identification), and dedication (high identification). Burnout was related to health problems as well as to turnover intentions, and mediated the relationship between job demands and health problems, while work engagement mediated the relationship between job resources and turnover intentions (Schaufeli & Bakker, 2004).

Currently, there is an emerging shift towards positive psychology – with the focus on human strengths and optimal functioning, rather than on weaknesses, malfunctioning and damage (Seligman & Csikszentmihalyi, 2000). According to these authors, optimism has been discovered as a human strength that acts as a buffer against mental illness. Optimism is regarded as the generalised expectation of positive outcomes. As a dispositional variable, optimism has been of considerable interest as a potential moderator of the relationship between job stressors and psychological strain (Cooper et al., 2001). Optimism has been found to moderate the relationship between daily hassles and health outcomes (Fry, 1995) and perceived stress and depression (Sumi, Horie & Haykawa, 1997).

This study will make the following contributions to the field of Industrial Psychology:

- **It will result in a standardised measuring instrument for burnout of engineers, which has been proven to be reliable and valid.**
- **It will produce a standardised measuring instrument, which has been proven to be reliable and valid for engagement for engineers.**
- **Information about causes of occupational stress of engineers would exist and the relationship between occupational stress, organisational commitment and ill-health would exist that could be used to plan interventions to manage the work wellness of engineers.**
- **A causal model would exist that could be used to predict the work-related well-being of engineers.**

1.2. AIM OF THE RESEARCH

1.2.1 General aim

The general aim of the research is to standardise the MBI and the UWES for engineers, to determine the occupational stressors of engineers and to test causal models of burnout and engagement of engineers.

1.2.2 Specific objectives

- **To validate the Maslach Burnout Inventory for engineers in South Africa.**
- **To investigate the relationship between burnout and various demographic characteristics i.e. age, job levels, years of experience, performance and job satisfaction.**
- **To assess whether organisational commitment moderates the effects of occupational stress on ill-health of engineers.**
- **To determine the psychometric properties of the Utrecht Work Engagement Scale for engineers in South Africa.**
- **To determine differences between the work engagement of engineers in different demographic groups.**

- To develop and test a causal model of work-related well-being of engineers, which includes job characteristics, burnout, work engagement, optimism, organisational commitment and ill-health.

1.3 RESEARCH METHOD

The research consists of a literature review and an empirical study. The results obtained are presented in the form of research articles.

1.3.1 Research design

A cross-sectional research design with a survey as technique of data collection is used to reach the objectives of this research. Cross-sectional designs are used to examine groups of subjects in various stages of development simultaneously, while the survey describes a technique of data collection in which questionnaires are used to gather data about an identified population. This design will be well suited to the descriptive and predictive functions associated with correlational research, whereby relationships between variables are examined (Shaughnessy & Zechmeister, 1997). Schaufeli and Enzmann (1998) criticise the use of cross-sectional designs in burnout research, and recommend that experiments and longitudinal studies should be used when possible. However, a cross-sectional design is the most appropriate design for the validation of the MBI and the UWES. Furthermore, structural equation modelling will be used to address the problems associated with this design (Byrne, 2001).

1.3.2 Participants

Random samples ($N = 369$) were taken from Engineers in South Africa who are professionally registered with ECSA (Engineering Council of South Africa). The random sampling was carried out with the help of the SAS Program (SAS Institute, 2000). Professionally registered engineers were listed numerically on the grounds of registration numbers (the ECSA registration numbers are based on year of registration with additional numeric digits). Questionnaires were posted to the selected individuals and each engineer was asked to complete the questionnaire. All questionnaires were completed anonymously and treated as confidential.

1.3.3 Measuring battery

A biographical questionnaire, the Maslach Burnout Inventory – General Survey (MBI-GS), the Utrecht Work Engagement Scale (UWES), the Job Characteristics Scale (JCS), the Organisational Stress Screening Tool (ASSET), the Health subscales of the ASSET, the Organisational Commitment subscale of the ASSET, and the Life Orientation Test-Revised (LOT-R) will be used.

The *Maslach Burnout Inventory – General Survey* (MBI-GS) (Schaufeli, Leiter, Maslach & Jackson, 1996) is used in this study. The MBI-GS (Schaufeli et al., 1996) measures respondents' relationships with their work. The MBI-GS has three subscales: Exhaustion (five items, e.g. "I feel used up at the end of the workday"), Cynicism (five items, e.g. "I have become less enthusiastic about my work") and Professional Efficacy (six items, e.g. "In my opinion, I am good at my job"). Together the subscales of the MBI-GS provide a three-dimensional perspective on burnout. Internal consistencies (Cronbach alpha coefficients) reported by Schaufeli et al. (1996) varied from 0,87 to 0,89 for Exhaustion, 0,73 to 0,84 for Cynicism and 0,76 to 0,84 for Professional Efficacy. Test-retest reliabilities after one year were 0,65 (Exhaustion), 0,60 (Cynicism) and 0,67 (Professional Efficacy) (Schaufeli et al., 1996). All items are scored on a seven-point frequency rating scale ranging from 0 (*never*) to 6 (*daily*). Storm and Rothmann (2003) confirmed the three-factor structure of the MBI-GS in a sample of 2 396 SAPS members. Structural equivalence of the MBI-GS for different race groups in the SAPS was confirmed. The following Cronbach alpha coefficients were obtained for the MBI-GS: Exhaustion: 0,88; Cynicism: 0,79; Professional Efficacy: 0,78 (Storm & Rothmann, 2003).

The *Utrecht Work Engagement Scale* (UWES) (Schaufeli & Buunk, 2002) is used to measure work engagement. Work engagement is a concept that includes three dimensions: vigour, dedication and absorption. Engaged workers are characterised by high levels of vigour and dedication, and they are immersed in their jobs. The UWES is scored on a seven-point frequency rating scale, varying from 0 (*never*) to 6 (*always*). The questionnaire consists of 17 items and includes statements such as "I am bursting with energy every day in my work", "Time flies when I am at work" and "My job inspires me". The alpha coefficient could be improved (it varies between 0,78 and 0,89 for the three subscales) by eliminating a few items

without substantially decreasing the scales' internal consistency. Storm and Rothmann (2003) obtained the following alpha coefficients for the UWES in a sample of 2 396 members of the South African Police Service: Vigour: 0,78; Dedication: 0,89; Absorption: 0,78.

The *Job Characteristics Scale* (JCS) measures job demands and job resources for employees. The JCS consists of 48 items. The questions are rated on a four-point scale ranging from 1 (*never*) to 4 (*always*). The dimensions of the JCS include pace and amount of work, mental load, emotional load, work variety, opportunities to learn, work independence, relationships with colleagues, relationship with immediate supervisor, ambiguities of work, information, communications, participations, contact possibilities, uncertainty about the future, remuneration and career possibilities.

An *Organisational Stress Screening Tool* (ASSET) (Cartwright & Cooper, 2002) was used to measure stress in this study. The ASSET is based upon the stress model of Cooper and Marshall (1976). It is also designed to recognise additional factors, such as job satisfaction and organisational commitment, which serve to either exacerbate or moderate the stress levels experienced at work (Cartwright & Cooper, 2002). The measure is divided into four questionnaires; the first three assess the respondent's perceptions of the sources of pressure and the outcomes of work stress, whilst the fourth collects biographical information.

Questions within the 'Perceptions of your job' and 'Attitudes towards your organisation' scales are answered on a Likert scale, varying from 1 (*strongly disagree*) to 6 (*strongly agree*). The 'Your health' scale is answered on a Likert scale, varying from 1 (*not at all*) to 4 (*much more than usual*). The tool comprises four main questionnaires. The first three cover sources and outcomes of stress (i.e. Perceptions of your job, 37 items relating to eight sources of stress; Attitudes towards your organisation, 9 items measuring commitment levels; and Your health, 19 items measuring the frequency of physical and psychological ill-health symptoms of stress). The fourth questionnaire – Supplementary Information – consists of 24 customised items. The ASSET has an established set of norms from a database of responses from 9 188 workers in the public and private sector organisations in the UK.

Reliability is based on the Guttman split-half coefficient. All but two factors returned coefficients in excess of 0,70 – ranging from 0,60 to 0,91 (Cartwright & Cooper, 2002). The

Psychological Well-Being subscale has good convergent validity, with an existing measure of psychiatric disorders, the General Health Questionnaire.

The Health Subscales of the *ASSET* (which refers to An Organisational Stress Screening Tool) (Cartwright & Cooper, 2002) is used to measure physical and psychological ill-health. The Health subscales consists of 19 items arranged on two subscales: The Physical health and Psychological well-being questionnaire's items are scored on a four-point scale ranging from 1 (*never*) to 4 (*often*). All items on the Physical health subscale relate to physical symptoms of stress. The role of this subscale is to give an insight into physical health, not an in-depth clinical diagnosis. The items listed in the Psychological health subscale are symptoms of stress-induced mental ill-health. Johnson and Cooper (2003) found a Guttman split-half reliability coefficient of 0,70 and 0,90 for the Physical and Psychological Health subscales respectively. They also found that the Psychological well-being subscale has good convergent validity with an existing measure of psychiatric disorders, the General Health Questionnaire (Goldberg & Williams, 1988).

The Organisational Commitment Subscale of the *ASSET* (Cartwright & Cooper, 2002) is used to measure the individual's attitude toward his or her organisation, and includes questions relating to perceived levels of commitment to the organisation. The subscale consists of seven items. The questions are rated on a six-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). Johnson and Cooper (2003) found a Guttman split-half reliability coefficient of 0,74 for the scale.

The Life Orientation Test-Revised (LOT-R), a 10-item measure, was developed by Scheier, Carver and Bridges (1994) to measure dispositional optimism. Six items contribute to the optimism scale and four items are fillers. The LOT-R is measuring a continuum of high, average and low optimism/pessimism (Scheier et al., 1994). The LOT-R measures optimism/pessimism on a five-point Likert scale, ranging from 5 (strongly agree) to 1 (strongly disagree). The LOT-R was found to have adequate internal consistency (Cronbach's alpha = 0,78), and excellent convergent and discriminant validity (Scheier et al., 1994).

1.4 Statistical analysis

The statistical analysis is carried out with the help of the SAS Program (SAS Institute, 2000) and the Amos Program (Arbuckle, 1999). The SAS Program is used to carry out statistical analyses regarding reliability and validity of the measuring instruments, descriptive statistics, t-tests, analysis of variance, correlation coefficients and multiple regression analyses. The Amos Program is used to carry out structural equation modelling.

Cronbach alpha coefficients, inter-item correlation coefficients and factor analysis are used to assess the reliability and validity of the measuring instruments (Clark & Watson, 1995). Descriptive statistics (e.g. means, standard deviations, range, skewness and kurtosis) and inferential statistics are used to analyse the data. A cut-off point of $p = 0,05$ is set for the statistical significance of the results. Effect sizes (Cohen, 1988) are used to decide on the practical significance of the findings. Pearson product-moment correlation coefficients are used to specify the relationships between the variables. A cut-off point of 0,30 (medium effect, Cohen, 1988) will be set for the practical significance of correlation coefficients. T-tests and analysis of variance are used to determine the differences between groups. Stepwise multiple regression analyses are conducted to determine the percentage of the variance in the dependent variables (burnout) that is predicted by the independent variables.

Structural equation modelling is used to construct causal models of burnout and engagement. Structural equation modelling is a statistical methodology that takes a confirmatory (i.e. hypothesis-testing) approach to the analysis of a structural theory bearing on some phenomenon (Byrne, 2001). The term "structural equation modelling" conveys two important aspects of the procedure:

- that the causal processes under study are represented by a series of structural (i.e. regression) equations, and
- that these structural relations can be modelled pictorially to enable a clear conceptualisation of the theory under study.

Several aspects of SEM set it apart from the older generation of multivariate procedures (Byrne, 2001). Firstly, it takes a confirmatory rather than an exploratory approach to data

analysis. (Furthermore, by demanding that the pattern of inter-variable relations be specified a priori, SEM lends itself well to the analysis of data for inferential purposes.) Secondly, although traditional multivariate procedures are incapable of either assessing or correcting for measurement error, SEM provides explicit estimates of these error variance parameters. Thirdly, SEM procedures can incorporate both unobserved (latent) and observed variables.

1.5 DIVISION OF CHAPTERS

- Chapter 1: Introduction
- Chapter 2: Burnout of engineers in South Africa
- Chapter 3: Occupational stress of engineers in South Africa
- Chapter 4: Work engagement of engineers in South Africa
- Chapter 5: A causal model of work-related well-being of engineers
- Chapter 6: Conclusions, limitations and recommendations

1.6 CHAPTER SUMMARY

This chapter discussed the problem statement and research objectives. The measuring instruments and research method that are used in this research were explained, followed by a brief overview of the chapters that follow.

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BURNOUT OF ENGINEERS IN SOUTH AFRICA

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ABSTRACT

The objectives of this research were to validate the Maslach Burnout Inventory-General Survey (MBI-GS) for engineers in South Africa and to analyse the differences between the burnout levels of various demographic groups. A cross-sectional survey design was used. Stratified random samples ($N = 369$) were taken of engineers in South Africa. The MBI-GS and a biographical questionnaire were administered. A three-factor model of burnout consisting of exhaustion, cynicism and professional efficacy was confirmed. The internal consistencies of the scales were acceptable. The results obtained from comparing burnout levels of various demographic groups showed that practically significant differences existed between burnout of engineers with different levels of job satisfaction, age, years of experience and self-rated performance.

OPSOMMING

Die doelstelling van die navorsing was om die Maslach Uitbrandingsvraelys – Algemene Opname te valideer vir ingenieurs in Suid-Afrika en om verskille tussen uitbrandingsvlakke van verskillende demografiese groepe is bepaal. 'n Dwarssnee-ontwerp is gebruik. Gestratifiseerde ewekansige steekproewe van ingenieurs in Suid-Afrika ($N = 369$) is geneem. Die MBI-GS en 'n biografiese vraelys is afgeneem. 'n Driefaktormodel van uitbranding, bestaande uit uitputting, sinisme en professionele doeltreffendheid is bevestig. Die interne konsekwenheid van die skale was aanvaarbaar. Navorsingsresultate van die vergelyking van demografiese groepe dui daarop dat daar betekenisvolle verskille bestaan tussen uitbranding van ingenieurs met verskillende vlakke van werktevredenheid, ouderdom, jare diens en selfbeoordeling van prestasie.

The core assets of the modern business enterprise lie not only in buildings, machinery, and real estate, but also in the intelligence, understanding, skills, and experience of employees. Harnessing the capabilities and commitment of knowledge workers is, it might be argued, the central managerial challenge of our time (Manville & Ober, 2003). At the start of the new millennium, humans find themselves in a vortex of changes, which forces them to look at the world with new eyes (Pines & Yanai, 2001). This new way of seeing has a direct implication for treating burnout – which occurs as a result of a complex interaction between individual characteristics and issues in the work environment (Lingard, 2003). Burnout is a crucial issue for businesses committed to quality, and for organisations that are innovating constantly and that need top performance of talented people. Talented people are hard to replace. Building and sustaining an organisational environment that supports engagement with work helps to retain valuable staff members and to make the most of their talents (Leiter & Maslach, 2001). In order to retain talent, organisations are urged to look after the well-being of engineers in their service. One area that should be researched in this regard is burnout.

A basic assumption underlying this study of burnout to date has been that individuals chose a profession for life; they made a life-long commitment to their work and, in return, the company was supposed to reciprocate (workers presumably enjoyed a degree of loyalty from their employing organisations) (Schaufeli & Greenglass, 2001). This tendency is now changing. The choice of a career is a complex and multifaceted process that includes all spheres of a person's life (Hall, 1996). According to the existential approach, the choice of a career involves some major issues, and people approach the process with very high hopes and expectations, high ego involvement, and passion. Success and personal fulfilment give highly motivated individuals a sense of existential significance (Pines & Yanai, 2001). When they feel that they have failed, when work does not bring a sense of meaning to their lives, they burn out (Pines, 2000). One of the professions that greatly contributes to South Africa's growing economy, and that also seems to be influenced by this phenomenon, is the engineering profession.

The success of engineers depends largely on the extent and nature of their ability to adapt to, and work with, continual change and challenge. Engineers have to cope with the demands that arise from the nature of their work as well as increased pressure to perform. Engineering is seen as one of the major contributors to South Africa's technological advancement and as a key to wealth creation, helping the country to become an active player in the global economy.

The potential of the engineering profession to contribute towards the success of our country will be significantly influenced by the 'work wellness' of the individuals that operate in these fields of expertise. Economic growth cannot continue without engineers. According to Ferrara (1998) engineers are challenged by keeping up with technology, shortening design cycles and computerising designs. Some of the design objectives include ease of manufacturing, higher quality and lower costs.

Burnout is traditionally construed as a phenomenon occurring among professionals who work with people (Taris, Schreurs & Schaufeli, 1999). According to Schaufeli and Greenglass (2001), burnout may be defined as a state of physical, emotional and mental exhaustion that results from long-term involvement in work situations that are emotionally demanding. The phenomenon of burnout was first identified by Bradley (1969) in a paper on probation officers, and was further elaborated upon by Freudenberger (1974) from his observations of the extreme psychological strain often experienced by workers in the human service professions, such as nurses, police officers, social workers and school teachers (Cooper, Dewe & O'Driscoll, 2001). While stress and burnout in human service professionals constitute a large part of the literature available in the area, individuals in all occupations are vulnerable to burnout (Schaufeli & Greenglass, 2001). According to Schaufeli and Enzmann (1998), there is little theoretical rationale for limiting burnout to human service professions. Ample empirical evidence shows that the stressors that may lead to burnout in the human services can be found in other work settings as well (Buunk, De Jonge, Ybema & De Wolff, 1998; Kahn & Byosiere, 1992).

According to Schutte, Toppinen, Kalimo and Schaufeli, (2000), attempts have been made to measure burnout in occupational groups outside the human services. However, it turned out that the original MBI could not be applied indiscriminately outside the human services – the setting for which it was originally designed. The need for developing a scale that measures burnout in occupational groups other than human service professionals prompted the development of the Maslach Burnout Inventory – General Survey (MBI-GS) (Schaufeli, Leiter, Maslach & Jackson, 1996).

Research on burnout has shown that it could have a negative effect on both organisations and individuals. Burnout has been related to health problems, depression, reduced productivity, absenteeism, and job turnover (Schaufeli & Enzmann, 1998).

These negative outcomes also apply to engineers. According to Lingard (2003), the work environment of engineers is demanding and stressful. The results of the study of Lingard (2003) showed that burnout cannot be attributed to a single cause, but occurs as a result of a complex interaction of individual characteristics and issues in the work environment.

With this in mind, a study of burnout of engineers in South Africa is relevant. Professionals working in the construction industry (civil engineers) may be a high-risk group for burnout, but there has been little research into the burnout issue focusing specifically on the construction industry (Lingard, 1998). No research has been done in South Africa on the topic of burnout in the engineering profession. A reliable measuring instrument will have to be developed to qualify and quantify the construct of burnout.

In light of the above discussion, the lack of empirical research that investigates burnout of engineers in South Africa is a concern. There is limited research in South Africa regarding burnout and engineers. According to Rothmann (2003), an analysis of burnout in South Africa showed a lack of empirical research systematically investigating burnout as well as various limitations (including poorly designed studies, small sample sizes, a lack of sophisticated statistical analyses and poorly controlled studies). The present study is thus a first step towards addressing this need. Researchers currently acknowledge that employees in almost any job can develop burnout (Schaufeli & Enzmann, 1998).

Given the significance of burnout for the individual, it was necessary to have a standardised instrument to measure burnout (Schaufeli & Greenglass, 2001). It is important to use a reliable and valid instrument to measure burnout. The importance of a reliable and valid instrument for the measurement of burnout is evident not only for the purpose of empirical research, but also for individual assessment (Rothmann, 2003). A recent development in burnout research is the adaptation of the original version of the MBI for use outside the human services. The new version is called the MBI-General Survey (MBI-GS: Schaufeli et al., 1996). The Maslach Burnout Inventory (MBI: Maslach et al., 1986) is currently the most widely used research instrument to measure burnout – used in over 90% of empirical research (Schaufeli & Enzmann, 1998). The concept of burnout and its measurements was broadened in the MBI-General Survey to include all employees and not just those who do 'people work' (Maslach & Leiter, 1997).

The research problem is that a reliable and valid instrument to measure burnout of engineers in South Africa does not exist. The MBI-GS has not yet been validated for engineers. The MBI-General Survey (MBI-GS: Schaufeli et al., 1996) will be used to measure burnout. People demand scientific and well thought-out questionnaires. There is sensitivity with regard to the measurement of human behaviour and people tend to question the reliability of measuring instruments. Without these reliable measuring instruments, no norms and models can be developed to predict burnout.

The second research problem is that little information is available regarding the differences between burnout of demographic groups. People do not simply respond to the work setting; rather, they bring unique qualities to the relationship. These personal factors include demographic variables such as age or formal education. Of all the demographic variables that have been studied, age is the one that has been most consistently related to burnout (Maslach, Schaufeli & Leiter, 2001). No research on burnout and gender pertaining to engineers could be found. Research on burnout and gender in other occupations reveals no clear-cut distinction. Leiter and Schaufeli (1996) found a small but consistent difference in that women scored slightly higher on exhaustion and men on depersonalisation. There was reason to believe that there will be differences between demographic groups in terms of burnout.

The objectives of this study were to assess the construct validity and internal consistency of the MBI-GS of engineers in South Africa and to analyse differences between demographic groups.

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

Traditionally, the burnout concept and its measurement are closely linked to the human services where professionals do 'people work' (Maslach & Schaufeli, 1993). However, it turned out that the original MBI-HSS could not be applied indiscriminately outside the human services – the setting for which it was originally designed (Maslach & Jackson, 1986). The need for developing a scale that measures burnout in occupational groups other than human service professionals prompted the development of the Maslach Burnout Inventory – General Survey (MBI-GS) (Schaufeli et al., 1996). The MBI-GS measures respondents' relationships with their work on a continuum from engagement to burnout (Schaufeli & Greenglass, 2001).

The MBI-GS comprises three subscales that parallel those of the original MBI: Exhaustion (Ex), Cynicism (Cy) and Professional Efficacy (PE). The MBI-GS assesses the same three dimensions as the original measure, using slightly revised items, and maintains a consistent factor structure across a variety of occupations (Maslach et al., 2001). Maslach and Jackson (1986) suggest that the three subscales be dealt with separately, based on considerable factor-analytical support for their separation (Maslach & Jackson, 1986; Schaufeli & Janczur, 1994).

The exhaustion component in the MBI-GS is generic; i.e. without direct reference to people as the source of those feelings as in the MBI emotional exhaustion subscale. In a similar vein, cynicism reflects indifferences or a distant attitude towards one's work in general, rather than towards recipients of one's services. Professional efficacy covers a broader scope than personal accomplishment because social and non-social aspects of occupational accomplishments are included (Schutte et al., 2000).

The MBI-GS has good psychometric properties such as cross-national factor validity and construct validity (Leiter & Schaufeli, 1996; Taris et al., 1999). According to Schutte et al. (2000), the MBI-GS is encouraging: its factorial validity across nations and occupational groups is largely confirmed, its subscales are internally consistent and most differences in levels of burnout are in line either with previous research or with theorising.

According to Taris et al. (1999), it appears that burnout can validly be measured across a range of different occupations, despite the qualitative differences between contactual and non-contactual professions. The strong resemblance between the two versions of the MBI ensures maximum comparability of results obtained for one occupational group to another. According to the study of Storm and Rothmann (2003), the MBI-GS seems to be a suitable instrument for measuring burnout among police members in the SAPS. The MBI-GS was also used in the research of Rothmann and Malan (2003) to measure burnout in social workers. In the study of Rothmann (2004) senior managers were also measured by the MBI-GS to determine their burnout levels.

Storm and Rothmann (2003) confirmed the three-factor structure of the MBI-GS in a sample of 2 396 SAPS members, but recommended that Item 13 ("I just want to do my job and not be bothered") be dropped from the questionnaire. Confirmatory factor analysis by Rothmann (2004), Rothmann and Malan (2003), and Kruger, Veldman, Rothmann and Jackson (2002) consistently showed low loadings on item 13. According to Schutte et al. (2000) the ambivalent nature of this item is likely to cause problems.

This study will also focus on burnout measures that are applied to various demographic characteristics. Rothmann (2003) confirmed that biographical characteristics that could explain burnout include age, work experience and gender. According to Schaufeli (2003) impressive cross-sectional evidence exists on the relationship of burnout with such job attitudes as job dissatisfaction, poor organisation communication and intention to quit. According to Rothmann (2003) burnout is observed more often among younger employees compared with those older than 30 or 40 years. According to Maslach et al. (2001) some studies found that those with a higher level of education report higher levels of burnout than less educated employees. It is possible that people with higher education have jobs with greater responsibilities and higher stress. Age is confounded with work experience, so burnout appears to be more of a risk earlier in one's career. Burnout is negatively related to work experience. Women tend to score higher on emotional exhaustion, whereas men score higher on depersonalisation. In order to gather information with regard to demographic characteristics of engineers, a questionnaire was developed.

The above discussion leads to the following hypotheses:

- H1: Burnout, as measured by the MBI-GS is a three dimensional construct and the MBI-GS shows high internal consistency.
- H2: There is a relationship between burnout and various demographic characteristics, namely age, years of experience, job levels, and job satisfaction levels.

METHOD

Research design

A survey design was used to achieve the research objectives. The specific design is the cross-sectional design where a sample is drawn from a population at a particular point in time. The cross-sectional design will be used, because the focus is on describing the differences among two or more populations. Cross-sectional designs can also be used to assess interrelationships among variables within a population (Shaughnessy & Zechmeister, 1997). However, the cross-sectional design is the most appropriate design for the validation of the MBI-GS.

Participants

Random samples ($N= 369$) were taken from engineers in South Africa that are professionally registered with ECSA (Engineering Council of South Africa). The random sampling was carried out with the help of the SAS Program (SAS Institute, 2000). Registered professional engineers were listed numerically on the grounds of registration numbers – the ECSA registration numbers are based on year of registration with additional numeric digits. Questionnaires were posted to the selected individuals and each engineer was asked to complete the questionnaire. All questionnaires were completed anonymously and treated as confidential.

Table 1 presents some of the characteristics of the participants.

Table 1
Characteristics of the Participants

Item	Category	Frequency	Percentage
Environment	Mining	53	14,48
	Manufacturing	21	5,74
	Design and construction	56	15,30
	Petrochemical	68	18,58
	Energy and telecommunication	21	5,74
	Consulting	95	25,96
	Other	52	14,21
Job level	Engineer in training (1)	5	1,37
	Junior management (2)	22	6,04
	Middle management (3)	110	30,22
	Senior management (executive level) (4)	116	31,87
	Specialist (5)	35	9,62
	Consulting (6)	61	16,76
	Other	15	4,12
Age	18-27 (1)	11	3,02
	28-32 (2)	62	17,03
	33-38 (3)	46	12,64
	39-44 (4)	54	14,86
	45-50 (5)	65	17,86
	51-56 (6)	53	14,56
	> 56 (7)	73	20,05
Race	White	338	92,60
	Black	11	3,01
	Coloured	3	0,82
	Indian	10	2,74
	Other	3	0,82
Education level	Grade 12	2	0,54
	Technical college diploma	2	0,54
	Technicon diploma	8	2,18
	University degree	189	51,50
	Postgraduate degree	166	45,23
Gender	Male	346	94,79
	Female	19	5,21
Home language	Afrikaans	197	53,97
	English	159	43,56
	African	9	2,45

The sample consisted mostly of males (94,78%), which is a representation of the gender spread of the population in engineering. Almost half of the participants (45,23%) had postgraduate education. The mean age of participants was 45,68 years, while the mean length

of work experience in the field of engineering was 20,96 years. Job satisfaction and own performance was rated 3,83 and 4,18 respectively out of a possible rating of 5. This indicates that individuals rate their job satisfaction more than average and see their own performance as 'exceeding requirements'.

Instruments

The Maslach Burnout Inventory – General Survey (MBI-GS) (Schaufeli et al., 1996) was used in this study. The MBI-GS (Schaufeli et al., 1996) measures respondents' relationships with their work on a continuum from engagement to burnout. The MBI-GS has three subscales: Exhaustion (five items, e.g. "I feel used up at the end of the workday"), Cynicism (five items, e.g. "I have become less enthusiastic about my work") and Professional Efficacy (six items, e.g. "In my opinion, I am good at my job"). Together the subscales of the MBI-GS provide a three-dimensional perspective on burnout. Internal consistencies (Cronbach alpha coefficients) reported by Schaufeli et al. (1996) varied from 0,87 to 0,89 for Exhaustion, 0,73 to 0,84 for Cynicism and 0,76 to 0,84 for Professional Efficacy. Test-retest reliabilities after one year were 0,65 (Exhaustion), 0,60 (Cynicism) and 0,67 (Professional Efficacy) (Schaufeli et al., 1996). All items are scored on a seven-point frequency rating scale ranging from 0 (*never*) to 6 (*daily*). Storm and Rothmann (2003) confirmed the three-factor structure of the MBI-GS in a sample of 2396 SAPS members. Structural equivalence of the MBI-GS for different race groups in the SAPS was confirmed. The following Cronbach alpha coefficients were obtained for the MBI-GS: Exhaustion: 0,88; Cynicism: 0,79; Professional Efficacy: 0,78 (Storm & Rothmann, 2003).

A questionnaire was developed to gather information about the demographic characteristics of the participants. Other information that was gathered included age, gender, race, years practising in engineering discipline, ECSA registration, marital status, Certificate of competence, job level, education level, marital status, language, self-rated performance, self-rated job satisfaction, number of alcoholic drinks per week, smoking behaviour, number of cigarettes per day.

Statistical analysis

The statistical analysis was carried out with the help of the SAS Program (SAS Institute, 2000). Cronbach alpha coefficients and inter-item correlation coefficients were used to assess the reliability of the MBI-GS. Descriptive statistics (e.g. means, standard deviations, skewness and kurtosis) were used to analyse the data.

Structural equation modelling (SEM) methods as implemented by AMOS (Arbuckle, 1997) were used to test the factorial model for the MBI-GS, using the maximum likelihood method. Hypothesised relationships are tested empirically for goodness-of-fit with the sample data. The χ^2 statistic and several other goodness-of-fit indices summarise the degree of correspondence between the implied and observed covariance matrices. Jöreskog and Sörbom (1993) suggest that the χ^2 value may be described more accurately as a badness-of-fit (rather than a goodness-of-fit) measure in the sense that a small χ^2 value is indicative of good fit. However, because the χ^2 statistic equals $(N - 1)F_{\min}$, this value tends to be substantial when the model does not hold and the sample size is large (Byrne, 2001). A large χ^2 relative to the degrees of freedom is more commonly found, and indicates a need to modify the model to fit the data better (Jöreskog & Sörbom, 1993). Researchers have addressed the χ^2 limitations by developing goodness-of-fit indices that take a more pragmatic approach to the evaluation process. One of the first fit statistics to address this problem was the χ^2 /degrees of freedom ratio (CMIN/DF) (Wheaton, Muthén, Alwin & Summers, 1977). A value < 2 indicates acceptable fit (Tabachnick & Fidell, 2001). Various criteria, commonly referred to as "subjective" or "practical" indices of fit, are typically used as adjuncts to the χ^2 statistic.

The standardised RMR represents the average value across all standardised residuals, and ranges from zero to 1,00. A well-fitting model will require a value of 0,08 or less (Byrne, 2001). The Goodness-of-Fit Index (GFI) indicates the relative amount of the variances/covariances in the sample predicted by the estimates of the population. It usually varies between 0 and 1 and a result of 0,90 or above indicates a good model fit. The Adjusted Goodness-of-Fit Index (AGFI) is a measure of the relative amount of variance accounted for by the model, corrected for the degrees of freedom in the model relative to the number of variables. The GFI and AGFI can be classified as absolute indices of fit because they basically compare the hypothesised model with no model at all (Hu & Bentler, 1995).

Although both indices range from zero to 1,00, the distribution of the AGFI is unknown; consequently no statistical test or critical value is available (Jöreskog & Sörbom, 1986).

The Normed Fit Index (NFI) is used to assess global model fit. The NFI represents the point at which the model being evaluated falls on a scale running from a null model to perfect fit. This index is normed to fall on a 0 to 1 continuum. Marsh, Balla and Hau (1996) suggest that this index is relatively insensitive to sample sizes. The Comparative Fit Index (CFI) represents the class of incremental fit indices in that it is derived from the comparison of a restricted model (i.e. one in which structure is imposed on the data) with that of an independence (or null) model (i.e. one in which all correlations among variables are zero) in the determination of goodness-of-fit. The Tucker-Lewis Index (TLI) (Tucker & Lewis, 1973) is a relative measure of covariation explained by the model that is specifically developed to assess factor models. For these fit indices (NFI, CFI and TLI), it is more or less generally accepted that a value of less than 0,90 indicates that the fit of the model can be improved (Hoyle, 1995), although a revised cut-off value close to 0,95 has recently been advised (Hu & Bentler, 1999).

To overcome the problem of sample size, Browne and Cudeck (1993) suggest using the Root Mean Square Error of Approximation (RMSEA) and the 90% confidence interval of the RMSEA. The RMSEA estimates the overall amount of error; it is a function of the fitting function value relative to the degrees of freedom. The RMSEA point estimate should be 0,05 or less in order to indicate good fit, and the upper limit of the confidence interval should not exceed 0,08. Hu and Bentler (1999) suggest a value of 0,06 to be indicative of good fit between the hypothesised model and the observed data. MacCallum, Browne and Sugawara (1996) recently elaborated on these cut-off points and noted that RMSEA values ranging from 0,08 to 0,10 indicate mediocre fit, and those greater than 0,10 indicate poor fit.

Multivariate analysis of variance (MANOVA) was used to determine the significance of differences between the burnout (exhaustion, cynicism and professional efficacy) of demographic groups. MANOVA tests whether mean differences among groups on a combination of dependent variables are likely to have occurred by chance (Tabachnick & Fidell, 2001). In MANOVA a new dependent variable that maximises group differences is created from the set of dependent variables. One-way analysis is then performed on the newly created dependent variable. Wilk's lambda was used to test the significance of the effects.

Wilk's lambda is a likelihood ratio statistic that tests the likelihood of the data under the assumption of equal population mean vectors for all groups against the likelihood under the assumption that the population mean vectors are identical to those of the sample mean vectors for the different groups. When an effect was significant in MANOVA, ANOVA was used to discover which dependent variables were affected. Because multiple ANOVAS were used, a Bonferroni-type adjustment was made for inflated Type 1 error. Tukey tests were done to indicate which groups differed significantly when ANOVAS were done.

T-tests were used to determine differences between the groups in the sample. Effect sizes (Cohen, 1988; Steyn, 1999) were used in addition to statistical significance to determine the significance of relationships. Effect sizes indicate whether obtained results are important (while statistical significance may often show results which are of little practical relevance). The use of only statistical significance testing in a routine manner has been criticised and appeals have been made by editors of some periodicals to place more emphasis on effect sizes (Steyn, 1999). The following formula was used to determine the practical significance of differences (d) when t-tests were used (Steyn, 1999):

$$d = \frac{Mean_A - Mean_B}{SD_{MAX}}$$

where

$Mean_A$ = Mean of the first group

$Mean_B$ = Mean of the second group

SD_{MAX} = Highest standard deviation of the two groups

The following formula was used to determine the practical significance of means of more than two groups (Steyn, 1999):

$$d = \frac{Mean_A - Mean_B}{\sqrt[3]{MSE}}$$

where

$Mean_A$ = Mean of the first group

$Mean_B$ = Mean of the second group

Root MSE = Root Mean Square Error

A cut-off point of 0,50 (medium effect) (Cohen, 1988) was set for the practical significance of differences between means.

RESULTS

Structural equation modelling (SEM) methods, as implemented by AMOS (Arbuckle, 1997), were used to test the factorial model for the MBI-GS. Data analyses proceeded as follows: first, a quick overview of model fit was done by looking at the overall χ^2 value, together with its degrees of freedom and probability value. Global assessments of model fit were based on several goodness-of-fit statistics (GFI, AGFI, PGFI, NFI, TLI, CFI and RMSEA); secondly, given findings of an ill-fitting initially hypothesised model, analyses proceeded in an exploratory mode. Possible misspecifications as suggested by the so-called modification indices were looked for, and eventually a revised, re-specified model was fitted to the data.

Hypothesised model

A one-factor model was tested. However, a statistically significant χ^2 value of 1207 ($df = 104$; $p = 0,000$) revealed a poor overall fit of the model with the data. All other indices indicated a poor fit between a hypothesised one-factor model and the data. Table 2 presents fit statistics for the test of this model.

Table 2

Goodness-of-Fit Statistics for a One-Factor MBI-GS Model

Model	χ^2	χ^2 / df	GFI	AGFI	PGFI	NFI	TLI	CFI	RMSEA
1 Factor	1207,04	11,61	0,60	0,48	0,62	0,58	0,54	0,60	0,17

The statistical values of this model revealed a relatively poor overall fit of the originally hypothesised MBI model as indicated by the RMSEA value (must be $< 0,08$), χ^2 1207,04

(must be near 0 for a good fit) and χ^2/df 11,61 (must be < than 5). This hypothesised model was not that good from a practical perspective. The PGFI value lower than 0,80, NFL, TLI and CFI values lower than 0,95 and RAMSEA value higher than 0,05 are indicative of failure to confirm the hypothesised model. Following the above-mentioned procedure, the full hypothesised three-factor model consisting of all 16 items was tested. Table 3 presents fit statistics for the test of this model.

Table 3

Goodness-of-Fit Statistics for the Hypothesised Three-Factor MBI-GS Model

Model	χ^2	χ^2/df	GFI	AGFI	NFI	TLI	CFI	RMSEA
Model 2	367,34	3,64	0,66	0,84	0,73	0,89	0,90	0,08

Post hoc analyses

Table 3 shows that the model fit statistics did improve. However, the CFI (< 0,90) indicates that the model fit is not optimal and that there is still a possibility for improvement. Given rejection of the initially postulated three-factor model, the focus shifted from model testing to model development. It was decided to re-specify the model with item 13 deleted because of the item's high cross-loading. The NFI value is still lower than 0,95, but an improvement on model 1. All subsequent analyses are now based on the 15-item revision, which is labelled here as Model 2. It is apparent that some modification in specification is needed in order to determine a model that better represents the sample data. The improved fit statistics are presented in Table 4.

Table 4

Goodness-of-Fit Statistics for Model 2 of the MBI-GS

Model	χ^2	χ^2/df	GFI	AGFI	NFI	TLI	CFI	RMSEA
3 Factor	342,15	3,93	0,88	0,84	0,88	0,89	0,91	0,09

The statistically significant χ^2 value of 342,15 ($df = 3,93$; $p = 0,00$) revealed a relatively poor overall fit of the originally hypothesised MBI model. However, both the sensitivity of the likelihood ratio test to sample size and its basis on the central χ^2 distribution, which assumes

that the model fits perfectly in the population, have been reported to lead to problems of fit. Jöreskog and Sörbom (1993) pointed out that the use of χ^2 is based on the assumption that the model holds exactly in the population, which is a stringent assumption. A consequence of this assumption is that models that hold approximately in the population will be rejected in a large sample. Furthermore, the hypothesised model (Model 2) was also not that good from a practical perspective. The NFI value lower than 0,95 indicated areas that could be improved on in terms of fit. It is apparent that some modification in specification is needed in order to determine a model that better represents the sample data.

If one looked at the regression weights, one parameter item 13 stood apart from the rest because of a low factor loading. This might be caused by the ambivalence of the particular item. Modification indexes (MI) were considered to pinpoint areas of misspecification in the model. It was decided to re-specify the model with this to ensure a better model fit.

Post hoc analyses

Given rejection of the initially postulated model, the focus shifted from model testing to model development (exploratory factor analysis). All subsequent analyses are now based on the 15-item revision, which is labelled here as Model 3. The fit statistics are presented in Table 5.

Table 5
Goodness-of-Fit Statistics for Model 3 of the MBI-GS

Model	χ^2	χ^2/df	GFI	AGFI	NFI	TLI	CFI	RMSEA
Model 3	300,57	3,49	0,89	0,89	0,89	0,90	0,92	0,08

The statistical values did improve, but there is a possibility for further improvement. The NFI value lower than 0,95 indicated areas that could be improved on in terms of fit. It is apparent that some modification in specification is needed in order to determine a model that better represents the sample data. The improved fit statistics are presented in Table 6.

Table 6

Goodness-of-Fit Statistics for Model 4 of the MBI-GS

Model	χ^2	χ^2 / df	GFI	AGFI	NFI	TLI	CFI	RMSEA
Model 3	212,18	2,95	0,89	0,89	0,92	0,93	0,92	0,07

Although the statistical values did improve, the cut-off points are not yet ideal. It was decided to re-specify the model with item 7 additionally deleted because of the item's high cross-loading. The model fit statistics did improve because modification indexes (MI 15,76) were considered to pinpoint areas of misspecification in the model. The constrained exhibiting the highest degree of misfit lay in the error covariance matrix and represent a correlation between error 14 and 15 (MI =12,87) The fit statistics are presented in Table 7.

Given rejection of the initially postulated model, the focus shifted from model testing to model development (exploratory factor analysis). The NFI value is still lower than 0,95, which is an improvement on model 3. Considering the high cross-loading of Item 7, it was decided to re-specify the model with this item deleted. All subsequent analyses are now based on the 14-item revision, which is labelled here as Model 4. It is apparent that some modification in specification is needed in order to determine a model that better represents the sample data.

The fit statistics are presented in Table 7.

Table 7

Goodness-of-Fit Statistics for Model 5 of the MBI-GS

Model	χ^2	χ^2 / df	GFI	AGFI	NFI	TLI	CFI	RMSEA
Model 5	196,05	71	0,93	0,89	0,92	0,94	0,95	0,07

The fit statistics in Table 7 indicate a good fit for the re-specified model. Although the NFI value is still lower than 0,95, is it an improvement on model 4. All the other fit statistics indicate excellent fit of the measurement model to the data. Since this model fit was

satisfactory and the results agreed with the theoretical assumptions underlying the structure of the MBI-GS, no further modifications of the model were deemed necessary.

The descriptive statistics, alpha coefficients and inter-item correlations of the three factors of the MBI-GS are given in Table 8.

Table 8
Descriptive Statistics, Alpha Coefficients and Mean Inter-Item Correlation Coefficients of the MBI-GS

Item	Mean	SD	Skewness	Kurtosis	$r(\text{Mean})$	α
Exhaustion	11,75	6,40	0,45	-0,20	0,56	0,86
Cynicism	6,50	5,25	0,80	0,03	0,55	0,83
Professional efficacy	24,71	4,14	-1,08*	1,33*	0,52	0,84

* High skewness and kurtosis

The coefficient alphas for the three factors compare well with the guideline of 0,70 (Nunnally & Bernstein, 1994). The mean inter-item correlations of the factors are close to the guideline of $0,15 < r < 0,50$ (Clark & Watson, 1995). These results provide support for hypothesis 1 in terms of internal consistency and validity of the MBI-GS for engineers in South Africa.

Table 9
MANOVA of Differences between Burnout of Demographic Groups

	Value	F	Df	Den DF	p
Environment	0,94	1,27	18	1010,20	0,20
Job level	0,91	1,93	18	1004,60	0,01*
Age category	0,86	3,11	18	1004,60	0,00*
Years experience	0,88	2,51	18	990,43	0,00*
Performance	0,60	16,80	12	958,05	0,00*
Job satisfaction	0,46	27,62	12	958,05	0,00*

* Statistically significant difference: $p < 0,01$

In an analysis of Wilk's lambda values, no difference regarding burnout levels could be found between the different engineering environments. Statistically significant differences ($p < 0,01$)

were found between burnout of job levels, age categories, years of experience, performance and job satisfaction. Next, the demographic variables that showed statistically significant differences were analysed.

The relationship between burnout and job levels was analysed to determine practical significance, using ANOVA, followed by Tukey HSD tests. The results are given in Table 10.

Table 10
ANOVA of Differences between Burnout and Job Levels

Item	1	2	3	4	5	6	7	<i>p</i>	Root MSE
Exhaustion	11,60	15,00	12,26	11,91	10,49	10,56	10,33	0,10	6,39
Cynicism	8,40	8,14	7,12	5,95	5,89	5,98	6,67	0,36	5,27
Professional efficacy	20,40 ^b	23,00	24,29	25,53	24,23	25,66 ^a	22,67	0,00 ^a	4,07

* Statistically significant ($p \leq 0,01$)

a. Practically significant difference from job level where b ($d > 0,50$, medium effect) or c ($d > 0,80$, large effect) is indicated.

Table 10 shows that consultants experienced practically significant higher levels of professional efficacy than engineers in training. No practically significant differences were found in terms of exhaustion and cynicism.

The relationship between burnout and age category was further analysed to determine practical significance using ANOVA, followed by Tukey HSD tests, and the results are given in Table 11.

Table 11

ANOVA of Differences between Burnout and Age Category

Item	1	2	3	4	5	6	7	<i>p</i>	Root MSE
Exhaustion	12,27 *	12,73	12,35	14,70	12,28	12,00	7,93 ^b	0,00*	6,07
Cynicism	7,64	7,69	6,24	7,48	6,32	6,83	4,90	0,05	5,22
Professional efficacy	21,55	24,01	24,67	24,41	24,55	25,06	25,87	0,02	4,10

* Statistically significant ($p \leq 0,01$)

a. Practically significant difference from job level where b ($d > 0,50$, medium effect) or c ($d > 0,80$, large effect) is indicated.

The results in Table 10 show that there are practically significant difference between the age groups 39 to 44 and individuals older than 56 for the construct exhaustion; exhaustion is a maximum in the middle of the age category range (39 to 44) and lowest for individuals older than 56 years. No practically significant differences were found in terms of professional efficacy and cynicism.

The relationship between burnout and years experience was further analysed to determine practical significance using ANOVA, followed by Tukey HSD tests, and the results are given in Table 12.

Table 12

ANOVA of Differences between Burnout and Years Experience

Item	1	2	3	4	5	6	7	<i>p</i>	Root MSE
Exhaustion	12,38	12,48	12,77	13,85 ^a	12,46	12,44	8,85 ^b	0,00*	6,22
Cynicism	6,90	7,03	6,64	6,90	7,22	6,24	5,42	0,45	5,24
Professional efficacy	22,41 ^b	24,57	23,98	25,10	24,15	25,27	25,95 ^a	0,00*	4,08

* Statistically significant ($p \leq 0,01$)

a. Practically significant difference from job level where b ($d > 0,50$, medium effect) or c ($d > 0,80$, large effect) is indicated.

The results in Table 12 show that there are practically significant differences between the groups 16 to 22 and 31 to 45 for the construct exhaustion. Exhaustion peaks in the middle group (16 to 22 years experience) and reduces to a minimum for the group with the most years of experience (31 to 45 years). This is also true for professional efficacy for the groups 0 to 5 and 31 to 45 in terms of years of experience. Professional efficacy is the lowest in the

group with the least years of experience and it grows to a maximum for the group with the most years of experience. No practically significant differences were found in terms of cynicism.

The relationship between burnout and performance was further analysed to determine practical significance using ANOVA, followed by Tukey HSD tests, and the results are given in Table 13.

Table 13
ANOVA of Differences between Burnout and Performance

Item	1	2	3	4	5	<i>p</i>	Root MSE
Exhaustion	15,50	15,50	13,02	12,67	9,73	0,00*	6,26
Cynicism	16,00 ^a	15,67	9,96	6,96	4,06 ^b	0,00*	4,73
Professional efficacy	19,00	16,83 ^c	20,11	24,41	27,19 ^a	0,00*	3,38

* Statistically significant ($p \leq 0,01$)

a. Practically significant difference from job level where b ($d > 0,50$, medium effect) or c ($d > 0,80$, large effect) is indicated.

Columns 1 to 5 represent a five-point scale indicating self-rated performance, with 1 representing low and 5 representing high performance. The results in Table 13 show that there is a practically significant difference between low and high performance (1 and 5) for cynicism; the same accounts for underperformance and high performance (2 and 5) for professional efficacy. No practical significant difference was found in terms of exhaustion. The results for exhaustion and cynicism reflect that people experience higher levels when they rate their own performance lower and they rate their performance higher as levels decrease. Professional efficacy has an increasing trend as individuals experience and rate their performance improving.

The relationship between burnout and job satisfaction was further analysed to determine practical significance using ANOVA, followed by Tukey HSD tests, and the results are given in Table 14.

Table 14

ANOVA of Differences between Burnout and Job Satisfaction

Item	1	2	3	4	5	<i>p</i>	Root MSE
Exhaustion	17,92 ^a	16,29	15,19	10,55	9,18 ^b	0,00*	5,82
Cynicism	15,25 ^a	13,54	10,30	5,23	2,79 ^c	0,00*	3,75
Professional efficacy	20,92	19,71 ^d	23,19	25,10	26,99 ^a	0,00*	3,60

* Statistically significant ($p \leq 0,01$)

a. Practically significant difference from job level where b ($d > 0,50$, medium effect) or c ($d > 0,80$, large effect) is indicated.

Columns 1 to 5 represent a five-point scale indicating job satisfaction, with 1 being 'very unsatisfied', 3 neutral and 5 'very satisfied'. For both the constructs of exhaustion and cynicism the highest levels are experienced when job satisfaction is low and it decreases as job satisfaction increase with lowest levels when the individuals are very satisfied. Professional efficacy shows a general trend to increase with growing levels of job satisfaction. The results in Table 14 show that there are practically significant differences between the exhaustion, cynicism and professional efficacy of engineers with different levels of job satisfaction.

DISCUSSION

The aim of this study was to determine the construct validity and internal consistency of the Maslach Burnout Inventory – General Survey (MBI-GS) for engineers in South Africa and to determine the differences between the burnout and engagement levels of various demographic groups. A three-factor structure was confirmed using the structural equation modelling approach, which is consistent with research findings across various samples, occupational groups and countries (Leiter & Schaufeli, 1996; Schaufeli, Salanova, González-Romá and Bakker, 2002; Schutte et al., 2000; Storm & Rothmann, 2003; Taris et al., 1999). Reliability analysis revealed that all three subscales were sufficiently internally consistent.

Based on empirical grounds, two items (7 and 13) were deleted from the original MBI-GS to ensure adequate model fit, resulting in a 14-item scale. Item 7 was probably unsuitable for engineers because a quarter of the participants are working as consultants and are not directly involved with a specific organisation. (Item 7 is worded as follows: "I feel I am making an effective contribution to what this organisation does.") Item 13 is worded as follows: "I just

want to do my work and not be bothered." Schutte et al. (2000) also excluded item 13 in a cross-national study on the factorial validity of the MBI-GS. This is because a high score may indicate disengagement and social isolation. A high score may also indicate strong motivation and engagement: the respondent concentrates on his or her work and does not welcome interruptions (Rothmann & Storm, 2003). The results obtained using the structural equation modelling approach supported a three-dimensional factor structure. Elimination of item 13 is consistent with previous research (Storm & Rothmann, 2003; Campbell & Rothmann, in press) and should not be regarded as a model specification to fit data.

Errors within subscales were allowed to correlate in order to improve model fit. According to Aish and Jöreskog (1990), correlated errors may be derived from specified characteristics of either respondents or the items of a survey. Correlated errors may occur because of the overlap in item content (when items asked the same question, but worded them differently) (Byrne, 2001). Correlated errors 9 and 10 were item 14 "I have become more cynical about whether my work contributes anything" and item 15 "I doubt the significance of my work." Correlated errors 3 and 4 were item 3 "I feel tired when I get up in the morning and have to face another day on the job" and item 4 "Working all day is really a strain for me." Correlated errors 14 and 15 were item 11 "I feel exhilarated when I accomplish something at work" and item 15 "I doubt the significance of my work."

The second objective of the study was to investigate the relationship between burnout and various demographic characteristics i.e. age, job levels, years of experience, performance and job satisfaction. In an analysis of Wilk's lambda values, no difference regarding burnout levels could be found between the different engineering environments i.e. mining, electrical, civil, process, metallurgy and industrial. Statistically significant differences were found between burnout and job levels, age, years of experience, performance and job satisfaction. These relationships were further analysed to determine practical significance. The results indicated that older engineers with more years of experience experienced practically significant higher levels of exhaustion than younger engineers fairly new in the profession. One explanation for this could be that older engineers experience exhaustion and depletion of emotional and physical resources, because the complexity of their work and their responsibilities are higher than their younger counter parts. Engineers in senior positions with many years of experience also experienced practically significant higher levels of professional efficacy than engineers who are in junior positions with few years of experience.

A possible explanation could be that managers in senior positions experience themselves at work as highly competent because of their achievements and career successes. Practically significant differences were experienced between underperforming engineers with low levels of job satisfaction and high performing individuals with high levels of job satisfaction in terms of cynicism.

Engineers who suffer from burnout were more dissatisfied with their work and then perform poorly. Employees' satisfaction with aspects of their jobs may influence their motivation, which, in turn, could affect their performance (Makin, Cooper & Cox, 1996). The results of the study confirmed the findings that burnout is associated with job dissatisfaction (Campbell & Rothmann, in press). According to Campbell and Rothmann (in press), it is not clear whether burnout causes people to be dissatisfied with their jobs, or whether job dissatisfaction causes burnout. Large effects were lastly experienced for professional efficacy and cynicism that were statistically significant for performance and satisfaction.

No practically significant differences between job levels were found in terms of cynicism and exhaustion thus indicating that individuals on all levels can experience cynicism and exhaustion. Also no practically significant differences for age in terms of professional efficacy and cynicism, and years of experience in terms of cynicism were found. There are also no practically significant differences between performance in terms of exhaustion, and between job satisfaction in terms of professional efficacy. The results of the study confirm the findings of Campbell and Rothmann (in press) that no practically significant differences between levels of job satisfaction were found in terms of professional efficacy.

In conclusion, based on the results obtained in this study, it seems that the MBI-GS is a suitable instrument for measuring burnout of engineers in South Africa. This study could serve as a reference for engineers regarding burnout levels in South Africa. The three-factor structure and internal consistency of the burnout construct were confirmed.

A limitation of this study was that the sample was too small to determine structural equivalence of the MBI-GS for different race and language groups, and different engineering categories. The underrepresentation of young engineers is a concern, as young engineers are exposed to extreme stressors during the first years of their careers. Further research, using a

longitudinal design, can be conducted to overcome these limitations and obtain a fuller picture of the burnout experience of engineers.

RECOMMENDATIONS

Based on the results of this study, it is recommended that the MBI-GS be used to assess burnout of engineers. Item 7 and 13 should, however, be left out when administering the questionnaire.

Institutions and businesses that employ engineers can reduce burnout firstly by recruiting the best individuals for the relevant positions. If an improved job-person fit can be achieved, employees are likely to feel more empowered and that they are doing something important, thus curbing the negative effects of stress, such as burnout (Lingard, 2003). Career development should be proactively managed through consultation by human resource consultants or industrial psychologists to enable focused career planning and personal career path development for engineers.

It seems that age correlated with burnout. Organisations should focus on burnout and must create an awareness of the causes and symptoms of burnout. A causal model of burnout should be developed and integrated with the career development of engineers. The area of physical wellness should be addressed and developed with specific focus on stress, exercise, eating the right kinds of food and relaxation. The area of mental capacity can also be addressed through encouraging engineers to get mental stimulation through reading a wide variety of media on different topics and to have hobbies that can be personally fulfilling. The last area to focus on is the spiritual dimension. Spiritual activities help inspire people, and it will help them discover and understand their mission and purpose in life.

Although this study found the MBI-GS to be reliable and confirmed the three-factor structure, it is suggested that future research should focus on the MBI-GS in other occupation samples in South Africa to verify the current findings. More young people should be included and evaluated in research regarding burnout. The impact of career counselling and orientation should form part of any future research with regard to burnout studies and proactive management thereof.

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OCCUPATIONAL STRESS OF ENGINEERS IN SOUTH AFRICA

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ABSTRACT

The objectives of this study were to determine the occupational stressors of engineers in South Africa and to determine whether organisational commitment moderates the effect of occupational stressors on health outcomes. A cross-sectional survey design was used. The sample consisted of ($N = 369$) engineers in South Africa. The ASSET questionnaire was administered. Compared to normative data, participants reported lower levels of physical ill-health and psychological outcomes of stress. The most important stressors identified were work-life balance, work demands and work overload. The results do not support previous findings that commitment has a protective effect against the negative consequences of workplace stress. The buffer hypotheses of organisational commitment is not supported by the data.

OPSOMMING

Die doelstelling van hierdie studie was om beroepstressore van ingenieurs in Suid-Afrika te bepaal en ook om vas te stel of organisasieverbondenheid 'n modererende effek op werkstressore en gesondheidsuitkomst het. 'n Dwarsdeursnee opname-ontwerp is gebruik. Die steekproef het bestaan uit ($N = 369$) ingenieurs in Suid-Afrika. Die ASSET-vraelys is afgeneem. Deelnemers het beduidend laer vlakke van fisieke ongesondheid en psigologiese uitkomst van stres gerapporteer. Werk-lewe-balans, werkseise en werkoorlading is as die belangrikste stressore geïdentifiseer. Die resultate het aangetoon dat organisasieverbondenheid nie 'n beskermende effek op negatiewe uitkomstes van stres in die werkplek het nie. Die beskermingshipotese van organisasieverbondenheid word nie deur hierdie data ondersteun nie.

Work stress has become one of the most serious health issues in the modern world (Lu, Cooper, Kao & Zhou, 2003). The Health and Safety Executive (2001) describes how ill-health (both physical and mental) can result if stress is prolonged or intense. According to Johnson and Cooper (2003), workplace stress and its potential negative impact on employees have been well documented. However, the negative impact of stress on employees is only part of the full story, since the organisation itself can also expect to experience negative outcomes (Johnson & Cooper, 2003). Workplace stress can lead to increased medical costs, higher rates of absenteeism and turnover, more accidents, and worse performance (Sui, 2003).

Stress is not a factor that resides in the individual or the environment; rather, it is embedded in an ongoing process that involves individuals contracting with their environments, making appraisal of those encounters, and attempting to cope with the issues that arise. At the heart of the transactional definition is the idea that stress is a dynamic cognitive state (Cooper, Dewe & O'Driscoll, 2001). It is a disruption in homeostasis or an imbalance that gives rise to a requirement for resolution of that imbalance or restoration of homeostasis (Dewe, 1993). Stress occurs when the magnitude of the stressor exceeds the individual's capacity to cope (Siu, Spector, Cooper, Lu & Yu, 2002).

In terms of the current research, occupational stress of engineers is studied. It presents an appealing context for the study of occupational stress because of extremely high job demands engineers have been faced with. The association of professional engineers, scientists and managers, Australia (APESMA, 2000), report that more than a quarter of respondents (engineers) believed that there had been an increase in health problems as a result of their working lives. The most common ailments they identified were those related to excessive workloads, such as constant tiredness (60%) and stress (70%). According to Lingard (2003), companies operate in a highly competitive market with relatively low profit levels, completing construction projects within tight deadlines and budget constraints. With the threat of significant penalties for time overruns, work hours are often long and sometimes irregular. A recent survey confirmed that Australian engineers experience considerable time-related work pressures (APESMA, 2000).

Increased productivity and change in the workplace have become an integral part of an engineer's working life. Engineers' key performance areas are structured by the company

according to the business needs. It is possible that many engineers feel that their skills and expertise are not fully utilised, which may lead to career frustration. Lack of stimulation, underutilisation of skills, and boredom characterise many blue-collar occupations, and may also be dangerous (Cooper et al., 2001). Many engineers enter the world of work with great career expectations, but many organisations do not focus on potential development. The individual is thus not afforded the opportunity to use acquired skills or to develop full potential ability (Cooper et al., 2001). According to Karasek and Theorell (1990), it is not the demands of work itself but the organisational structure of work that plays the most consistent role in the development of stress-related illness.

As a result of the above-mentioned, the consequences may be far-reaching, not only for engineers themselves, but also for the organisation. According to Garland (2002), the high cost of hiring and training recruits to fill vacated positions will take its toll on the budget. Organisations could also experience further indirect costs as a result of stress, for example low morale, low job satisfaction, faulty decision-making, aggression and violence among workers (Johnson & Cooper, 2003). Stress can also have an impact on young, talented people. According to Garland (2002), newcomers fresh out of college filled with dreams and lofty ambitions can soon be trampled underneath bureaucratic policies. The letdown of realising that one's career expectations were over inflated can dishearten a new recruit so profoundly that he or she spirals rapidly into burnout. According to Siu (2003), work stress can lead to increased health costs, higher rates of absenteeism and turnover, more accidents, and worse performance. The implication of this is that a promising career could end. Garland (2002) confirmed that the initial barrage of stress and strain can be overwhelming and it could lead to premature exit.

Stress does not always directly result from the source of pressure itself, but rather from the perception of that pressure. Therefore, the individual difference variables that might relate to perceptions should be considered (Sui, 2003). Jex (1998) argued that across all stressors and performance dimensions, the relation between stress and job performance is not particularly strong. He suggested, instead, looking for more moderators of the stress-performance relationship. A moderator is some third factor that exerts an influence on the zero-order correlation between two variables (Cooper et al., 2001).

Sources of occupational stress among other occupations cannot be generalised to engineers. It is therefore important to study the effects of occupational stress on engineers and to identify occupational stressors. In the light of the above discussion, the lack of empirical research that investigates occupational stress of engineers in South Africa is a concern. No study could be found in South Africa, investigating work stressors and the effect thereof on engineers.

Occupational stress

The phrase "being under stress" is one that most people can identify with, although it can mean different things to different individuals. This expression focuses not so much on the nature of stress itself but on its outcomes or consequences (Cooper et al., 2001). Cooper et al. (2001) define the concepts of strain, stressors and stress as follows: stress is the overall transactional process, stressors are the events or stimuli that are encountered by individuals and strain is the individual's psychological, physical, and behavioural response to stressors.

The experience of stress reactions in the workplace is not an isolated phenomenon (Fletcher, 1988). A number of aspects of working life have been linked to stress. Aspects of the work itself can be stressful, namely work overload (DeFrank & Ivancevich, 1998; Sparks & Cooper, 1999, Taylor, Repetti & Seeman, 1997) and role-based factors such as lack of power, role ambiguity, and role conflict (Burke, 1988; Nelson & Burke, 2000). Threats to career development and achievement – including threat of redundancy, being undervalued and unclear promotion prospects – are stressful (Nelson & Burke, 2000). The physical demands of work surroundings and the distress caused by noise, vibration and extremes of temperature are some of the earliest forms of stressors that were investigated by organisational psychologists and other researchers in the field (Cooper et al., 2001). The conflict between home and work (and the work impact on personal relationships) is stressful (Sparks & Cooper, 1999).

A number of conceptual models have been developed that relate job characteristics to the health and well-being of working populations (Cooper, 1998). According to Kitaoka-Higashiguchi et al. (2003), models of occupational stress have focused on specific functions of social support that contribute to occupational stress and employee well-being. The occupational stress model most frequently used is that of demand-control. The original

demand-control model developed by Karasek (1979) was later expanded by him to include social support, based on research focusing the impact of social support on well-being.

According to Schaufeli and Bakker (2002), any occupation can be viewed from a stress perspective in terms of two elements, namely job demands and job resources. Job demands refer to those aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs, e.g. work overload, personal conflicts and emotional demands (Demerouti, Nachreiner & Bakker, 2001). The job demands-control model is also referred to as the strain hypothesis (Pelfrene et al., 2002). The demand-control model predicts that the strongest aversive job-related strain reaction (such as depression, exhaustion and health complaints) occur when jobs are simultaneously high in job demands, low in decision latitude and low in workplace social support (Kitaoka-Higashiguchi et al., 2003). This is supplemented by the learning hypothesis and stating that high job demands in combination with high job control will favour learning, motivation and development of skills.

In contrast, jobs characterised by low demands and low control will most often discourage employees and put them – or even lock them up – in a 'passive' situation. According to Schaufeli and Bakker (2002), job demands are not necessarily negative, yet they can turn into stressors when trying to meet these high demands requires sustained effort. In sum, strain occurs when environmental demands or constraints are perceived by a person to exceed his or her resources and capacities (Cooper et al., 2001). Consequently, job demands eventually become associated with negative responses such as depression, anxiety or burnout.

Job resources refer to those organisational aspects of the job that (1) are functional in the achievement of work goals, (2) reduce the job demands and the associated physiological and psychological costs, and (3) stimulate personal growth and development through social support and job security (Demouriti et al., 2001).

Cooper et al. (2001) have differentiated six primary work-related stressors: factors intrinsic to the job itself, roles in the organisation, relationships at work, career development issues, organisational factors and home-work interface. The identification of major sources of stress in the workplace can significantly benefit management and employees. Firstly, it could lead to changes in the work environment that reduce stress and increase productivity, and

secondly, it could facilitate the development of effective interventions that could reduce the before-mentioned negative effects of work stress (Spielberger & Vagg, 1999). Individual differences that might relate to perceptions should also be considered (Jex, 1998). Therefore it is important to identify the potential occupational stressors for engineers and to find out which have beneficial consequences for both employees and organisations.

Cartwright and Cooper (2002) distinguish between seven occupational stressors, namely work relationships (i.e., poor or unsupportive relationships with colleagues and/or superiors, isolation and unfair treatment), work-life imbalance (i.e., when work interferes with the personal and home life of individuals), overload (i.e., unmanageable work loads and time pressures), job security (i.e., fear of job loss or obsolescence), control (i.e., lack of influence in the way work is organised and performed), resources and communication (i.e., having the appropriate training, equipment and resources), pay and benefits (i.e., the financial rewards that work brings) aspects of the job (i.e., sources of stress related to the fundamental nature of the job itself), are sources of stress. Commitment (including the individual's commitment to the organisation and the organisation's commitment to the individual) refers to an effect of stress. Poor health is an outcome of stress, which can be used to ascertain if workplace pressures have positive and motivating or negative and damaging effects. However, poor health may not necessarily be indicative of workplace stress. Individuals may, for example, be unwell because they choose not to lead a healthy lifestyle or may be unaware of how to do so (Cartwright & Cooper, 2002).

Engineers often do not have enough time to do their work well because of unmanageable workloads. The sheer number of hours that a person works can produce strain (Cooper et al., 2001). Engineers are often required to work overtime, even weekends. This could interfere with an engineer's home and personal life. In some fields of engineering there is a continuous need for safety and in some cases they (the engineers) are, according to law, held responsible for that. A continued emphasis on the need for safety in a hazardous environment might even be a greater source of strain than the hazards themselves. Too much responsibility for other people's lives and safety is a major source of psychological strain (Cooper et al., 2001). Engineers are fast-track individuals who have great expectations and ambition for their careers because of their specialist knowledge and expertise. Their goals and expectations are sometimes not aligned with those of the companies they work for. Poor or lacking job resources preclude actual goal accomplishment, which is likely to result in failure or

frustration (Schaufeli & Bakker, 2002). Job demands threaten one's resources and, therefore, trigger stress. Prolonged exposure to such job demands will result in strain (Taris, Schreurs, & Van-Iersel-Van Silfhout, 2001). Consequently, people could develop health problems. Indicators of psychological well-being or distress are depression, fatigue, sleep disorders and the use of drugs (Pelfrene et al., 2002).

Stress has been associated with important occupational outcomes of job satisfaction, organisational commitment and employee withdrawal behaviour (Nieumann, 1993; Sullivan & Bhagat, 1992; Tett & Meyer, 1993). According to Cooper (1998), it seems intuitive that stress can lead to a deterioration of employee commitment to the organisation. The possibility that causality may also operate in the opposite direction does not appear to have been given much consideration. Personal characteristics can moderate the relationship between occupational stressors and employees' strains – it would either strengthen or weaken the potential effects on strains. The construct labelled as "hardiness" is one of the factors that have been hypothesised to moderate the effects of environmental stressors on the individual's experience of strain and ill-health. A hardy personality is characterised as one that encompasses high levels of commitment (Cooper, 1998). Moreover, occupational commitment has also been found to be a stress moderator (Begley & Cazjka, 1993). That is to say, stress increased job displeasure only when commitment was low. The mechanism might be that, due to positive attitudes, committed employees are less distressed by occupational stressors.

Organisational commitment is an attitudinal variable (Sui et al., 2002). Organisational commitment focuses on an employee's allegiance to the organisation that provides employment (Cooper, 1998). Meyer and Allen (1990) define organisational commitment as the psychological link between the employee and the organisation that makes it less likely that the employee would want to leave. Organisational commitment has received substantial attention in past research due to its significant impact on work attitudes such as job satisfaction and performance (Dwyer, 2001). In previous studies only the direct association between stressors and their potential outcomes were discussed, but not the factors that may affect the relationship. According to Sui (2003), organisational commitment protects employees from the negative effects of stressors and moderates the stress-performance relationship in a positive direction. There was reason to believe that organisational commitment could moderate the effect of stress on ill-health. Cooper et al. (2001) define a

moderator as a variable that affects the direction and strength of the relation between an independent variable and a dependent variable.

The objectives of this study were to assess the occupational stressors for engineers, to determine if occupational stress is related to ill-health in engineers and to assess whether organisational commitment moderates the effect of occupational stressors on health outcomes.

METHOD

Research design

A survey design was used to achieve the research objectives. This specific design is the cross-sectional design, where a sample is drawn from a population at a particular point in time (Shaughnessy & Zechmeister, 1997). The measuring instrument used in this study (An Organisational Stress Screening Tool – ASSET) is most often used within a cross-sectional design. It is practically useful for organisations and not scientifically problematic (Cartwright & Cooper, 2002).

Participants

Random samples ($N = 369$) were taken from Engineers in South Africa that are professionally registered with ECSA (Engineering Council of South Africa). Registered professional engineers were randomly identified and each engineer was asked to complete the questionnaire. Table 1 presents some of the characteristics of the participants.

Table 1
Characteristics of the Participants

Item	Category	Frequency	Percentage
Environment	Mining	53	14,48
	Manufacturing	21	5,74
	Design and construction	56	15,30
	Petrochemical	68	18,58
	Energy and telecommunication	21	5,74
	Consulting	95	25,96
	Other	52	14,21
	Job level	Engineer in training	5
Junior management		22	6,04
Middle management		110	30,22
Senior management (executive level)		116	31,87
Specialist		35	9,62
Consulting		61	16,76
Other		15	4,12
Age	18-27	11	3,02
	28-32	62	17,03
	33-38	46	12,64
	39-44	54	14,86
	45-50	65	17,86
	51-56	53	14,56
	> 56	73	20,05
Race	White	338	92,60
	Black	11	3,01
	Coloured	3	0,82
	Indian	10	2,74
	Other	3	0,82
Education level	Grade 12	2	0,54
	Technical college diploma	2	0,54
	Technicon diploma	8	2,18
	University degree	189	51,50
	Postgraduate degree	166	45,23
Gender	Male	346	94,79
	Female	19	5,21
Home language	Afrikaans	197	53,97
	English	159	43,56
	African	9	2,45

The sample consisted mostly of males (94,78%), which is a representation of the gender spread of the population in engineering. Almost half of the participants (45,23%) had

postgraduate education. The mean age of participants was 45,68 years, while the mean length of work experience in the field of engineering was 20,96 years. Job satisfaction and own performance was rated 3,83 and 4,18 respectively out of a possible rating of 5. This indicates that individuals rate their job satisfaction more than average and see their own performance as 'exceeding requirements'.

Measuring instrument

An Organisational Stress Screening Tool (ASSET) (Cartwright & Cooper, 2002) was used to measure stress in this study. The ASSET is based upon the stress model of Cooper and Marshall (1976). It is also designed to recognise additional factors, such as job satisfaction and organisational commitment, which serve to either exacerbate or moderate the stress levels experienced at work (Cartwright & Cooper, 2002). The measure is divided into four questionnaires; the first three assess the respondent's perceptions of the sources of pressure and the outcomes of work stress, whilst the fourth collects biographical information.

Questions within the 'Perceptions of your job' and 'Attitudes towards your organisation' scales are answered on a Likert scale, varying from 1 (*strongly disagree*) to 6 (*strongly agree*). The 'Your health' scale is answered on a Likert scale, varying from 1 (*not at all*) to 4 (*much more than usual*). The tool comprises four main questionnaires. The first three cover sources and outcomes of stress (i.e. Perceptions of your job, 37 items relating to eight sources of stress; Attitudes towards your organisation, 9 items measuring commitment levels; and Your health, 19 items measuring the frequency of physical and psychological ill-health symptoms of stress). The fourth questionnaire – Supplementary Information – consists of 24 customised items. The ASSET has an established set of norms from a database of responses from 9188 workers in the public and private sector organisations in the UK.

Reliability is based on the Guttman split-half coefficient. All but two factors returned coefficients in excess of 0,70 ranging from 0,60 to 0,91 (Cartwright & Cooper, 2002). The Psychological Well-Being subscale has good convergent validity, with an existing measure of psychiatric disorders, the General Health Questionnaire.

Statistical analysis

The statistical analysis was carried out with the help of the SAS Program (SAS Institute, 2000). The standardised RMR represents the average value across all standardised residuals, and ranges from zero to 1,00. A well-fitting model will require a value of 0,08 or less (Byrne, 2001). The Goodness-of-Fit Index (GFI) indicates the relative amount of the variances/covariances in the sample predicted by the estimates of the population. It usually varies between 0 and 1 and a result of 0,90 or above indicates a good model fit. The Adjusted Goodness-of-Fit Index (AGFI) is a measure of the relative amount of variance accounted for by the model, corrected for the degrees of freedom in the model relative to the number of variables. The GFI and AGFI can be classified as absolute indices of fit because they basically compare the hypothesised model with no model at all (Hu & Bentler, 1995). Although both indices range from zero to 1,00, the distribution of the AGFI is unknown; consequently no statistical test or critical value is available (Jöreskog & Sörbom, 1986).

The Normed Fit Index (NFI) is used to assess global model fit. The NFI represents the point at which the model being evaluated falls on a scale running from a null model to perfect fit. This index is normed to fall on a 0 to 1 continuum. Marsh, Balla and Hau (1996) suggest that this index is relatively insensitive to sample sizes. The Comparative Fit Index (CFI) represents the class of incremental fit indices in that it is derived from the comparison of a restricted model (i.e. one in which structure is imposed on the data) with that of an independence (or null) model (i.e. one in which all correlations among variables are zero) in the determination of goodness-of-fit. The Tucker-Lewis Index (TLI) (Tucker & Lewis, 1973) is a relative measure of covariation explained by the model that is specifically developed to assess factor models. For these fit indices (NFI, CFI and TLI), it is more or less generally accepted that a value of less than 0,90 indicates that the fit of the model can be improved (Hoyle, 1995), although a revised cut-off value close to 0,95 has recently been advised (Hu & Bentler, 1999).

To overcome the problem of sample size, Browne and Cudeck (1993) suggest using the Root Mean Square Error of Approximation (RMSEA) and the 90% confidence interval of the RMSEA. The RMSEA estimates the overall amount of error; it is a function of the fitting function value relative to the degrees of freedom. The RMSEA point estimate should be 0,05 or less in order to indicate good fit, and the upper limit of the confidence interval should not

exceed 0,08. Hu and Bentler (1999) suggest a value of 0,06 to be indicative of good fit between the hypothesised model and the observed data. MacCallum, Browne and Sugawara (1996) recently elaborated on these cut-off points and noted that RMSEA values ranging from 0,08 to 0,10 indicate mediocre fit, and those greater than 0,10 indicate poor fit.

Descriptive statistics (means, standard deviations, skewness and kurtosis) were also computed to describe the data. Cronbach alpha coefficients and their inter-item correlations were used to determine the internal consistency of the measuring instrument (Clark & Watson, 1995).

Standard multiple regression analysis was carried out to assess the contribution of the independent variables. According to Tabachnick and Fidell (2001), the correlation between an independent variable and a dependent variable reflects variance shared with the dependent variable, but some of the variance may be predictable from other independent variables.

RESULTS

Structural equation modelling (SEM) methods, as implemented by AMOS (Arbuckle, 1997), were used to test the factorial model for the ASSET.

Hypothesised model

A nine-factor model was tested. Table 2 presents fit statistics for the ASSET.

Table 2
Goodness-of-Fit Statistics for the ASSET Factors

Factor	χ^2	χ^2/df	GFI	AGFI	NFI	TLI	CFI	RMSEA
Control	10,77	5,39	0,99	0,93	0,98	0,94	0,98	0,11
Job characteristics	33,40	12	0,97	0,94	0,91	0,90	0,94	0,07
Job security	9,74	2	0,99	0,94	0,98	0,95	0,98	0,10
Work overload	6,39	2	0,99	0,96	0,99	0,98	0,99	0,08
Work relationships	48,30	19	0,97	0,94	0,94	0,95	0,97	0,06
Resources and communication	1,49	1	1,00	0,98	0,99	0,99	1,00	0,04
Work-life balance	6,80	2	0,99	0,95	0,98	0,96	0,99	0,08
Your health	309,10	132	0,91	0,89	0,88	0,92	0,93	0,06
Organisational commitment	97,42	25	0,94	0,90	0,97	0,97	0,98	0,09

The fit statistics in Table 2 indicate a good fit for the specified model. All indices indicate a good fit between the hypothesised model and the data obtained. The χ^2 values are fairly low and the Goodness-of-Fit Index (GFI) indicates a good model fit as all values are greater than 0,90. Since this model fit was satisfactory, no further modification to the model was done.

The descriptive statistics, alpha coefficients and mean inter-item correlation coefficients for the extracted factors of the ASSET are reported in Table 3. The ASSET has an established set of norms from a database of responses from 9188 workers in public- and private-sector organisations in the United Kingdom. The ASSET presents scores in sten (standardised ten) format. A sten is a standardised score based on a scale of 1-10, with a mean of 5,5 and a standard deviation of 2. The sten system enables meaningful comparison to the norm group. Most people (68%) score between sten 3 and sten 8. Scores that fall further from the mean (either in the high or the low direction) are considered more extreme. About 16% score at the low end, and another 16% score at the high end.

Table 3

Descriptive Statistics, Alpha Coefficients and Mean Inter-Item Correlation Coefficients of the ASSET

Item	Mean	Sten	SD	Skewness	Kurtosis	r(Mean)	α
Work-life balance	11,59	6	4,58	0,48	-0,28	0,42	0,75
Resources and communication	9,53	1	3,55	0,54	0,11	0,35	0,68
Work relationships	17,58	3	6,06	0,82	0,97	0,36	0,81
Work overload	10,98	5	4,21	0,52	-0,01	0,49	0,79
Job insecurity	9,97	1	3,89	0,75	0,46	0,38	0,71
Job characteristics	16,95	1	5,00	0,45	0,24	0,37	0,70
Control	9,55	1	3,87	0,80	0,61	0,49	0,79
Organisational commitment to the individual	21,87	8	6,19	-0,94	0,23	0,71	0,92
Individual commitment to the organisation	18,47	8	4,33	-1,27*	1,62*	0,63	0,87
Physical (ill) health	11,59	1	3,64	0,43	-0,29	0,35	0,76
Psychological (ill) health	21,89	10	6,20	0,51	0,09	0,37	0,88

* High skewness and kurtosis

The coefficient alphas for the 14 factors are considered to be acceptable compared to the guideline of 0,70 (Nunnally & Bernstein, 1994). However, four scales, namely work relationships, occupational commitment, individual commitment, and psychological (ill) health showed an alpha coefficient significantly higher than the guideline of 0,70. The mean inter-item correlations of the factors are well within the guideline of $0,15 < r < 0,50$ (Clark & Watson, 1995) except for items eight and nine. These results provide support for the internal consistency and validity of the ASSET for engineers in South Africa.

The results show that Work-Life Balance is the highest stressor for engineers. The second highest stressor is Work Overload. The level of the stressor is indicated by the dimensional values with higher scores correlate to higher levels of stress. High levels of commitment are indicated by high scores, beneficial against the negative consequences of workplace stress. For Physical (ill) health the results show a lower than the norm score, but a higher than norm score for Psychological (ill) health.

Comparisons between ASSET means and norms per item are reported in Table 4.

Table 4

Comparisons between ASSET Means and International Norms

Variable	Mean	Sten
Perceptions of your job		
I work longer hours than I choose or want to	3,40	6
I work unsocial hours, e.g. weekends, shift work, etc.	2,61	4
I spend too much time travelling in my job	2,37	5
I have little control over many aspects of my job	2,54	1
My work interferes with my home and personal life	3,22	4
I may be doing the same job for the next 5 to 10 years	3,33	4
My physical working conditions are unpleasant	1,89	2
My job involves the risk of actual physical violence	1,66	3
My boss behaves in an intimidating and bullying way towards me	1,66	3
My performance at work is closely monitored	2,99	5
I do not receive the support from others (boss/colleagues) that I would like	2,36	3
My job is insecure	2,36	3
My job is not permanent	2,19	4
My pay and benefits are not as good as other people doing the same or similar work	3,19	4
The technology in my job has overloaded me	2,33	4
My organisation is constantly changing for change's sake	2,60	4
My work is dull and repetitive	2,03	3
I feel isolated at work, e.g. working on my own or lack of social support from others	2,11	3
I am not sure what is expected of me by my boss	2,18	2
Other people at work are not pulling their weight	3,16	4
I am set unrealistic deadlines	2,67	6
I am given unmanageable workloads	2,64	3
My boss is forever finding fault with what I do	1,83	4
Others take the credit for what I have achieved	2,49	6
I have to deal with difficult customers/clients	3,60	5
My relationships with colleagues are poor	1,79	2
I do not feel I am informed about what is going on in this organisation	2,46	1
I am never told if I am doing a good job	2,72	3
I am not involved in decisions affecting my job	2,33	2
I am not adequately trained for many aspects of my job	2,07	1
I do not have the proper equipment or resources to do my job	2,28	3
I do not have enough time to do my job as well as I would like	3,35	6
My job is likely to change in the future	3,38	5
My job skills may become redundant in the near future	2,04	2
My ideas or suggestions about my job are not taken into account	2,31	3

Variable	Mean	Sten
I have little or no influence over my performance targets	2,37	2
I do not enjoy my job	2,19	3

In general the mean sten values for items and dimensions are lower than the norm. However, above average sten values were obtained on the following items which measure occupational stress: a) "I work longer hours than I choose or want to"; b) "I am set unrealistic deadlines"; c) "Others take the credit for what I have achieved", and d) "I do not have enough time to do my job as well as I would like." Regarding the dimensions, only one occupational stressor showed a score of average or higher, namely work overload. The level of the stressor is indicated by the dimensional values with higher scores correlate to higher levels of stress, the lower than the norm values thus indicate better than average levels of stress.

The Pearson and Spearman correlations between the ASSET constructs are reported in Table 5.

Table 5
Correlations between the ASSET Constructs

	1	2	3	4	5	6	7	8	9	10	11
1. Work-life balance	-	-	-	-	-	-	-	-	-	-	-
2. Resources and Communication	0,24 ⁺	-	-	-	-	-	-	-	-	-	-
3. Work relationships	0,36 ^{**}	0,67 ^{***}	-	-	-	-	-	-	-	-	-
4. Work overload	0,56 ^{***}	0,52 ^{***}	0,52 ^{***}	-	-	-	-	-	-	-	-
5. Job security	0,23 ⁺	0,45 ^{**}	0,51 ^{***}	0,35 ^{**}	-	-	-	-	-	-	-
6. Job characteristics	0,29 ⁺	0,61 ^{***}	0,63 ^{***}	0,46 ^{**}	0,45 ^{**}	-	-	-	-	-	-
7. Control	0,28 ⁺	0,68 ^{***}	0,68 ^{***}	0,46 ^{**}	0,46 ^{**}	0,63 ^{***}	-	-	-	-	-
8. Organisational commitment	-0,03	-0,50 ⁺	-0,48 ⁺	-0,16	-0,27 ⁺	-0,44 ⁺	-0,54 ^{***}	-	-	-	-
9. Individual commitment	0,06	-0,44 ⁺	-0,37 ^{**}	-0,09	-0,19 ⁺	-0,36 ⁺	-0,42 ^{**}	0,83 ^{***}	-	-	-
10. Physical (ill) health	0,30 ⁺	0,25 ⁺	0,28 ⁺	0,33 ^{**}	0,24 ⁺	0,25 ⁺	0,17 ⁺	-0,16 ⁺	-0,15	-	-
11. Psychological (ill) health	0,34 ^{**}	0,34 ^{**}	0,37 ^{**}	0,42 ^{**}	0,27 ⁺	0,33 ^{**}	0,26 ⁺	-0,22 ⁺	-0,19 ⁺	0,67 ^{***}	-

+ $p < 0,01$
* $r > 0,30$ (medium effect)
** $r > 0,50$ (large effect)

Table 5 shows that Work Life Balance correlates practically significantly with Work Overload (large effect) and Work Relationships, Psychological (ill) Health (medium effect). Resources and Communication correlates practically significantly with Work Relationships (medium effect), Work Overload, Job Characteristics and Control (large effect). Work

Relationships correlate with Work Overload (large effect), Job Security (large effect), Control (large effect), Individual Commitment (medium effect), and Psychological (ill) Health (medium effect). Work Overload correlates with Job Security (medium effect), Job Characteristics (medium effect), Control (medium effect), Physical (ill) Health (medium effect) and Psychological (ill) Health (medium effect). Job Security correlates with Job Characteristics (medium effect) and Control (medium effect). Job characteristics correlates with Control (large effect) and Psychological (ill) Health (medium effect). Control correlates with Organisational Commitment (large effect), and Individual Commitment (medium effect). Organisational Commitment correlates with Individual Commitment (large effect). Physical (ill) Health lastly correlates with Psychological (ill) Health (large effect).

The results of a stepwise multiple regression analysis with occupational stressors (as measured by the Perceptions of your Job Scale of the ASSET) as independent variables and Psychological (ill) Health (as measured by the Health Subscales of the ASSET) as dependent variable are reported in Table 6.

Table 6

Multiple Regression Analysis of ASSET Sources of Stress with Psychological (ill) Health as the Dependent Variable

Analysis of Variance				
$R = 0,48$		<i>df</i>	Sum of Square	Mean Square
$R^2 = 0,23$	Regression	4	3276,11	819,03
	Residual	364	10891,98	29,92
	$F = 27,37$			
Independent Variables				
	B	Standard Error	<i>t</i>	<i>p</i>
Work overload	0,30	0,09	3,37	0,001
Work relationships	0,15	0,07	2,17	0,030
Work-life balance	0,19	0,08	2,59	0,010
Job characteristics	0,23	0,11	2,16	0,032

Table 6 shows that four occupational stressors, namely Work Overload, Work Relationships, Work-Life Balance and Job Characteristics (as measured by the Perceptions of your Job Scale of the ASSET) explain 23,1% of the variance in Psychological (ill) Health (as measured by the Health Subscales of the ASSET).

The results of a stepwise multiple regression analysis with occupational stressors (as measured by the Perceptions of your Job Scale of the ASSET) as independent variables and Physical (ill) Health (as measured by the Health Subscales of the ASSET) as dependent variable are reported in Table 7.

Table 7

Multiple Regression Analysis of ASSET Sources of Stress with Physical (ill) health as the Dependent Variable

Variance Analysis				
$R = 0,40$		<i>df</i>	Sum of Square	Mean Square
$R^2 = 0,16$	Regression	3	794,48	264,83
	Residual	365	4100,55	11,23
	$F = 23,57$			
Independent Variables				
	B	Standard Error	<i>t</i>	<i>p</i>
Work overload	0,18	0,06	3,35	0,001
Work relationships	0,09	0,03	2,66	0,008
Work-life balance	0,11	0,05	2,30	0,022

Table 7 shows that three occupational stressors, namely Work Overload, Work Relationships and Work-Life Balance (as measured by the Perceptions of your Job Scale of the ASSET) explain 16,2% of the variance in Physical (ill) Health (as measured by the Health Subscales of the ASSET).

A schematic representation of the final occupational stress, organisational commitment and ill-health model for engineers in South Africa, is displayed in Figure 1.

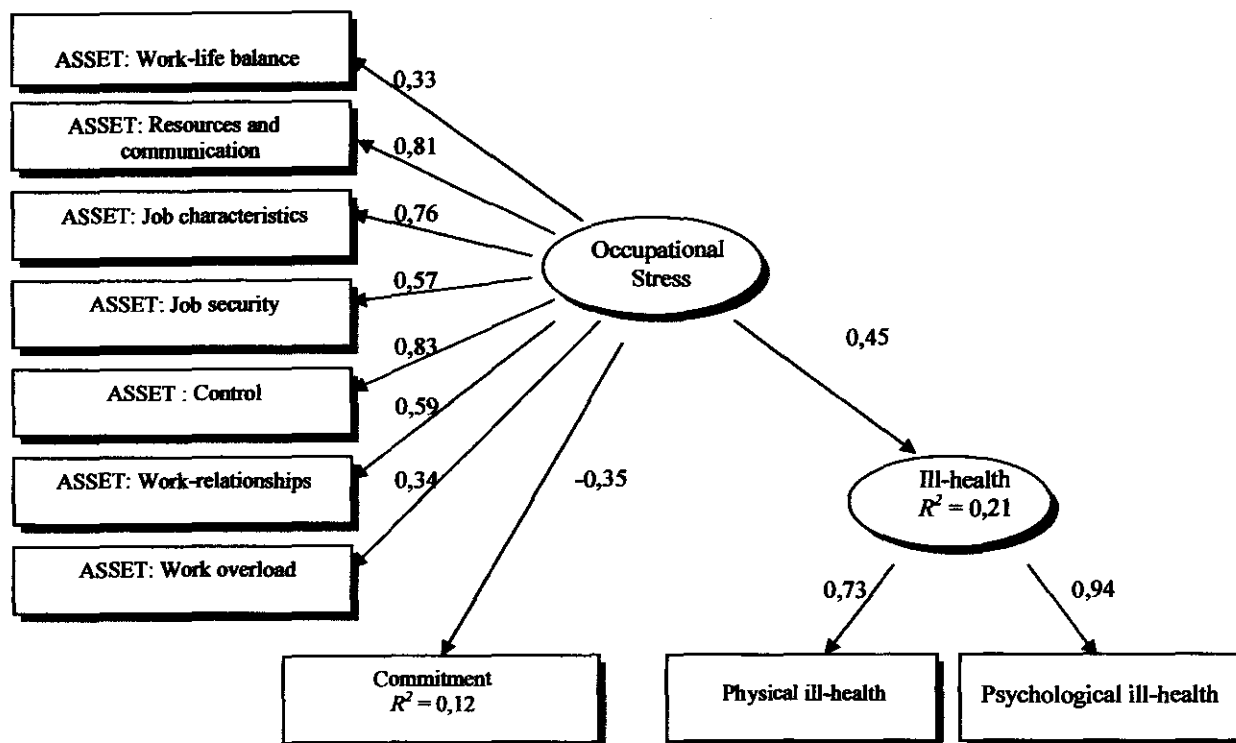


Figure 1. Occupational stress, organisational commitment and ill-health(standardised solution). (Note: All factor loadings and path coefficients are significant, $p < 0,01$).

A schematic representation of the final occupational stress, organisational commitment and ill-health model for engineers in South Africa is displayed in Figure 1. According to the analysis, 12% of the variance in organisational commitment is explained by occupational stressors. Furthermore, 21% of the variance in ill-health is explained by occupational stressors. The results indicated that the model fitted adequately to the data: $\chi^2 = 115,43$; $\chi^2/df = 3,60$; GFI = 0,94; AGFI = 0,90; CFI = 0,95; IFI = 0,95; TLI = 0,93; RMSEA = 0,08.

DISCUSSION

The objectives of this study were to assess the occupational stressors for engineers, to determine if occupational stress is related to ill-health of engineers and to assess whether organisational commitment moderates the effect of occupational stressors on health outcomes.

Goodness-of-fit statistics showed a good fit between the hypothesised model and the data obtained. No modification was needed in terms of the ASSET model. Results provided support for the internal consistency and validity of the ASSET for engineers. Coefficient alphas compared well with the guideline of 0,70.

Engineers experience work-life balance as the major stressor in their current jobs. Role conflict results from the competing demands of work and family obligations. The effect of stress on role conflict can influence task performance and can have harmful effects on well-being. The stressor Work-life balance includes that engineers feel that they have to work long hours. Most of the engineers also feel that they spend too much time travelling in their jobs. One reason for this finding is that most of the engineers are consultants and they do travel a lot, which interferes with their home and personal life.

Correlations were found between Commitment and ill-health. Engineers who are committed to the organisation do not frequently complain about their health. We can assume that engineers who are committed are emotionally attached to the organisation and they can identify with the organisation or with their work. Job characteristics correlated with ill-health. This could mean that engineers who experience their physical working conditions as unpleasant are more prone to ill-health. This is also true for people who experience their job as dull and repetitive. Engineers who work with difficult customers and clients could experience ill- health. Change in the organisation could also lead to ill-health. One possibility for the correlation between job characteristics and ill-health could be that people are constantly in an ongoing transaction with the environment and make appraisals of their encounters. According to Dewe, Cox and Ferguson (1993), stress is viewed as a dynamic cognitive state where the individual's interaction with the environment can be describe as an ongoing transaction. The individual makes appraisals of their encounters with the environments and attempt to cope with the issues arising from its interaction. The last correlation was between Job Control and Commitment. We could assume that engineers that are in control feel that their ideas and suggestions are taken into account and this may lead to commitment. Engineers who feel that they have control over their performance targets also experience more commitment. One possibility could be that engineers that are in control of their careers are driven by performance targets and are measured against performance outcomes. Fixed performance indicators usually challenge engineers and this motivates them to full performance.

Workload and work demands were also identified as stressors. Engineers that are secluded by insufficient communication and information without supporting resources also experience levels of stress. The levels of stress are increased by unrealistic workload and deadlines. The resulting lack of control leads to perceived self-underperformance where the opinions are not heard and overall objectives are not met. This fits with Karasek's (1979) Demand-Control theory of occupational stress, which states that work characteristics may evoke different processes. High job demands (i.e. work overload) may exhaust employees' mental and physical resources and may therefore lead to health problems or burnout. This, in turn, could lead to withdrawal from work, and reduced motivation or commitment. This also supports the view of Hobfoll and Freedy (1993) who found that job demands threaten one's resources and, therefore, trigger stress. Prolonged exposure to such job demands will result in ill-health.

The findings of this study were compared to the norms from England. Compared to normative data, participants reported lower levels of ill-health and psychological outcomes of stress. These findings supported the findings of Tytherleigh (2003) in academic staff. They also found lower levels than the norm for physical ill-health symptoms. Bradley and Eachus (1995) reported statistically lower levels of job satisfaction as well as more frequent symptoms of physical ill-health outcomes of stress. Moreover, the physical ill-health factors "mood swings", "feeling unable to cope" and "unable to listen to other people" came out very low compared to the normative data. Because engineers seem to experience less mood swings, cope better than average and have the general ability to listen to other people, they will experience lower ill-health symptoms. In conclusion, the lower-than-the-norm variables as mentioned above, may explain why the frequency of ill-health symptoms that contribute to stress are currently lower than normative levels. It seems reasonable to assume that ill-health symptoms are low because engineers work fairly independently and are therefore less influenced by people-related issues. Engineers operate in environments where they are normally required to handle complex and challenging issues. Their scope of work is very diverse, they are used to interact with various parties from different environments and disciplines. They become accustomed to consult business partners. Our results suggest that in our sample, engineers are motivated by their work to meet the sources of stress and to manage stress. This does not imply that engineers will never run the risk of experiencing more frequent physical ill-health. Indeed, as shown by Winefield et al. (2002), when stress

was high, levels of psychological strain - a potential precursor to physical ill-health-increased considerably.

The results showed that organisational commitment was related to most of the physical and psychological outcomes among workers. The higher-than-the-norm levels of commitment identified by our study may explain why the frequency of ill-health stress symptoms is currently lower than the norm.

The model was tested with all the occupational stressors to determine if they could possibly have a moderating effect on commitment. Stress, in this case, leads to ill-health, but it is not moderated by the individual's commitment. According to Anshel (2000), chronic stress might inhibit the body's immune system and can lead to an array of medical illnesses and disease. Workload is identified as a stressor. Tytherleigh (2003) reported higher levels of stress for the two subscales of long working hours and impact of work on home-life balance in academics. Irrespective of category of employee, however, levels of stress for both of these subscales were lower than the norm. What was also interesting was that, whilst engineers reported the highest levels of stress for work-life balance and overload, both compared to the norm and other categories, they did not report the highest levels of stress outcomes. Indeed, they reported the lowest levels of physical ill-health. Thus, these results again suggest that engineers are committed and are still engaged in the work they do. One possibility is that engineers use several advanced technologies in order to be competitive in the market and to deliver good outputs; the organisation relies on their initiative and competence to deliver work of outstanding quality. Because of the amount of work or the fact that engineers are fast-tracked, the organisation demands workload from engineers that could be unmanageable. Many engineers are managers with wide spans of control, adding to their overall responsibility with regard to people and activities. This means that they do not have enough time to do their own jobs as well as they would have liked.

The current research provides evidence that stressors contributed in this study to ill-health, but the interaction between these two variables was not significant. The influence of commitment on ill-health is positive and the overall effect of work life balance and work overload is negative. Workload and work-life balance did not have an influence on a person's commitment. Resources and communication have a direct influence on health if overload is present, but it is not enabled through commitment. Commitment can influence health if overload is present or if stress is present because of work-life balance. Commitment also has

no influence if there is stress about resources. Resources have an influence on both health and individual commitment; in this case commitment is rather a cause than an influence. According to Barkhuizen, Rothmann and Tytherleigh (2003) social support is an important resource since it can promote better well-being when combined with the characteristics of the job. It can be argued that engineers will experience role ambiguity when they perceived lack of support provided by supervisors. There is considerable evidence in the literature that the organisational commitment of employees is strongly influenced by the supervisory behaviour of their supervisors. The supervisory behaviours considered are performance feedback, participation in decision-making and communication (Lee & Ashforth, 1990). In summary, our results show that engineers are committed to their jobs.

RECOMMENDATIONS

In terms of the experience of stressors by engineers, work-life balance as a stressor for engineers is a concern. The organisation can expect to find negative costs associated with continued levels of stress, because of burnout and resulting lower productivity and efficiency and also high employee turnover. Organisations are therefore advised to prioritise the issue of work-life balance. Based on the results of this study, three levels of intervention strategies should be considered (Cooper et al., 2001).

The primary level intervention is the most effective way to combat ill-health to eliminate or reduce the sources of strain (stressors) in the work environment. In this case, the organisation is advised to assist engineers with work-life balance.

Young engineers must have the necessary skills and capacity to do their jobs before they are put in supervisory positions. Purposeful job rotation will help young engineers gaining experience to demonstrate their full potential. In terms of middle management it is advised to redesign job tasks (such as increasing employee autonomy and control over job functions and work schedules). This may not always be easy to achieve, because job structures are relatively fixed. One of the major challenges for the organisation is to create job designs that promote the achievement of organisational goals, while at the same time providing individuals with the opportunity to engage in satisfying and fulfilling job tasks that do not create unmanageable strain (Cooper et al., 2001). Performance management is an area that

must be managed. More constructive feedback on job performance will enhance productivity, but this calls for clear performance indicators. This type of intervention is the most proactive and preventative approach to stress management and has been reported as being effective when implemented as a result of careful assessment of specific stressors.

The organisation can also invest in secondary interventions that focus on stress management training to alleviate the impact that environmental stressors exert on engineers. Training in performance management and career development could help the engineer to understand what is expected of him as well as how to manage his/her subordinates. Supervision training is important to young engineers as well as middle management because it is targeted at the individual changes. Supervisory courses must aim to increase the individuals' awareness of their levels of strain and to enhance their personal coping strategies. This could include relaxation training, time management and conflict resolution strategies. The overall focus should be on the real business and personal essentials that can help the person to assimilate effective knowledge of himself or herself and the business environment, and also to gain insights into his or her leadership skills. Organisational development practitioners could focus on programs which indicates the factors that may contribute to high levels of organisational performance. The will lead to increased organisation output and improving quality by involving employees in the decisions that affect them on their jobs.

The organisation could also assign an industrial psychologist so that individuals who have suffered ill-health or reduced well-being as a result of strain can be referred for rehabilitation. Climate studies can provide the psychologist with relevant information to designing focused wellness interventions. Interventions at this level are based on a 'treatment'. Counselling may help individuals to deal with workplace stressors that cannot be changed structurally.

Organisations could evaluate these three interventions and make a sound decision that will benefit the individual as well as the organisation. These interventions can have cost implications for both the individual and the organisation. Further research is needed to evaluate the effect of organisational interventions on organisational behaviour. Organisation development should focus on people development and align their strategic objectives with suitable interventions.

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WORK ENGAGEMENT OF ENGINEERS IN SOUTH AFRICA

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ABSTRACT

The objectives of this study were to determine the psychometric properties of the Utrecht Work Engagement Scale (UWES) for engineers in South Africa and to determine differences between the work engagement of engineers in different demographic groups. A cross-sectional survey design was used. Stratified random samples ($N= 369$) were taken of engineers in South Africa. The UWES and a biographical questionnaire were administered. Structural equation modelling confirmed a model of work engagement, consisting of Vigour, Dedication and Absorption. These three factors had acceptable internal consistencies. The results showed that the self-rated performance and job satisfaction of engineers varied depending on their levels of work engagement. No demographic differences regarding engagement levels could be found between the different age groups, engineering environments, job levels and years of experience.

OPSOMMING

Die doelstellings van hierdie studie was om die psigometriese eienskappe van die Utrecht-werksbegeesteringskaal (UWES) asook die verskille tussen werksbegeesting van verskillende demografiese groepe te bepaal ten opsigte van ingenieurs in Suid-Afrika. 'n Dwarsdeursnee-opname is gebruik. Gestratifiseerde ewekansige steekproewe ($N= 369$) van ingenieurs in Suid-Afrika is gebruik. Die UWES en 'n biografiese vraelys is afgeneem. Strukturele vergelykingsmodellering het 'n model bestaande uit Energie, Toewyding en Absorpsie aangetoon. Hierdie faktore het aanvaarbare interne konsekwentheid getoon. Die resultate toon aan dat self-evaluering van werksprestasie en werkstevredenheid van ingenieurs verskil afhangend van die vlak van werksbegeesting. Geen demografiese verskille is aangetoon met betrekking tot die verskillende ouderdomsgroepe, verskillende ingenieurs omgewings, werksvlakke en werkservaring.

Work often generates ambivalent feelings. On the one hand, work requires effort and is associated with lack of freedom and negative feelings. On the other hand, work gives energy, enables development and generates positive feelings. Therefore it can be concluded that work could either contribute to illness or have a therapeutic effect (Rothmann, 2002).

Psychology after World War II became a science largely devoted to healing. It concentrated on repairing damage using a disease model of human functioning. This almost exclusive attention to pathology neglected the possibility that building strength may be the most potent weapon in the arsenal of therapy (Snyder & Lopez, 2002). Psychologists realised that the field of psychology is about positive experiences, e.g. well-being and satisfaction. Researchers recently extended their view to the positive pole of employees' well-being, instead of concentrating exclusively on the negative pole.

According to Seligman and Csikszentmihalyi (2000), 'positive psychology', which focuses on human strengths and optimal functioning rather than on weaknesses and malfunctioning is an emerging field of study in psychology. The aim of positive psychology is to expand the focus of scientific psychology beyond a perceived dominant preoccupation with pathology to also building positive qualities (Ranzijn, 2002). Researchers in positive psychology seek a detailed understanding of positive human experience at both individual and social levels. They are interested in individual attributes like the ability to engage in satisfying and joyful activities, maintain an optimistic outlook, and live in accord with positive values (Miller, 2002). Treatment is not only about fixing what is wrong; it is also building what is right. Psychology is not just about illness or health; it also is about work, education, insight, love, growth and play (Seligman, 2002). Instead of looking exclusively to the negative pole, researchers recently expanded their interest to the positive pole of employees' well-being. Seen from this perspective, burnout is rephrased as an erosion of engagement with the job (Schaufeli, Salanova, González-Romá & Bakker, 2002).

Work engagement is the opposite pole of burnout (Maslach, Schaufeli & Leiter, 2001). Seen from this perspective, burnout happens if there is a mismatch between the job environment and the individual, whereas a good fit between the individual and the environment promotes work engagement (Berkeleyan, 2001). The concept of a burnout-to-engagement continuum enhances our understanding of how the organisational context of work can affect workers' well-being. It recognises the variety of reactions that employees can have to the

organisational environment, ranging from the intense involvement and satisfaction of engagement, through indifference to the exhausted, distant, and discouraged state of burnout (Cooper, 1998).

The Utrecht Work Engagement Scale (UWES) was developed to measure work engagement, but it is not yet standardised for engineers in South Africa. The UWES was developed by Schaufeli, Salanova, Gonzalez-Romá and Bakker (2002). They found acceptable reliability for it. Previous studies demonstrated factor validity for the UWES (Schaufeli et al., 2002; Schaufeli, Bakker, Hoogduin, Schaap & Kladler, 2001). Only one study (Storm & Rothmann, 2003) regarding the internal consistency, factorial validity and structural equivalence of the UWES was found in South Africa. Storm and Rothmann (2003) tested the three-factor model comprising all 17 items. They found that the three factors have acceptable internal consistencies. Two recent international studies using confirmative factor analysis demonstrated the factorial validity of the UWES (Schaufeli et al., 2001; Schaufeli et al., 2002).

The UWES lacks norms for engineers in South Africa. This makes it very difficult to place research results into context, to assess the levels of engagement of engineers and to compare engineers in various demographic groups. Most studies did not investigate demographic differences in engagement (Maslach et al., 2001; Schaufeli & Enzmann, 1998). Therefore it is necessary to validate the UWES for engineers in South Africa.

The objectives of this study were to determine differences between work engagement levels of various demographic groups and to determine the construct validity and internal consistency of the UWES.

Work engagement

Recently, the multidimensional theory of burnout has expanded to this other end of the continuum (Leiter & Maslach, 1998). According to the literature, attention has been paid to the concept of engagement, but there are differences in terms of the definition, views as well as the measurement of engagement. Schaufeli et al. (2002) are of the opinion that Maslach and Leiter (1997) assumed that engagement is characterised by energy, involvement, and

efficacy, which are considered the direct opposites of the three burnout dimensions – exhaustion, cynicism, and lack of professional efficacy, respectively.

According to Cooper (1998), this state is distinct from established constructs in organisational psychology such as organisational commitment, job satisfaction or job involvement. Organisational commitment focuses on an employee's allegiance to the organisation that provides employment, while engagement focuses on the work itself. Job satisfaction is the extent to which the job is a source of need fulfilment and contentment, or a means of freeing employees from hassles of dissatisfiers; 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 energy and effectiveness dimensions.

Engagement with work provides a more complex and thorough perspective on an individual's relationship with work (Maslach et al., 2001). Engaged employees according to their view, have a sense of energetic and effective connection with their work activities and they see themselves as able to deal completely with demands of their job. According to Britt (2003), there is a common misconception that job engagement – high motivation to work – is a personality trait and that motivated people will throw themselves with equal enthusiasm into pretty much any job. However, research consistently shows that even the most committed employees will quickly become demotivated if they cease to find their work meaningful or if they cannot succeed at it. What started out as important, meaningful, and challenging work becomes unpleasant, unfulfilling, and meaningless. Energy turns into exhaustion, involvement turns into cynicism, and efficacy turns into ineffectiveness. Accordingly, engagement is then characterised by energy, involvement, and efficacy – the direct opposites of the three burnout dimensions (Maslach et al., 2001). In the light of the above-mentioned it means that, according to Maslach and Leiter (1997), engagement is assessed by the opposite pattern scores on the MBI dimensions.

Schaufeli and Bakker (2001) take a different perspective by considering burnout and engagement to be opposite concepts that should be measured independently with different instruments. Schaufeli et al. (2002) define engagement as a positive, fulfilling, work-related state of mind that is characterised by vigour, dedication and absorption. According to Schutte, Toppinen, Kalimo and Schaufeli, (2000), engagement can also be defined as an energetic

state in which the employee is dedicated to excellent performance at work and is confident of his or her effectiveness.

According to Maslach et al. (2001), there is no presumption that engagement is assessed by the opposite profile of the MBI scores. Burnout and engagement may be considered two prototypes of employee well-being that are part of a more comprehensive taxonomy constituted by two independent dimensions of pleasure and activation (Watson & Tellegen, 1985). According to this framework, burnout is characterised by low levels of activation and pleasure, whereas engagement is characterised by high levels of activation and pleasure (Maslach et al., 2001).

According to Schaufeli et al. (2002), engagement refers to a more persistent and affective-cognitive state that is not focused on any event, particular object, individual or behaviour. Engagement consists of the following dimensions (Schaufeli & Bakker, 2001):

- Vigour is characterised by high levels of energy and mental resilience while working, 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 difficulty detaching oneself from it. Time passes quickly and one forgets everything else.

The concept of work engagement is also applicable to engineers in focusing on their well-being and health. In an organisation it is very important for engineers to be in 'flow' with their work. This means that they must be able to deal with job complexity and demands. Engineers have different approaches towards work. Engineers' work approach must accommodate change management as well as challenges. An engineer who is focused on his or her work, experiences his or her job as important and meaningful. The implication of this is that people experience their jobs as meaningful, they enjoy working and they do not see it as effort. However, if engineers struggle with the complexity of their jobs, they may experience their

jobs as meaningless. Being fully absorbed in one's work comes close to what has been called 'flow', a state of optimal experience that is characterised by focused attention, a clear mind, mind and body unison, effortless concentration, complete control, distortion of time, and intrinsic enjoyment (Schaufeli et al., 2001).

Based on the work of Cooper (1998), it could be argued that for these high performers, factors they can't control – role ambiguity, inadequate resources, and overwork – can hinder them in their work and may ultimately drive them to seek jobs elsewhere. The ones who stay behind may well be those who simply do not care (Britt, 2003). Including engagement in our burnout research, gives us a promising avenue that contributes to our understanding of engineers' well-being. This could be done by focusing on the concept of work engagement or the different levels of engagement experienced by engineers.

People do not simply respond to the work setting; rather they bring unique qualities to the relationship. These personal factors include demographic variables such as age or formal education (Maslach et al., 2001). According to Schaufeli and Bakker (2003) scores on the UWES are significantly and positively correlated with age; men feel more engaged than women; and some professional groups (e.g. managers) score higher on work engagement than other groups (e.g., blue collar workers). However, although statistically significant, practically speaking these differences are irrelevant. Hence, no age, gender, or occupation specific norm group for engineers of the UWES are presented.

Based on the work of Ryan and Deci (2000), it could be argued that there is a possible relationship between performance and engagement, because positive performance feedback enhances intrinsic motivation. According to Rothmann (2002) engaged employees generate their own positive feedback. Through their attitudes and activities, engaged employees create their 'rewards' in the form of recognition, success, admiration and appreciation. It could then be argued that engaged people will experience job satisfaction because according to Maslach et al., (2001) engagement focus on an individual's relationship with work, and job satisfaction is the extent to which work is a source of need fulfilment and contentment (Maslach et al., 2001).

The above discussion leads to the following hypotheses:

- H1: Work engagement, as measured by the UWES is a three-dimensional construct and the UWES shows high internal consistency
- H2: Significant differences regarding work engagement levels exist between different age groups, job levels, years of experience, engineering environments, work performance and job satisfaction.

METHOD

Research design

A survey design was used to achieve the research objectives. This specific design is the cross-sectional design, where a sample is drawn from a population at a particular point in time (Shaughnessy & Zechmeister, 1997).

Participants

Random samples ($N= 369$) were taken from engineers in South Africa that are professionally registered with the Engineering Council of South Africa (ECSA). The random sampling was carried out with the help of the SAS Program (SAS Institute, 2000). Professionally registered engineers were listed numerically on the grounds of registration numbers-the ECSA registration numbers is based on year of registration with additional numeric digits. Questionnaires were posted to the selected individuals and each engineer was asked to complete the questionnaire. All questionnaires were completed anonymously and treated as confidential.

Table 1 presents some of the characteristics of the participants.

Table 1
Characteristics of the Participants

Item	Category	Frequency	Percentage
Environment	Mining	53	14,48
	Manufacturing	21	5,74
	Design and construction	56	15,30
	Petrochemical	68	18,58
	Energy and telecommunication	21	5,74
	Consulting	95	25,96
	Other	52	14,21
Job level	Engineer in training	5	1,37
	Junior management	22	6,04
	Middle management	110	30,22
	Senior management (executive level)	116	31,87
	Specialist	35	9,62
	Consulting	61	16,76
	Other	15	4,12
Age	18-27	11	3,02
	28-32	62	17,03
	33-38	46	12,64
	39-44	54	14,86
	45-50	65	17,86
	51-56	53	14,56
Race	> 56	73	20,05
	White	338	92,60
	Black	11	3,01
	Coloured	3	0,82
	Indian	10	2,74
	Other	3	0,82
Education level	Grade 12	2	0,54
	Technical college diploma	2	0,54
	Technicon diploma	8	2,18
	University degree	189	51,50
	Postgraduate degree	166	45,23
Gender	Male	346	94,79
	Female	19	5,21
Home language	Afrikaans	197	53,97
	English	159	43,56
	African	9	2,45

The sample consisted mostly of males (94,78%), which is a representation of the gender spread of the population in engineering. Almost half of the participants (45,23%) had postgraduate education. The mean age of participants was 45,68 years, while the mean length

of work experience in the field of engineering was 20,96 years. Job satisfaction and own performance was rated 3,83 and 4,18 respectively out of a possible ratings of 5. This indicates that individuals rate their job satisfaction more than average and see their own performance as 'exceeding requirements'.

Measuring battery

The Utrecht Work Engagement Scale (UWES) (Schaufeli et al., 2002) was used to measure work engagement. Work engagement is a concept that includes three dimensions: vigour, dedication and absorption. Engaged workers are characterised by high levels of vigour and dedication, and they are immersed in their jobs. The UWES is scored on a seven-point frequency rating scale, varying from 0 (*never*) to 6 (*always*). The questionnaire consists of 17 items and includes statements such as "I am bursting with energy every day in my work", "Time flies when I am at work" and "My job inspires me". The alpha coefficient could be improved (it varies between 0,78 and 0,89 for the three subscales) by eliminating a few items without substantially decreasing the scale's internal consistency. Storm and Rothmann (2003) obtained the following alpha coefficients for the UWES in a sample of 2396 members of the South African Police Service: Vigour: 0,78; Dedication: 0,89; Absorption: 0,78.

Statistical analysis

The statistical analysis was carried out with the help of the SAS Program (SAS Institute, 2000). Cronbach alpha coefficients and inter-item correlation coefficients were used to assess the reliability and validity of the UWES (Clark & Watson, 1995). Descriptive statistics were used to analyse the data.

Structural equation modelling (SEM) methods as implemented by AMOS (Arbuckle, 1997) were used to test the factorial model for the UWES, using the maximum likelihood method. Hypothesised relationships are tested empirically for goodness-of-fit with the sample data. The χ^2 statistic and several other goodness-of-fit indices summarise the degree of correspondence between the implied and observed covariance matrices. Jöreskog and Sörbom (1993) suggest that the χ^2 value may be considered more accurately as a badness-of-fit rather than as a goodness-of-fit measure in the sense that a small χ^2 value is indicative of good fit.

However, because the χ^2 statistic equals $(N - 1)F_{\min}$, this value tends to be substantial when the model does not hold and the sample size is large (Byrne, 2001). A large χ^2 relative to the degrees of freedom is more commonly found, and indicates a need to modify the model to fit the data better (Jöreskog & Sörbom, 1993). Researchers have addressed the χ^2 limitations by developing goodness-of-fit indices that take a more pragmatic approach to the evaluation process. One of the first fit statistics to address this problem was the χ^2 /degrees of freedom ratio (CMIN/DF) (Wheaton, Muthén, Alwin & Summers, 1977). A value < 5 indicates acceptable fit (Tabachnick & Fidell, 2001). Various criteria, commonly referred to as "subjective" or "practical" indices of fit, are typically used as adjuncts to the χ^2 statistic.

The Goodness-of-Fit Index (GFI) indicates the relative amount of the variances/covariances in the sample predicted by the estimates of the population. It usually varies between 0 and 1 and a result of 0,90 or above indicates a good model fit. The Adjusted Goodness-of-Fit Index (AGFI) is a measure of the relative amount of variance accounted for by the model, corrected for the degrees of freedom in the model relative to the number of variables. The GFI and AGFI can be classified as absolute indices of fit because they basically compare the hypothesised model with no model at all (Hu & Bentler, 1995). Although both indices range from zero to 1,00, the distribution of the AGFI is unknown, consequently no statistical test or critical value is available (Jöreskog and Sörbom, 1986).

The Normed Fit Index (NFI) is used to assess global model fit. The NFI represents the point at which the model being evaluated falls on a scale running from a null model to perfect fit. This index is normed to fall on a 0 to 1 continuum. Marsh, Balla and Hau (1996) suggest that this index is relatively insensitive to sample sizes. The Comparative Fit Index (CFI) represents the class of incremental fit indices in that it is derived from the comparison of a restricted model (i.e. one in which structure is imposed on the data) with that of an independence (or null) model (i.e. one in which all correlations among variables are zero) in the determination of goodness-of-fit. The Tucker-Lewis Index (TLI) (Tucker & Lewis, 1973) is a relative measure of covariation explained by the model that is specifically developed to assess factor models. For these fit indices (NFI, CFI and TLI), it is more or less generally accepted that a value of less than 0,90 indicates that the fit of the model can be improved (Hoyle, 1995), although a revised cut-off value close to 0,95 has recently been advised (Hu & Bentler, 1999).

To overcome the problem of sample size, Browne and Cudeck (1993) suggest using the Root Mean Square Error of Approximation (RMSEA) and the 90% confidence interval of the RMSEA. The RMSEA estimates the overall amount of error; it is a function of the fitting function value relative to the degrees of freedom. The RMSEA point estimate should be 0,05 or less in order to indicate good fit, and the upper limit of the confidence interval should not exceed 0,08. Hu and Bentler (1999) suggest a value of 0,06 to be indicative of good fit between the hypothesised model and the observed data. MacCallum, Browne and Sugawara (1996) recently elaborated on these cut-off points and noted that RMSEA values ranging from 0,08 to 0,10 indicate mediocre fit, and those greater than 0,10 indicate poor fit.

Multivariate analysis of variance (MANOVA) was used to determine the significance of differences between the burnout (exhaustion, cynicism and professional efficacy) of demographic groups. MANOVA tests whether mean differences among groups on a combination of dependent variables are likely to have occurred by chance (Tabachnick & Fidell, 2001). In MANOVA a new dependent variable that maximises group differences is created from the set of dependent variables. One-way analysis is then performed on the newly created dependent variable. Wilk's lambda was used to test the significance of the effects. Wilk's lambda is a likelihood ratio statistic that tests the likelihood of the data under the assumption of equal population mean vectors for all groups against the likelihood under the assumption that the population mean vectors are identical to those of the sample mean vectors for the different groups. When an effect was significant in MANOVA, ANOVA was used to discover which dependent variables were affected. Because multiple ANOVAS were used, a Bonferroni-type adjustment was made for inflated Type 1 error. Tukey tests were done to indicate which groups differed significantly when ANOVAS were done.

T-tests were used to determine differences between the groups in the sample. Effect sizes (Cohen, 1988; Steyn, 1999) were used in addition to statistical significance to determine the significance of relationships. Effect sizes indicate whether obtained results are important (while statistical significance may often show results which are of little practical relevance). The use of only statistical significance testing in a routine manner has been criticised and from editors of some periodicals there have been appeals to place more emphasis on effect sizes (Steyn, 1999). The following formula was used to determine the practical significance of differences (d) when t-tests were used (Steyn, 1999):

$$d = \frac{Mean_A - Mean_B}{SD_{MAX}}$$

where

$Mean_A$ = Mean of the first group

$Mean_B$ = Mean of the second group

SD_{MAX} = Highest standard deviation of the two groups

The following formula was used to determine the practical significance of means of more than two groups (Steyn, 1999):

$$d = \frac{Mean_A - Mean_B}{\text{Root MSE}}$$

where

$Mean_A$ = Mean of the first group

$Mean_B$ = Mean of the second group

Root MSE = Root Mean Square Error

A cut-off point of 0,50 (medium effect) (Cohen, 1988) was set for the practical significance of differences between means.

RESULTS

Structural equation modelling (SEM) methods as implemented by AMOS (Arbuckle, 1997) were used to test the factorial model for the UWES. Data analyses proceeded as follows: first, a quick overview of model fit was done by looking at the overall χ^2 value, together with its degrees of freedom and probability value. Global assessments of model fit were based on several goodness-of-fit statistics (GFI, AGFI, NFI, TLI, CFI and RMSEA); secondly, given findings of an ill-fitting initially hypothesised model, analyses proceeded in an exploratory mode. Possible misspecifications as suggested by the so-called modification indices were looked for, and eventually a revised, re-specified model was fitted to the data.

Hypothesised model

A one-factor model was tested. However, a statistically significant χ^2 value of 576,11 (df = 111; $p = 0,000$) revealed a very poor overall fit. All other indices indicated a poor fit between a hypothesised one-factor model and the data. Table 2 presents fit statistics for the test of this hypothesised UWES model 1.

Table 2

Goodness-of-Fit Statistics for the Hypothesised UWES Model

Model	χ^2	χ^2/df	GFI	AGFI	NFI	TLI	CFI	RMSEA
Model 1	576,11	119	0,81	0,76	0,84	0,85	0,87	0,10
Model 2	624,50	119	0,81	0,75	0,83	0,84	0,86	0,11
Model 3	481,71	116	0,85	0,80	0,87	0,88	0,89	0,09
Model 4	444,96	115	0,86	0,81	0,88	0,89	0,90	0,09
Model 5	421,80	114	0,86	0,82	0,88	0,89	0,91	0,09
Model 6	483,30	116	0,85	0,81	0,87	0,88	0,90	0,09
Model 7	388,76	101	0,87	0,83	0,89	0,90	0,91	0,09
Model 8	334,34	87	0,89	0,84	0,90	0,91	0,92	0,09
Model 9	308,91	86	0,89	0,85	0,91	0,92	0,93	0,08

The statistically significant $\chi^2 = 567,11$ ($p < 0,00$) revealed a relatively poor overall fit of the original hypothesised UWES model. However, both the sensitivity of the likelihood ratio test to sample size and its basis on the central χ^2 distribution, which assumes that the model fits perfectly in the population, have been reported to lead to problems of fit. Jöreskog and Sörbom (1993) pointed out that the use of χ^2 is based on the assumption that the model holds exactly in the population, which is a stringent assumption. A consequence of this assumption is that models that hold approximately in the population will be rejected in a large sample. Furthermore, the hypothesised model (Model 1) was also not that good from a practical perspective. The NFI, TLI and CFI values lower than 0,95 and RMSEA value higher than 0,05 are indicative of failure to confirm the hypothesised model and indicated areas that could be improved on in terms of fit. It is apparent that some modification in specification is needed in order to determine a model that better represents the sample data.

To pinpoint possible areas of misfit, standardised residual values were examined. Standardised residuals are fitted residuals divided by their asymptotic (large sample) standard errors (Jöreskog & Sörbom, 1988). In essence, they represent estimates of the number of standard deviations the observed residuals are from the zero residuals that would exist if model fit were perfect (Byrne, 2001). Values > 2,58 are considered to be large (Jöreskog & Sörbom, 1988).

Post hoc analysis

Given rejection of the initially postulated one-factor model, the focus shifted from model test to model development. All subsequent analyses are now based on the 21-item revision, which is labelled here as model 2.

Although the various fit indexes for this model are substantially improved compared to those for the initial model, there is still some evidence of misfit in the model. For example, the $\chi^2 = 624,50$ and $481,71$ ($p < 0,00$) was still statistically significant, while the RMSEA value was only marginally adequate. Modification indexes (MI) were considered to pinpoint areas of misspecification in the model. The constraint parameters exhibiting the highest degree of misfit lay in the error covariance matrix and represent a correlated error between Item 11 and Item 9 (MI=20,11). Compared with other MI values for all other error covariance parameters, this value is exceptionally high and clearly needs to be re-specified. Considering the low regression coefficient of Items 16 and 17, it was decided to re-specify the model with these items deleted to ensure a better model fit.

The fit statistics in Table 2 indicate a relatively good fit for the re-specified model. Since this model fit was satisfactory and the results agreed with the theoretical assumptions underlying the structure of the UWES, no further modifications of the model were deemed necessary.

Descriptive statistics are given in table 3.

Table 3

Descriptive Statistics, Alpha Coefficients and Mean Inter-Item Correlation Coefficients of the UWES

Item	Mean	SD	Skewness	Kurtosis	r(Mean)	α
Vigour	21,41	5,31	-0,76	0,24	0,51	0,84
Dedication	12,10	5,61	-1,19*	1,40*	0,63	0,89
Absorption	21,77	5,15	-0,81	0,70	0,42	0,78

* High skewness and kurtosis

The coefficient alpha for the three factors compare well with the guideline of 0,70 for dedication (Nunnally & Bernstein, 1994). The mean inter-item correlations for the factor absorption are well within the guideline of $0,15 < r < 0,50$ except for dedication and in the order range for vigour (Clark & Watson, 1995). These results provide support for the internal consistency and validity of the UWES for engineers in South Africa.

MANOVA analyses showed (Table 4) that a non-significant relationship exists between engagement and environment, job level, age category and years experience ($p > 0,01$).

Table 4

MANOVA of Differences between Engagement of Demographic Groups

	Value	F	df	Den DF	p
Environment	0,97	0,60	18	1010,20	0,90
Job level	0,90	2,16	18	1004,60	0,01
Age category	0,96	0,85	18	1004,60	0,64
Years experience	0,93	1,48	18	990,43	0,09
Performance	0,66	13,33	12	958,05	0,00*
Job satisfaction	0,43	29,55	12	958,05	0,00*

* Statistically significant difference: $p < 0,01$

In an analysis of Wilk's Lambda values, no difference regarding engagement levels could be found between the different engineering environments, age categories and years of experience. Statistically significant differences ($p < 0,01$) were found between performance, and job satisfaction for engagement levels.

The relationship between engagement and performance and satisfaction was further analysed to determine practical significance, using ANOVA, followed by Tukey HSD tests. The results are given in Table 5 and 6.

Table 5

ANOVA of Differences between Engagement and Performance

Item	1	2	3	4	5	p	Root MSE
Vigour	7,50 ^a	12,00	16,73	21,04	24,23 ^a	0,00*	4,53
Dedication	9,00 ^a	10,83	18,02	22,94	25,88 ^a	0,00*	4,74
Absorption	9,50 ^a	15,33	18,59	21,71	23,46 ^a	0,00*	4,81

• Statistically significant ($p \leq 0,01$)

a. Practically significant difference from job level where a ($d > 0,80$, large effect) is indicated (vigour $d=3,69$, dedication $d= 3,56$ and absorption $d=2,90$)

Columns 1-5 represent a five category scale indicating own performance, with 1 representing low and ranging to 5 representing high performance. The results in Table 5 show that there is a practically significant difference between low and high performance (1 and 5) for vigour; the same accounts for dedication and absorption.

Table 6

ANOVA of Differences between Engagement and Satisfaction

Item	1	2	3	4	5	<i>p</i>	Root MSE
Vigour,	11,42 °	13,54	18,48	22,59	25,03 *	0,00*	3,80
Dedication	12,83 °	14,68	19,81	24,35	27,04 *	0,00*	3,96
Absorption	15,42 °	16,46	19,85	22,26	24,60 *	0,00*	4,50

* Statistically significant ($p \leq 0,01$)

a. Practically significant difference from job level where a ($d > 0,80$, large effect) is indicated (vigour $d=3,58$, dedication $d=3,59$ and absorption $d=2,04$)

Columns 1-5 represent a five-point scale indicating job satisfaction, with 1 being 'dissatisfied', 3 'neutral' and 5 'satisfied'. The results in Table 6 show that engineers who are dissatisfied with their jobs measured practically significantly (large effect) lower on vigour, dedication and absorption compared to those who are satisfied with their jobs.

DISCUSSION

The objectives of this study were to determine engagement levels of engineers in South Africa and to determine the construct validity and internal consistency of the UWES. The original UWES has 17 items. The UWES is a recently constructed measuring instrument. Consequently, few studies have critically reviewed its psychometric properties (Storm & Rothmann, 2003). The questionnaire was adapted and items were reformulated. Some of the problem items may be related to words that some of the participants could have found it difficult to understand or interpret. Therefore, we put in three alternatives for three items, item 4's ("I feel strong and vigorous in my job") alternative item is item 19 ("I feel strong and full of life and energy in my work"). Item 15's ("I am very resilient, mentally, in my job") alternative item is item 20 ("In my job I can comfortably deal with stressful situations and I can easily recover from such situations"). Item 11's ("I am immersed in my job") alternative item is item 21 ("I enjoy devoting all my attention and energy to my work"). Item 9's ("I feel happy when I am engrossed in my work") alternative item is item 18 ("I feel happy when my attention is totally focused on my work").

Internal consistencies were computed for the three engagement scales. Initial alpha (α) coefficients for the three engagement scales were: vigour (α) = 0,84, dedication (α) = 0,89 and absorption (α) = 0,78. The coefficient alpha for the three factors compare well with the

guideline of 0,70 (Nunally & Bernstein, 1994). The results provide support for the internal consistency of the UWES.

According to Schaufeli, Salanova and Bakker (in press) research concluded that work engagement is a multidimensional construct comprising three dimensions. It was thus decided to test a three-factor model, using structural equation modelling. In order to obtain a factor structure that best represents the UWES, exploratory factor analysis was used to assess the factorial structure.

A one-factor model was tested. However, a statistically significant χ^2 value of 576,11 (df = 111; $p = 0,000$) revealed a very poor overall fit. All other indices indicated a poor fit between a hypothesised one-factor model and the data. In examining the factor structure of the original UWES model for this research, some undesirable psychometric characteristics were found. Considering the low regression coefficient of items 16 ("It is difficult to detach myself from my job") and 17 ("I always persevere at work, even when things do not go well"), it was decided to re-specify the model with these items deleted to ensure a better model fit. This could be due to the fact that a large number of the respondents come from consulting environments where they are fairly uninvolved with businesses for long-term project implementation and benefit tracking. Alternative models for engagement were fitted to the data. Error terms were allowed to correlate in order to improve model fit (Byrne, 2001). It was considered more realistic to incorporate the correlated errors in this study, rather than to ignore their presence (Storm & Rothmann, 2003). According to Aish and Jöreskog (1990), the specification of correlated error terms for the purpose of achieving a better-fitting model is not an acceptable practice. Correlated error terms in measurement models represent systematic, rather than random, measurement errors in item responses. They may derive from characteristics specific either to the items or the respondents. Correlated errors may present a high degree of overlap in item content when an item, although worded differently, essentially asks the same question (Byrne, 2001).

Two other items that were deleted in the three-factor model were item 4 ("I feel strong and vigorous in my job") and item 14 ("I get carried away by my work"). The revised three-factor model fits significantly better to the data than the original three-factor model with the three relative fit indices close to 0,90. One possible assumption could be that the measure for

success for engineers is to rather implement projects and show results than to experience internal contentment. Results and performance are measured on visible deliverables.

The hypothesised three-factor model of the UWES fitted the data better, after removing two items, and after allowing some error terms to correlate. The analysis of the revised three-factor model indicated that the revised three-factor model fits reasonably well to the data with the RAMSEA and the CFI approaching 0,90. The three-factor model represented the data well and supported the three-factor model findings of Schaufeli et al. (2002).

Storm and Rothmann (2003) examined the psychometric properties of the UWES as an instrument constructed to measure the engagement levels of employees. They found that the one-factor model fits the data better than the three-factor model. According to Storm and Rothmann (2003), there is, as yet, insufficient evidence to suggest that a one-factor model is superior to a three-factor model. Their findings are in contrast to the findings of Schaufeli et al. (2002).

The second objective of the study was to investigate the differences between the work engagement of various demographic groups. In an analysis of Wilk's Lambda values, no differences regarding engagement levels could be found between the age groups, engineering environments, job levels and years of experience. Statistically significant differences were found between the work engagement of employees who rated their performance and job satisfaction high (compared with those who rated these aspects as low). It seems reasonable to assume that the demographic factors like the work environment, age and years of experience and job level are less important than performance and job satisfaction.

Engineers that perform well and that are successful are more inclined to be engaged than their counterparts. The results showed that practically significant differences were experienced between underperforming engineers with low levels of job satisfaction and high-performing individuals with high levels of job satisfaction in terms of vigour, dedication and absorption. It can be argued that engineers that are willing to invest time and effort in their work will perform better and they will then experience more job satisfaction. This implies that engineers who are solid performers are happy in their work because their work is meaningful to them. Engineers are energised by challenges and persist in their work and they are not easily fatigued. Challenges inspire them to perform in their work, even if they face

difficulties. This could lead to job satisfaction and a feeling of achievement and fulfilment. Large effects were experienced for all constructs of performance and satisfaction. It makes sense that employees that perform well and experience high levels of job satisfaction have high levels of energy and mental resilience while they work. They are totally immersed in their work and the time passes quickly for them.

In conclusion, it seems acceptable to use the UWES to compare work engagement of different demographic groups. The fit statistics indicated a relatively good fit for the re-specified model. Since this model fit was satisfactory and the results agreed with the theoretical assumptions underlying the structure of the UWES, no further modifications of the model were deemed necessary.

The major limitation of this study is the item wording of the UWES that is not appropriate for this context. Improvement in terms of item wording is needed. There is a high overlap in item content. This could lead to misinterpretation of the items. The correlated errors may represent respondent characteristics such as social desirability (Aish & Jöreskog, 1990). Longitudinal studies could provide a better understanding of the concept of work engagement.

RECOMMENDATIONS

Based on the results of this study, it is recommended that the 'mismatch model' of Maslach and Leiter (1997) may be a useful framework for developing interventions, because it focuses attention on the relationship between the person and the situation, rather than on one of these in isolation. Workload, control, rewards, community, fairness and values are the six areas to focus on when interventions are developed. According to Cooper (1998), the model provides an alternative way of identifying burnout and of incorporating situational changes along with personal ones. Interventions can focus on the job design and must ensure that the workload for that specific job position is manageable. Positions must be audited to ensure that the right person with the right qualities is in the job. People must have access to experts and mentors for career advice and to discuss issues. People must be accountable for their projects and their work. This enhances decision-making and problem solving in their area of responsibility. If people are accountable for the outcomes of their work, they already have a sense of control over their work. People feel more empowered when they feel that they work independently, therefore they must develop their own specific development and performance plan of action

to make sure that they have met the performance areas and outcomes of their work. Companies must be prepared to pay for performance. The only indicator or measurement is demonstrated performance. A merit-based system of rewards is very important, because people can perceive performance management as an unfair process. Companies and line managers must therefore ensure that their people are aligned with their jobs as well as with the strategic objectives of the company. This will lead to development of core competencies in order to perform well in the job and to ensure a fair measurement that will be linked with rewards. Teamwork must be encouraged so as to share ideas and to create diverse thinking. This creates greater cohesion between people. Communication is also important to establish aligned understanding and common focus. The last important indicator is values. The people must be able to identify with the company. This means that the company has to make its priorities clear. People will then use the values as a driving force in order to reach their goals and to direct their behaviour.

The emerging science of positive psychology may help to illuminate ways to reduce the gap between person and environment variables by working on the person side of the equation to develop unrealised potential, which can then be used to influence the environment. Quality of life can be enhanced by improving the fit between the person and the environment, and this fit can be improved by either enhancing personal attributes, altering the environment to suit the attributes of the person, or both (Ranzijn, 2002).

The general issue of the locus of intervention – the person or the situation – is a particular important one (Maslach & Goldberg, 1998). When a better fit exist in these six areas, then engagement with work is the likely outcome. The potential of this approach is very promising as a means of dealing with individual burnout in its situational context (Cooper, 1998). The more you are engaged with your job, the better you will be at it. The right person-environment fit will create a healthier and more humane workplace.

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A CAUSAL MODEL OF WORK-RELATED WELL-BEING OF ENGINEERS IN SOUTH AFRICA

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ABSTRACT

The aims of this study were to assess the validity and internal consistency of constructs in a measurement model of work-related well-being and to test a causal model thereof for engineers in South Africa. A stratified random sample ($N = 369$) was taken of engineers in South Africa. The Maslach Burnout Inventory – General Survey (MBI-GS), Utrecht Work Engagement Scale (UWES), the Job Characteristics Scale (JCS), Life Orientation Test Revised (LOT-R), and the Health and Organisational Commitment subscales of the ASSET were administered. A good fit was found for a model in which exhaustion mediated the relationship between job demands and ill-health, and work engagement (vigour and dedication) mediated the relationship between job resources and organisational commitment. The results suggested that the effect of a lack of job resources on exhaustion and the effect of job resources on work engagement depends on the level of dispositional optimism.

OPSOMMING

Die doelstellings van hierdie studie was om die geldigheid en interne konsekwentheid van konstrukke in 'n metingsmodel van werksverwante welstand vir ingenieurs in Suid-Afrika te toets en 'n oorsaaklike model van werksverwante welstand te toets. Gestratifiseerde ewekansige steekproewe ($N = 369$) van ingenieurs in Suid-Afrika is gebruik. Die Maslach Uitbrandingsvraelys, Utrecht-werksbegeesteringskaal (UWES), die Taakeienskappe-vraelys, die Gesondheid- en Verbondenheid-subskale van die ASSET asook die Lewensoriëntasievraelys is afgeneem. 'n Goeie passing is verkry vir 'n model waarin uitputting die verwantskap tussen poseise en swak gesondheid, en werksbegeestering (energie en toewyding) die verwantskap tussen werksbronne en organisasie-verbondenheid bemiddel het. Die resultate het aangetoon dat die effek van 'n gebrek aan werksbronne op uitputting en werksbegeestering afhang van die vlak van disposisionele optimisme.

The work-related well-being of engineers in South Africa plays an important role in the development of talent retention strategies. Compared to the past, engineers in South Africa currently have to invest more in their jobs in terms of time, effort, skill, and flexibility, whereas they receive less in terms of career opportunities, lifetime employment and job security. Today's engineers have less time, more work, and a growing need for information (Lingard, 2003). Furthermore, engineers need to be equipped with ways to build and capitalise on their strengths to maintain excellent performance. Therefore, organisations need to nurture their talent and focus on the well-being of engineers to eventually eradicate career development problems.

Engineers' stress and burnout have not received the necessary recognition and attention as it was not viewed as a serious problem for the industry. According to Jackson, Rothmann and van de Vijver (in press), burnout and eventual ill-health result from high levels of stress due to overload, inordinate time demands, inadequate collegial relationships, lack of resources, role ambiguity, limited promotional opportunities, little involvement in decision-making, insufficient financial support, and role ambiguity. These problems could also trouble the engineering profession and can lead to strain (ill-health). The latter occurs when environmental demands or constraints are perceived by a person to exceed his or her resources or capacities. Therefore the conclusion that working as an engineer may result in illness seems to be legitimate.

According to Schaufeli and Bakker (2001), research on burnout shows that some individuals, regardless of high job demands and long working hours, do not show symptoms of burnout. Instead, it seems that they find pleasure in working hard and dealing with job demands. From a positive psychology perspective (Seligman & Csikszentmihalyi, 2000), such individuals could be described as engaged in their work. The "positive psychology" paradigm helps to understand the relationship between work (and more specifically goal-directed, structured activity) and well-being (Kelloway & Barling, 1991). The focus on engagement as the positive antithesis of burnout promises to yield new perspectives on the interventions to promote healthy perceptions, beliefs and physical well-being (Salovey, Rothman, Detweiler & Steward, 2000) and to alleviate burnout (Maslach, Schaufeli & Leiter, 2001). According to Nelson and Simmons (2003), meaningful work leads to eustress, which would promote engagement even if the situation is demanding. Eustress reflects the extent to which cognitive appraisal of the situation is seen to either benefit or enhance an individual's well-being.

Assuming the presence of the positive attitudes toward work (e.g. work engagement) by observing the absence of its negative aspects (e.g. burnout), or vice versa, is a simplistic approach to understanding eustress and distress. Therefore burnout and work engagement (being aspects of work-related well-being) should be integrated into a single model (Rothmann, 2003).

Work-related well-being

Burnout and engagement. In the helping professions, burnout refers to the condition of physical and emotional exhaustion, as well as the associated negative attitudes resulting from the intense interaction in working with people (Bakker, Schaufeli, Sixma & Bosveld, 2001). Maslach and Jackson (1986) have conceptualised burnout as encompassing the components of emotional exhaustion, depersonalisation, and reduced personal accomplishment. Recently, the concept of burnout has been expanded towards all types of professions and occupational groups. The publication of the Maslach Burnout Inventory – General Survey (MBI-GS) (Schaufeli, Leiter, Maslach & Jackson, 1996) makes it possible to study burnout outside the service sector and to make comparisons among different occupational groups.

From a theoretical point of view, one could argue that exhaustion and mental distancing (cynicism and/or depersonalisation) constitute the two key aspects of burnout (Schaufeli, 2003). Exhaustion refers to employees' *incapability* of performing because all energy has been drained, whereas mental distancing involves the employees' *unwillingness* to perform because of an increased intolerance of any effort. Mental distancing – or psychological withdrawal from the task – can be seen as an adaptive mechanism to cope with excessive job demands and resulting feelings of exhaustion (Maslach, Schaufeli & Leiter, 2001). However, when this coping strategy becomes a habitual pattern (as is the case in cynicism and depersonalisation), it disrupts adequate task performance and becomes dysfunctional. In turn, this condition leads to an increase in job demands and exhaustion, which completes the vicious circle.

Essentially, incapacity and unwillingness to perform are considered two sides of the same coin (Schaufeli, 2003). Indeed, some empirical findings point to the central role of exhaustion and mental distancing as opposed to the third component – lack of professional efficacy. The following explanations could be given for this: firstly, relatively low correlations of

professional efficacy are observed with exhaustion and cynicism, whereas these two burnout dimensions are correlated relatively strongly (Lee & Ashforth, 1996). In a similar vein, both "core factors of burnout" sometimes collapse into one factor (Green, Walkey & Taylor, 1991). Secondly, it seems that cynicism develops in response to exhaustion, whereas professional efficacy seems to develop independently and in parallel (Leiter, 1993). Thirdly, professional efficacy is the weakest burnout dimension in terms of significant relationships with other variables (Lee & Ashforth, 1996). Moreover, several researchers have argued that professional efficacy reflects a personality characteristic rather than a genuine burnout component (Cordes & Dougherty, 1993; Shirom, 1989).

In line with the increased interest in positive psychology, it has been proposed to study the opposite of burnout in order to cover the entire continuum of work-related experiences, ranging from negative (burnout) to positive (work engagement) (see Maslach et al., 2001). The positive antipode of burnout is characterised by vigour (high energy) and dedication (strong identification). In addition, a third element – absorption – is distinguished, which most likely plays a less central role in the engagement concept. The first psychometric results with a measure that assesses these three characteristics of engagement – the Utrecht Work Engagement Scale – are encouraging (Schaufeli, Martínez, Pinto, Salanova, & Bakker, 2002; Schaufeli, Salanova, González-Romá, & Bakker, 2002). Hence, instead of focusing exclusively on negative work-related experiences, research should also include positive work experiences in order to arrive at a more balanced picture of employee (un)well-being.

There is disagreement about the question of how engagement should be measured. Maslach and Leiter (1997) state that engagement is adequately measured by reversing MBI scores, whereas Schaufeli et al. (2002) propose to measure positive and negative work aspects independently. They argue that although work engagement is the positive antithesis of burnout, the measurement and the structures of both concepts may well differ. By using the MBI for measuring work engagement, it is impossible to study its relationship with burnout empirically since both concepts are considered to be opposite poles on a continuum that is covered by one single instrument (the MBI).

Exhaustion (low energy) and mental distancing (poor identification) are the main features of burnout that are assessed by the MBI (Schaufeli, 2003). Vigour (high energy) and dedication (strong identification), as measured by the UWES, seem to be the positive counterparts of

exhaustion and mental distancing (as measured by the MBI). Therefore these aspects of work-related well-being could be integrated into one model of work-related well-being.

Organisational causes of well-being. The Job Demand-Resources (JD-R) model assumes that two underlying psychological processes play a role in burnout (as one aspect of wellness at work): 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, Bakker, Nachreiner & Schaufeli, 2001). Job demands are defined as things that have to be done, including physical, social and organisational aspects of the job that require sustained physical and mental effort. Quantitative job demands refer to the amount of work required and the available time frame, while qualitative workload involves employees' affective reactions to their jobs (Cooper, Dewe & O'Driscoll, 2001).

Job resources are those physical, psychological, social or organisational aspects of the job that may be functional in achieving work goals, reducing job demands, with the associated physiological and psychological costs, and stimulating personal growth and development (Demerouti et al., 2001). In terms of this definition, job characteristics such as variety, independence, opportunities for learning and participation, opportunities to participate, role clarity, effective communication, advancement, remuneration and good relationships with supervisors and colleagues create psychological meaningfulness and safety for employees, which are needed to be engaged in one's job (May, Gilson & Harter, 2004).

Schaufeli and Bakker (2004) extended the JD-R model by including engagement and by adding health impairment and organisational withdrawal in their Comprehensive Burnout and Engagement (COBE) Model. The COBE model assumes two job-related psychological processes, namely an energetic and a motivational process. The energetic process links job demands with health problems via burnout. The motivational process links job resources via work engagement with organisational outcomes. Job resources may play either an intrinsic motivational role (by fostering the employee's growth, learning and development), or they may play an extrinsic motivational role (by being instrumental in achieving work goals). Schaufeli and Bakker (2004) confirmed the model in an empirical study in the Netherlands. Job demands were associated with exhaustion, whereas job resources were associated with work engagement. Burnout was related to health problems as well as to turnover intentions, and mediated the relationship between job demands and health problems, while work

engagement mediated the relationship between job resources and turnover intentions. Jackson, Rothmann and Van de Vijver (in press), found in their study that burnout mediated the relationship between job demands and ill-health, while work engagement mediated the relationship between job resources and organisational commitment; lack of resources also contributed to burnout.

Ill-health. There is research evidence that consistently links occupational stress with physical and psychological ill-health. Heart disease, ulcers, some forms of cancer, allergies, migraine, back problems, depression and an increased frequency of minor ailments such as colds and flu have been associated with stress and burnout (Ho, 1997; Ryff & Singer, 1998; Sethi & Schuler, 1990). In their study of burnout of in a higher education institution in South Africa, Barkhuizen, Rothmann and Tytherleigh (2004) found that exhaustion was related to health problems. According to Maslach et al. (2001), perceived stressors lead to emotional reactions, which, in turn, lead to ill-health.

Organisational commitment. Organisational commitment is defined as a state in which an employee identifies with an organisation and its goals and wishes to maintain his or her membership of the organisation (Robbins, 1998). According to Meyer, Stanley, Herscovitch, and Topolnytsky (2002), organisational commitment includes three components, namely affective, continuance and normative commitment. Affective commitment denotes an emotional attachment to, identification with and involvement in the organisation. Continuance commitment denotes the perceived cost associated with leaving the organisation, and normative commitment reflects a perceived obligation to remain in the organisation.

Work engagement may be thought of as an antecedent to organisational commitment in that individuals who experience deep engagement in their jobs identify with their organisations. Based on interviews with engaged workers, Schaufeli, Taris, Blanck, Peeters and Bakker (2001) concluded that they have values and norms which are in line with those of their organisations. Disengagement, on the other hand, leads to a lack of organisational commitment (Aktouf, 1992).

Optimism. Currently, there is an emerging shift towards positive psychology with the focus on human strengths and optimal functioning, rather than on weaknesses, malfunctioning and

damage (Seligman & Csikszentmihalyi, 2000). According to these authors, optimism has been discovered as a human strength that acts as a buffer against mental illness. According to Nelson and Simmons (2003), there is benefit in identifying those individual differences that would promote wellness through their role in more positive appraisals of demands. Alternatively, these characteristics could work to arm individuals with the belief that they are equipped to handle a demand. As an individual difference variable, optimism has been associated with good mood, perseverance and health. Nelson and Simmons (2003) distinguish between two conceptualisations of optimism, namely dispositional optimism (Carver & Scheier, 2003) and learned optimism (Seligman, 1991). Learned optimism relates to an optimistic explanatory style. Dispositional optimism is defined as a global expectation that good things will be plentiful in the future and that bad things will be scarce.

Optimism is regarded as the generalised expectation of positive outcomes. As a dispositional variable, optimism has been of considerable interest as a potential moderator of the relationship between job stressors and psychological strain (Cooper et al., 2001). Optimism has been found to moderate the relationship between daily hassles and health outcomes (Fry, 1995) and perceived stress and depression (Sumi, Horie & Haykawa, 1997). Since burnout is a psychological strain caused by certain job stressors (Schaufeli & Enzmann, 1998), dispositional optimism could act as a moderator between job stressors and the development of burnout. Optimism has also been shown to be an important predictor of physical and psychological health adjustment (Chang, Rand & Strunk, 2000).

Definitions of optimism and pessimism rest on people's expectations for the future. This grounding in expectations links optimism and pessimism to expectancy-value models of motivation (Carver & Scheier, 2003). The first element of expectancy-value theories is that behaviour is aimed at the pursuit of goals. Goals are actions, end states or values that people see as desirable or undesirable. People try to fit their behaviours to what they see as desirable and to stay away from behaviours that they see as undesirable. The more important the goal is, the greater its value in a person's motivation. The second element in expectancy-value theories is expectancy – i.e. a sense of confidence or doubt about the attainability of the goal. If a person lacks confidence, there will be no action. When people are confident about an eventual outcome, effort continues – even in the face of great adversity. When confronting a challenge, optimists tend to approach it with confidence and persistence, while pessimists are doubtful and hesitant. When situations get difficult, optimists assume that adversity can be

handled successfully, whereas pessimists are more likely to anticipate disaster. Optimists do not only believe that good things will happen, but also that they can make good things happen (Carver & Scheier, 2003).

Research Aims

The aims of this study were as follows: a) to determine the validity and internal consistency of the constructs in the measurement model, including work-related well-being (burnout and work engagement), job characteristics, ill-health, organisational commitment and optimism, and b) to test a causal model of work-related well-being for engineers in South Africa.

METHOD

Research design

A survey design was used to reach the research objectives. This specific design is the cross-sectional design, where a sample is drawn from a population at a particular point in time (Shaughnessy & Zechmeister, 1997).

Participants

Random samples ($N = 369$) were taken from Engineers in South Africa that are professionally registered with ECSA (Engineering Council of South Africa). The random sampling was carried out with the help of the SAS Program (SAS Institute, 2000). Professionally registered engineers were listed numerically on the grounds of registration numbers (the ECSA registration numbers are based on year of registration with additional numeric digits). Questionnaires were posted to the selected individuals and each engineer was asked to complete the questionnaire. All questionnaires were completed anonymously and treated as confidential.

Table 1 presents some of the characteristics of the participants.

Table 1
Characteristics of the Participants

Item	Category	Frequency	Percentage
Environment	Mining	53	14,48
	Manufacturing	21	5,74
	Design and construction	56	15,30
	Petrochemical	68	18,58
	Energy and telecommunication	21	5,74
	Consulting	95	25,96
	Other	52	14,21
Job level	Engineer in training	5	1,37
	Junior management	22	6,04
	Middle management	110	30,22
	Senior management (executive level)	116	31,87
	Specialist	35	9,62
	Consulting	61	16,76
	Other	15	4,12
Age	18-27	11	3,02
	28-32	62	17,03
	33-38	46	12,64
	39-44	54	14,86
	45-50	65	17,86
	51-56	53	14,56
	> 56	73	20,05
Race	White	338	92,60
	Black	11	3,01
	Coloured	3	0,82
	Indian	10	2,74
	Other	3	0,82
Education level	Grade 12	2	0,54
	Technical college diploma	2	0,54
	Technicon diploma	8	2,18
	University degree	189	51,50
	Postgraduate degree	166	45,23
Gender	Male	346	94,79
	Female	19	5,21
Home language	Afrikaans	197	53,97
	English	159	43,56
	African	9	2,45

The sample consisted mostly of males (94,79%), which is a representation of the gender spread of the population in engineering. Almost half of the participants (45,23%) had

postgraduate education. The mean age of participants was 45,68 years, while the mean length of work experience in the field of engineering was 20,96 years. Job satisfaction and own performance was rated 3,83 and 4,18 respectively out of a possible rating of 5. This indicates that individuals rate their job satisfaction more than average and see their own performance as 'exceeding requirements'.

Measuring battery

The following measuring instruments were used in the empirical study:

The *Maslach Burnout Inventory – General Survey* (MBI-GS) (Schaufeli et al., 1996) was used in this study. The MBI-GS (Schaufeli et al., 1996) measures respondents' relationships with their work on a continuum from engagement to burnout. Two subscales of the MBI-GS were used in this study, namely Exhaustion (five items, e.g. "I feel used up at the end of the workday"), and Cynicism (four items, e.g. "I have become less enthusiastic about my work"). All items are scored on a seven-point frequency rating scale ranging from 0 (*never*) to 6 (*daily*). Internal consistencies (Cronbach alpha coefficients) reported by Schaufeli et al. (1996) varied from 0,87 to 0,89 for Exhaustion, and 0,73 to 0,84 for Cynicism. Test-retest reliabilities after one year were 0,65 (Exhaustion), and 0,60 (Cynicism) (Schaufeli et al., 1996). Storm and Rothmann (2003) confirmed the factor structure of the MBI-GS in a sample of 2 396 SAPS members. Structural equivalence of the MBI-GS for different race groups in the SAPS was confirmed. The following Cronbach alpha coefficients were obtained for the MBI-GS: Exhaustion: 0,88, and Cynicism: 0,79 (Storm & Rothmann, 2003).

The *Utrecht Work Engagement Scale* (UWES) (Schaufeli et al., 2002) was used to measure the levels of engagement. Two subscales of the UWES were used in this study, namely vigour and dedication. Engaged workers are characterised by high levels of vigour and dedication. The UWES is scored on a 7-point frequency rating scale, varying from 0 (*never*) to 6 (*everyday*). The questionnaire consists of 17 questions and includes statements such as "I am bursting with energy every day in my work", "Time flies when I am at work" and "My job inspires me". The alpha coefficient could be improved (it varies between 0,78 and 0,89 for the subscales) by eliminating a few items without substantially decreasing the scale's internal consistency. Storm and Rothmann (2003) obtained the following alpha coefficients for the

UWES in a sample of 2 396 members of the South African Police Service: Vigour: 0,78, and Dedication: 0,89.

The *Job Characteristics Scale* (JCS) was developed by the authors to measure job demands and job resources for employees. The JCS consists of 39 items. The questions are rated on a four-point scale ranging from 1 (*never*) to 4 (*always*). The dimensions of the JCS include pace and amount of work, mental load, emotional load, work variety, opportunities to learn, work independence, relationships with colleagues, relationship with immediate supervisor, ambiguities of work, information, communications, participations, contact possibilities, uncertainty about the future, remuneration and career possibilities.

The *Health Subscales of An Organisational Stress Screening Tool* (ASSET) (Cartwright & Cooper, 2002) were used to measure physical and psychological ill-health. The Health subscales consist of 19 items arranged on two subscales: the Physical health and Psychological well-being questionnaire's questions are scored on a four-point scale ranging from 1 (*never*) to 4 (*often*). All items on the Physical health subscale relate to physical symptoms of stress. The role of this subscale is to give an insight into physical health, not an in-depth clinical diagnosis. The items listed in the Psychological health subscale are symptoms of stress-induced mental ill-health. Johnson and Cooper (2003) found a Guttman split-half reliability coefficient of 0,70 and 0,90 for the Physical and Psychological Health subscales respectively. They also found that the Psychological well-being subscale has good convergent validity with an existing measure of psychiatric disorders, the General Health Questionnaire (Goldberg & Williams, 1988).

The *Organisational Commitment Subscale of the ASSET* (Cartwright & Cooper, 2002) was used to measure the individual's attitude toward his or her organisation, and includes questions relating to perceived levels of commitment to the organisation. The subscale consists of seven items. The questions are rated on a six-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Johnson and Cooper (2003) found a Guttman split-half reliability coefficient of 0,74 for the scale.

The *Life Orientation Test-Revised* (LOT-R), a 10 item measure, was developed by Scheier, Carver and Bridges (1994) to measure dispositional optimism. Six items contribute to the optimism scale and four items are fillers. The LOT-R is measuring a continuum of high,

average and low optimism/pessimism (Scheier et al., 1994). The LOT-R measures optimism/pessimism on a five-point Likert scale, ranging from 5 (*strongly agree*) to 1 (*strongly disagree*). The LOT-R was found to have adequate internal consistency (Cronbach's alpha = 0,78) and excellent convergent and discriminant validity (Scheier et al., 1994).

Statistical analysis

The statistical analysis was carried out with the help of the SAS Program (SAS Institute, 2000). Descriptive statistics were used to analyse the data.

Structural equation modelling (SEM) methods, as implemented in AMOS (Arbuckle, 1997), were used to test the causal model of work wellness using the maximum likelihood method. Hypothesised relationships are tested empirically for goodness of fit with the sample data. Among the fit indices produced by the AMOS programme is the Chi-square statistic (χ^2), which is the test of absolute fit of the model. However, the χ^2 value is sensitive to sample size. Therefore, additional goodness-of-fit indices such as the Goodness-of-Fit Index (GFI), the Adjusted Goodness-of-Fit Index (AGFI), the Normed Fit Index (NFI), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI) and the Root Means Square Error of Approximation (RMSEA) were used in this study.

Principle factor extraction with a direct oblimin or varimax rotation was performed on the 48 items of the Job Characteristics Scale for a sample of 369 engineers. Cronbach alpha coefficients were used to assess the internal consistency of the measuring instrument (Clark & Watson, 1995).

RESULTS

Construct Validity of the Measuring Instruments

Burnout and work engagement. A simple principal component analysis was conducted on the two components of work engagement (i.e. Vigour and Dedication) and burnout (Cynicism and Exhaustion). The eigenvalues and scree plot showed that three related factors, which explained 63,75% of the total variance, could be extracted (Engagement, Exhaustion and Cynicism). These factors represent two aspects of wellness, namely the energy dimension

(ranging from Exhaustion to Vigour) and the identification dimension (ranging from Mental Distance to Dedication). Next, a principal component analysis with an Oblimin rotation was conducted on these dimensions of burnout and engagement. The factors were labelled as follows a) Factor 1: Engagement (loading = 0,70), i.e. meaningful work and energised individuals. b) Factor 2: Exhaustion (loading = 0,75), i.e. emotionally drained individuals that are less enthusiastic. c) Factor 3: Cynicism (loading = 0,65), i.e. individuals that doubt the significance of their work.

Job demands and job resources. The 39 items of the Job Characteristic Scale were divided into 13 parcels chosen on the basis of item content, which consisted of three items each. A principle component analysis was carried out on all these parcels. The eigenvalues and scree plot showed two components, which explained 53,02% of the total variance. Next, a principal component analysis with an oblimin rotation was conducted on the 13 parcels. The results showed that pace and amount of work (loading = 0,86) and mental load (loading = 0,81) formed the first factor (labelled Job Demands). Information (loading = 0,81), participation (loading = 0,81), clarity (loading = 0,74) and supervisory support (loading = 0,71) formed the second factor (labelled Job Resources).

Ill-Health. A simple principal component analysis that was carried out on the 16 items of the health subscales of the ASSET resulted in two factors, which explained 50,48% of the variance. Next, a principal component analysis with a direct oblimin rotation was conducted on the 16 items. The two related factors that were extracted were physical ill-health (seven items) and psychological ill-health (nine items).

Organisational commitment. The principal component analysis that was carried out on the Organisational and Commitment subscale of the ASSET resulted in a one-factor solution, which explained 69,88% of the total variance. The factor, labelled Organisational Commitment, included the following items: a) "I feel valued and trusted by the organisation"; b) "I enjoy working for this organisation to the extent that I am not actively seeking a job elsewhere"; c) "I am proud of this organisation"; d) "Outside of my particular job, I take interest in many aspects of the running and success of this organisation"; e) "Overall, I am happy with my organisation"; f) "I feel that it is worthwhile to work hard for this organisation, and g) "I am committed to this organisation." The item loadings on the factors varied from 0,67 to 0,92.

Descriptive Statistics

Table 2 shows the descriptive statistics of the constructs.

Table 2

Descriptive Statistics

Scale	Mean	SD	Skewness	Kurtosis	α
Exhaustion	11,76	6,41	0,45	-0,20	0,86
Cynicism	6,50	5,25	0,81	0,04	0,83
Engagement	44,80	10,28	-1,01*	0,89	0,92
Job resources	96,69	15,09	-0,57	0,19	0,68
Overload	16,35	2,62	-0,58	-0,27	0,79
Ill-health	30,86	8,70	0,47	-0,69	0,82
Organisational commitment	40,35	10,18	-1,08*	0,78	0,92
Optimism	24,17	3,81	-0,69	0,31	0,70

* High skewness and kurtosis

The coefficient alphas for the eight factors compare well with the guideline of 0,70 (Nunnally & Bernstein, 1994). These results provide support for the internal consistency and validity of the wellness model for engineers in South Africa. The scores are fairly normally distributed, with engagement, job resources, overload, organisational commitment and optimism somewhat negatively skewed. The distributions for engagement and organisational commitment indicated the largest deviations for negative skewness.

Correlations

Table 3 shows the correlations of the constructs.

Table 3
Correlations between the Constructs

	1	2	3	4	5	6	7
1. Exhaustion	-	-	-	-	-	-	-
2. Cynicism	0,53**	-	-	-	-	-	-
3. Engagement	-0,38*	-0,68**	-	-	-	-	-
4. Overload	0,18	-0,15	0,37*	-	-	-	-
5. Resources	-0,38*	-0,58**	0,66**	0,34*	-	-	-
6. Optimism	-0,28	-0,31*	0,48*	0,21	-0,29	-	-
7. Ill-health	0,56**	0,37*	-0,30*	0,17	-0,25	-0,29	-
8. Commitment	-0,28	-0,47*	0,54**	0,22	0,58**	0,40*	-0,22

+ $p < 0,01$

* $r > 0,30$ (medium effect)

** $r > 0,50$ (large effect)

Pearson product-moment correlation coefficients were used to specify the relationship between the variables. Exhaustion correlates practically significantly (large effect) with cynicism and ill-health and resources, engagement (medium effect). Cynicism is practically significantly related to engagement, resources (large effect) and optimism, ill-health, commitment (medium effect). The same significance is also experienced between overload and resources.

Spearman nonparametric correlations were used to specify the relationship between variables when skewness was higher than one. Engagement is practically significantly related to job resources and organisational commitment (large effect) and optimism, ill-health (medium effect). Organisational commitment correlates practically significantly (large effect) with job resources and optimism (medium effect).

Regression analyses

Next, three multiple regression analyses were carried out. Exhaustion and cynicism (as measured by the MBI-GS) and engagement (as measured by UWES) were used as dependent variables. Overload and job resources (as measured by the Job Characteristic Scale) and optimism (as measured by LOT-R) were the independent variables.

Table 4 shows the result of Multiple Regression Analyses overload, job resources and optimism as dependent variables.

Table 4
Multiple Regression Analyses with Overload, Job Resources and Optimism as Independent Variables

Dependent Variable	<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	<i>F</i>	<i>p</i>
Exhaustion	0,51	0,26	0,26	43,59	0,00
Cynicism	0,59	0,34	0,34	63,26	0,00
Engagement	0,72	0,52	0,51	129,70	0,00

ANALYSIS OF VARIANCE						
	Exhaustion		Cynicism		Engagement	
	<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>
Overload	7,41	0,00*	1,16	0,20	4,09	0,00*
Job Resources	-8,01	0,00*	-11,54	0,00*	12,74	0,00*
Optimism	-2,52	0,01*	-0,38	0,71	3,54	0,00*

* Statistically significant: $p < 0,01$

Table 4 shows that overload and job resources (as measured by the JCS) and optimism (as measured by the LOT-R) contribute statistically significantly to exhaustion (as measured by the MBI-GS). These independent variables explained 26% of the variance in exhaustion. Lack of job resources (as measured by the JCS) contributes statistically significantly to cynicism. Job resources explained 34% of the variance in cynicism. Overload and job resources (as measured by the JCS) and optimism (as measured by the LOT-R) contribute significantly to engagement (as measured by the UWES). These variables explained 52% of the variance in engagement.

A Model of Work-Related Well-Being

Next, a model based on the findings of a literature review on work-related well-being was developed. The hypothesised model of work-related well-being was tested by considering the goodness-of-fit-statistics. The results indicated that the model fitted adequately to the data: $\chi^2 = 46,42$; $\chi^2/df = 10$; GFI = 0,97; AGFI = 0,91; CFI = 0,95; IFI = 0,96; TLI = 0,91; RMSEA = 0,10. The statistical significance of model $\chi^2 = 46,42$ revealed a good overall fit of the

hypothesised model. All other indices indicated a good fit between the hypothesised model and the data obtained. From a practical perspective, the degrees of freedom (*df*) of 10 together with the NFI value of 0,95 and a RMSEA value of 0,10 do not need modification. In order to obtain a sufficient model fit, cynicism as a construct was removed.

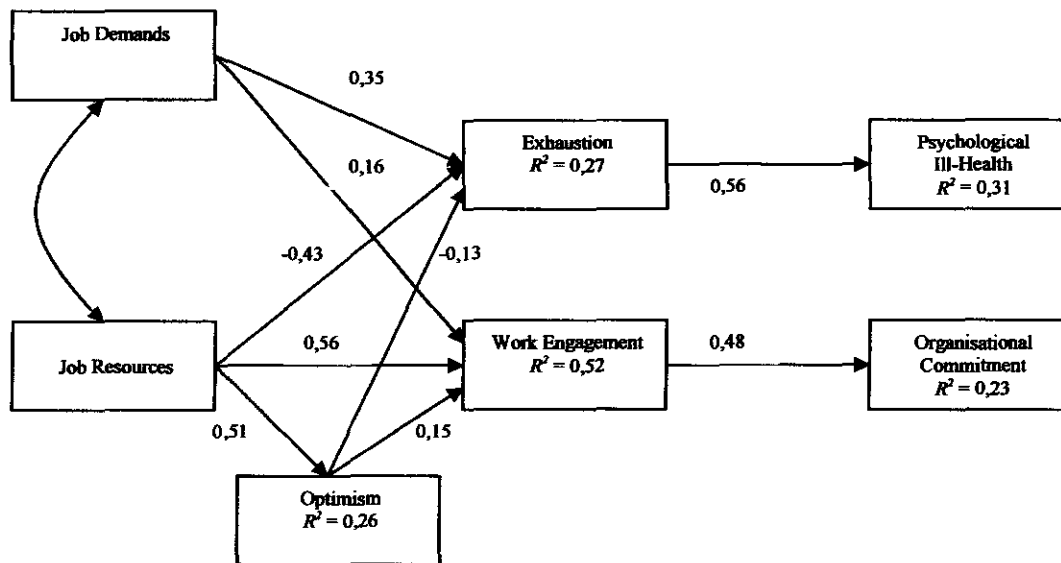


Figure 1. A maximum likelihood estimate for the model of work-related well-being (standardised solution). Note. All factors loadings and path coefficients are significant ($p < 0,01$).

The above model confirms that job demands and a lack of job resources lead to burnout (exhaustion), which results in ill-health. Figure 1 also shows that optimism moderates the effects of a lack of resources on burnout (exhaustion) and engagement (vigour and dedication). Job resources lead to work engagement, which results in organisational commitment. Job demands lead to exhaustion, which in turn leads to physical and psychological ill-health. Demands (work overload) also lead to engagement. This implies that workers who are engaged are enthusiastically involved in and pleasurably occupied by the demands of the work at hand. Workers can be engaged and perceive positive benefits even when confronted with extremely demanding stressors. Cynicism was excluded from this model because when it was included in the analyses, the solution was not admissible.

DISCUSSION

The study set out to test a causal model of work-related well-being of engineers in South Africa, using a cross-sectional survey design. An acceptable fit was found for a model in which exhaustion mediated the relationship between job demands/lack of job resources and ill-health, while work engagement mediated the relationship between job resources and organisational commitment of engineers. Unfortunately cynicism could not be included in the final model because the solution was inadmissible.

Exploratory factor analysis of the energy and identification variables resulted in two factors. The first factor represented burnout, amounting to an incapability to work (exhaustion and cynicism). The second factor represented work engagement, characterised by the capability (vigour) and willingness (dedication) to work. The correlations between these factors varied from 0,58 to 0,76 and these related factors explained 64% of the total variance as extracted. Therefore, although the results showed that these dimensions are related, it seems that they represent different aspects of well-being at work, which could be integrated into one model (Schaufeli, 2003).

Regarding organisational causes of burnout, two related factors (i.e. job demands and job resources) were extracted – which explained 53% of the total variance. Job demands included pace and amount of work and mental loading. Job resources included information, participation, clarity and supervisory support. The two related factors extracted, which explained 50% of the variance, were physical ill-health and psychological ill-health. Organisational commitment, a one factor solution, explained 70% of the total variance. The item loading of the factors varied from 0,67 to 0,90. Therefore, this study confirms previous findings (Demerouti et al., 2001; Schaufeli & Bakker, 2004) in that job demands and job resources represent two separate, though weakly related factors.

Regarding the negative aspects of work-related well-being, the structural model showed that job demands (i.e. pace and amount of work, mental load and emotional load) and a lack of resources (i.e. unfavourable task characteristics, poor structure and relationships as a lack of advancement) lead to burnout (i.e. exhaustion). As hypothesised in the JD-R model (Demerouti et al., 2001), excessive job demands lead to exhaustion (and incapability to perform), while a lack of job resources leads to mental distancing (unwillingness to perform).

Furthermore, burnout mediated the relationship between job demands and physical and psychological ill-health. These variables, as well as the interactions among them, lead to an incapability and unwillingness to perform.

Regarding the positive aspects of work-related well-being, the structural model showed that job resources lead to work engagement (i.e. vigour and dedication). Job resources, such as task characteristics, facilitative structures and supportive relationships and advancement have strong effects on work engagement. In addition, work engagement mediates the relationship between job resources and organisational commitment.

The results of the multiple regression analysis indicated that overload, job resources and optimism contribute to exhaustion. This implies that engineers who are optimistic and have enough resources and do not experience work overload are less likely to experience exhaustion. Lack of resources contributes statistically significantly to cynicism. This indicates that engineers who have a lack of resources are more likely to experience cynicism.

Overload, optimism and job resources contributed significantly to engagement. Engineers who have resources to do their work and who are optimistic are more likely to experience engagement. Very interesting is the phenomenon indicated by the results that work overload contributes to engagement (while the opposite was expected). In the high performance culture of engineers, individuals are expected to deal with high loads of work, complex in nature. It is especially the capability of high-performing and successful engineers to look upon these as challenges rather than stumbling blocks that differentiate them from other professions. Some of the unique attributes of an engineer are to analyse, prioritise and reduce work activities and set forth the necessary results or outcomes as required by business. Work overload should thus rather be seen in a positive light as an enabler to setting a fast pace than as the root of workaholism. Engaged engineers are not workaholics. They experience pleasure in their work. In contrast, workaholics give the impression of being stressed and compulsive (Rothmann, 2003).

The results of this study build on the COBE model (Schaufeli & Bakker, 2004), which assumes two psychological processes, namely an energetic and a motivational process. The energetic process links job demands with health problems via burnout. The motivational process links job resources via work engagement with organisational outcomes. Job resources

may play either an intrinsic motivational role (by fostering the employee's growth, learning and development), or they may play an extrinsic motivational role (by being instrumental in achieving work goals).

The results of this study confirmed that job resources, such as meaningful work, having the necessary information, participation and autonomy, fit between skills and demands, having realistic goals, constructive feedback, social integration, opportunities for personal growth, management and fair and equitable rewards (see Frey, Jonas, & Greitemeyer, 2003), impact on the burnout and engagement of engineers.

The results of the study suggested that the effect of a lack of job resources on exhaustion and the effect of job resources on work engagement depend on the level of dispositional optimism. The results indicated that optimism moderates the effects of a lack of job resources on burnout and work engagement. In other words, the levels of exhaustion and low work engagement do not only depend on the job resources, but also on the dispositional optimism of engineers. Optimism is a human strength that acts as a buffer against ill-health and the development of burnout (Schaufeli & Enzmann, 1998). Optimism can be used to promote engagement (vigour). Engineers who have high levels of job resources and optimism will have higher levels of engagement and feel more competent and productive. However, the opposite is also true.

Optimism can arm engineers with the belief that they are equipped to handle a lack of resources. Engineers that are goal-orientated and that place high value on meeting performance targets usually programme their behaviour accordingly. The more important the goal, the greater its value in a person's motivation (Carver & Scheier, 2003). When optimistic engineers are confronted with challenges, they will approach it with confidence, while pessimistic engineers are doubtful and hesitant. Optimism is regarded as a generalised sense of confidence (Carver & Scheier, 2003). Optimistic engineers will tend to be more engaged in their work. Optimists are less likely to display signs of disengagement (Carver & Scheier, 2003).

In sum, job demands and a lack of job resources lead to higher levels of exhaustion while job resources lead to engagement. In line with the COR theory (Hobfoll & Freedy, 1993) and the JD-R model (Demerouti et al., 2001), it can be argued that engineers are likely to become

victims of burnout when there is an increase in job demands without any corresponding increase in job resources. Burnout was related to ill-health in this study. Dispositional optimism was found to moderate the effect of job resources on both exhaustion and engagement. Mäkikangas and Kinnunen (2003) have found dispositional optimism to be significantly negatively related to burnout, more specifically to the exhaustion component.

The present study has certain limitations. The research design was a cross-sectional design, which makes it difficult to prove causal relationships even when, as in this case, advanced analytical procedures such as structural equation modelling techniques are employed. Furthermore, the results were obtained solely by self-report measures. This may lead to a problem commonly referred to as 'common method variance' which gives rise to an overestimation of the correlations studied.

RECOMMENDATIONS

Organisations should implement interventions to prevent burnout of engineers. The results suggest interventions that increase the work-life balance of engineers. Specific areas of interventions include work overload and work-life balance.

Interventions may be aimed at reducing stressors (primary intervention). Secondary interventions can be implemented to prevent employees who are already showing signs of stress from getting sick through time management and stress management. Time management efforts focus on eliminating stressors. According to Quick and Tetrick (2003), a more holistic approach to managing health at work is building and capitalising on strengths. Distress prevention and eustress generation together provide a more holistic framework for managing occupational health issues. Preventative stress management includes activities to directly change or eliminate the stressor and would encompass job redesign efforts. This implies that it is possible to increase the demand level of a job without making it distressful so long as job discretion is also increased.

Quick and Tetrick (2003) also focus on generating eustress at work. A model of eustress generation recognises that the interpretation of and response to work demands can be positive as well as negative. Managers interested in eustress generation might identify which aspects of the work employees find most engaging, and then, more importantly, identify why

individuals find the work pleasurable, and consider what could be done to enhance the positive aspects of the work experience. Any assignment of positive valence to work demands must be employee-generated and should not be considered a 'one size fits all' solution. The ability to generate hope among an organisation's members may be particularly important during radical change efforts. The key to eustress generation may be helping individuals develop competencies for recognising eustress in themselves and others to complement existing competencies for recognising distress. This implies that people must recognise and understand the presence of the positive as more than merely the absence of the negative.

The focus of promoting well-being at work should be on building engagement rather than reducing burnout. The interventions to address well-being must begin at a managerial level. A work setting that is designed to support the positive development of energy, vigour, involvement, dedication, absorption, and effectiveness among its employees should be successful in promoting their well-being and productivity (Maslach et al., 2001). This calls for renewal and change management on behalf of the organisation. The organisation must identify what people feel positive about and focus on those aspects in order to alleviate burnout.

Organisations can combat burnout and promote job engagement by preventing exhaustion. Teaching people how to prioritise, as well as promoting balanced lives outside the work, create energy within people and this leads to better effectiveness. A fulfilling quality of work life moves people towards engagement with work and away from burnout (Leiter & Maslach, 2001).

By involving people, the organisation helps to create organisational commitment. Organisations must take a personal interest in their employees, and empower employees to influence decisions that affect their work. The organisation can create a positive work environment by looking for opportunities to give people positive feedback. The performance management process should make it possible to reward outstanding achievements. An objective performance management process, as well as a career development plan for each employee, will encourage people to find meaning and purpose in their work.

The tertiary level of stress management interventions is concerned with the rehabilitation of individuals who have suffered from ill-health or reduced well-being as a result of strain in the workplace. Employee assistance programmes can be used to help these employees to improve their well-being at work.

Based on the results obtained in the study, future studies should also be conducted to evaluate the effectiveness of interventions to reduce burnout. Psychometrics to determine if employees are in 'flow' with what the organisation expects from them can be conducted to evaluate the individual's approach to work. The focus is on matching the right individual and his approach to work with the right position and job level required.

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CHAPTER 6

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

In this chapter, conclusions are drawn regarding the specific objectives of this study. The limitations of the research are discussed, followed by recommendations for the organisation and future research.

6.1 CONCLUSIONS

The first objective of this study was to determine the construct validity and internal consistency of the Maslach Burnout Inventory – General Survey (MBI-GS) for engineers in South Africa. A three-factor model of burnout consisting of exhaustion, cynicism and professional efficacy was confirmed. The internal consistencies of the scales were acceptable. Based on empirical grounds, two items (7 and 13) were deleted from the original MBI-GS so as to ensure adequate model fit, resulting in a 14-item scale. Item 7 was probably unsuitable for engineers because a quarter of the participants are working as consultants and are not directly involved with a specific organisation. Item 13, which is supposed to indicate disengagement and social isolation, loaded on professional efficacy rather than on cynicism. A high score may indicate strong motivation and engagement: the respondent concentrates on his or her work and does not welcome interruptions. Reliability analyses revealed that all three subscales were sufficiently internally consistent.

Errors within subscales were allowed to correlate in order to improve model fit. According to Aish and Jörekog (1990), correlated errors may be derived from specified characteristics of either respondents or the items of a survey. Correlated errors may occur because of the overlap in item content when an item, although worded differently, essentially asks the same question (Byrne, 2001). Correlated errors 9 and 10 were item 14 “I have become more cynical about whether my work contributes anything” and item 15 “I doubt the significance of my work.” Correlated errors 3 and 4 were item 3 “I feel tired when I get up in the morning and have to face another day on the job” and item 4 “Working all day is really a strain for

because of work-life balance includes that engineers feel that they have to work long hours. Most of the engineers also feel that they spend too much time travelling in their jobs. This interferes with their home and personal life (Many are consultants and they do travel a lot).

Correlations were found between commitment and ill-health. Engineers who are committed to the organisation do not frequently complain about their health. It can be assumed that engineers who are committed are emotionally attached to the organisation and can identify with the organisation or with their work. Job characteristics correlated with ill-health. This means that engineers who experience their physical working conditions as unpleasant are more prone to ill-health. This is also true for people who experience their job as dull and repetitive. Engineers who work with difficult customers and clients also tended towards ill-health. One possibility for the correlation between job characteristics and ill-health could be that people are constantly in an ongoing transaction with the environment and make appraisals of their encounters. According to Dewe, Cox and Ferguson (1993), stress is viewed as a dynamic cognitive state where the individual's interaction with the environment can be described as an ongoing transaction. The individual makes appraisals of his encounters with the environment and attempts to cope with the issues arising from such interaction.

Furthermore, stress because of job control correlated negatively with commitment. Engineers who are in control feel that their ideas and suggestions are taken into account and this may lead to commitment. Engineers who feel that they have control over their performance targets also experience more commitment. One possibility could be that engineers that are in control of their careers are driven by performance targets and are measured against performance outcomes. Fixed performance indicators usually challenge engineers and this motivates them to full performance. Workload and work demands were also identified as stressors. High job demands (i.e. work overload) may exhaust employees' mental and physical resources and may therefore lead to health problems or burnout. Compared to normative data, participants reported lower levels of ill-health and psychological outcomes of stress.

The fourth objective was to determine whether organisational commitment moderates the effect of occupational stressors on health outcomes. The results showed that organisational commitment was related to most of the physical and psychological outcomes among engineers. The higher-than-the-norm levels of commitment identified by our study may

explain why the frequency of ill-health stress symptoms is currently lower than the norm. The model was tested with all the occupational stressors to determine if they could possibly have a moderating effect on commitment. Stress, in this case, leads to ill-health, but the effects thereof were not moderated by the individual's commitment.

The results do not support previous findings that commitment has a protective effect against the negative consequences of workplace stress. This supported the findings of Taris, Schreurs and Van Iersel-Van Silfhout (2001). They found that work outcomes such as physical and psychological well-being may be considered to be strains in that they will occur first in response to occupational stress. Organisational commitment can be construed as occurring in response to these strains. Organisational commitment can be considered as a way of dealing with the strain resulting from an overly demanding work environment. This protective effect was previously identified by Sui, Spector and Cooper (2002) in the study of stressors and well-being and the role of organisational commitment among Chinese employees. We expected that commitment would be a moderator of stress. The results showed that organisational commitment was related to most of the physical and psychological outcomes among workers. The higher-than-the-norm levels of commitment identified by our study may explain why the frequency of psychological stress symptoms is currently at normative (and not higher-than-the-norm) levels.

The fifth objective of this study was to determine the psychometric properties of the Utrecht Work Engagement Scale (UWES) for engineers in South Africa. Structural equation modelling confirmed a model of work engagement, consisting of Vigour, Dedication and Absorption. According to Schaufeli and Bakker (2004), research concluded that work engagement is a multidimensional construct (comprising three dimensions). These three factors had acceptable internal consistencies. The questionnaire was adapted and items were reformulated. Some of the items may be related to words that some of the participants could have found difficult to understand or interpret. Therefore, alternatives were inserted for three of the items: item 4's ("I feel strong and vigorous in my job") alternative item is item 19 ("I feel strong and full of life and energy in my work"). Item 15's ("I am very resilient, mentally, in my job") alternative item is item 20 ("In my job I can comfortably deal with stressful situations and I can easily recover from such situations"). Item 11's ("I am immersed in my job") alternative item is item 21 ("I enjoy devoting all my attention and energy to my work").

Item 9's ("I feel happy when my attention is totally focused on my work"). Internal consistencies were computed for the three engagement scales. Alpha coefficients for the three engagement scales were acceptable: vigour = 0,84, dedication = 0,89 and absorption = 0,78. The coefficient alpha for the three factors compare well with the guideline of 0,70 (Nunnally & Bernstein, 1994). The results provide support for the internal consistency of the UWES.

In examining the factor structure of the original UWES model for this research, some undesirable psychometric characteristics were found. Considering the low regression coefficient of items 16 ("It is difficult to detach myself from my job") and 17 ("I always persevere at work, even when things do not go well"), it was decided to re-specify the model with these items deleted so as to ensure a better model fit. This could be due to the fact that a large number of the respondents came from consulting environments where they were fairly uninvolved with businesses for long-term project implementation and benefit tracking. Alternative models for engagement were fitted to the data. Error terms were allowed to correlate in order to improve model fit (Byrne, 2001). It was considered more realistic to incorporate the correlated errors into this study than to ignore their presence (Storm & Rothmann, 2003). According to Aish and Jöreskog (1990), the specification of correlated error terms for the purpose of achieving a better-fitting model is not an acceptable practice. Correlated error terms in measurement models represent systematic, rather than random, measurement errors in item responses. They may derive from characteristics specific either to the items or the respondents. Correlated errors may present a high degree of overlap in item content when an item, although worded differently, essentially asks the same question (Byrne, 2001).

Two further items that were deleted in the three-factor model were item 4 ("I feel strong and vigorous in my job") and item 14 ("I get carried away by my work"). The revised three-factor model fitted significantly better to the data than the original three-factor model with the three relative fit indices close to 0,90. One possible assumption could be that the measure for success for engineers is to rather implement projects and show results than to experience internal contentment. Results and performance are measured on visible deliverables.

In conclusion, the hypothesised three-factor model of the UWES fitted the data better, after removing two items and after allowing some error terms to correlate. The analysis of the

revised three-factor model indicated that the revised three-factor model fitted reasonably well to the data, with the RMSEA and the CFI approaching 0,90. The three-factor model represented the data well and supported the three-factor model findings of Schaufeli et al. (in press).

The next objective was to determine differences between the work engagement of engineers in different demographic groups. The results showed that the self-rated performance and job satisfaction of engineers varied depending on their levels of work engagement. In an analysis of Wilk's Lambda values, no differences regarding engagement levels could be found between the different engineering environments, age categories and years of experience. Statistically significant differences were found between the work engagement of employees who rated their performance and job satisfaction high (compared to those who rated these aspects as low). It seems reasonable to assume that the demographic factors such as the work environment, age and years of experience were not related to the work engagement of engineers, whereas performance and job satisfaction were.

The seventh objective was to assess the validity and internal consistency of constructs in a measurement model of work-related well-being and to test a causal model thereof for engineers in South Africa.

The Maslach Burnout Inventory – General Survey (MBI-GS), Utrecht Work Engagement Scale (UWES), the Job Characteristics Scale (JCS), Life Orientation Test Revised (LOT-R), and the Health and Organisational Commitment subscales of the ASSET were administered. A good fit was found for a model in which exhaustion mediated the relationship between job demands and ill-health, and work engagement (vigour and dedication) mediated the relationship between job resources and organisational commitment. The results suggested that the effect of a lack of job resources on exhaustion and the effect of job resources on work engagement depend on the level of dispositional optimism.

Exploratory factor analysis of the energy and identification variables resulted in two factors. The first factor represented burnout, amounting to an incapability to work (exhaustion and cynicism). The second factor represented work engagement, characterised by the capability (vigour) and willingness (dedication) to work. The correlations between these factors varied

from 0,58 to 0,76 and these related factors explained 64% of the total variance as extracted. Therefore, although the results showed that these dimensions are related, it seems that they represent different aspects of well-being at work, which could be integrated into one model (Schaufeli, 2003).

Regarding organisational causes of burnout, two related factors, namely job demands and job resources, were extracted – which explained 53% of the total variance. Job demands included pace and amount of work and mental loading. Job resources included information, participation, clarity and supervisory support. The two related factors extracted, which explained 50% of the variance, were physical ill-health and psychological ill-health. Organisational commitment, a one-factor solution, explained 70% of the total variance. The item loading of the factors varied from 0,67 to 0,90. Therefore, this study confirms previous findings (Demerouti, Nachreiner, Bakker & Schaufeli, 2001; Schaufeli & Bakker, 2004) in that job demands and job resources represent two separate, though weakly related, factors.

Regarding the negative aspects of work-related well-being, the structural model showed that job demands (i.e. pace and amount of work, mental load and emotional load) and a lack of resources (i.e. unfavourable task characteristics, poor structure and relationships as a lack of advancement) lead to burnout (i.e. exhaustion). As hypothesised in the JD-R model (Demerouti et al., 2001), excessive job demands lead to exhaustion (and incapability to perform), while a lack of job resources leads to mental distancing (unwillingness to perform). Furthermore, burnout mediates the relationship between job demands and physical and psychological ill-health. These variables, as well as the interactions among them, lead to an incapability and unwillingness to perform.

Regarding the positive aspects of work-related well-being, the structural model showed that job resources lead to work engagement (i.e. vigour and dedication). Job resources such as task characteristics, facilitative structures and supportive relationships and advancement have strong effects on work engagement. In addition, work engagement mediates the relationship between job resources and organisational commitment.

The model of work-related well-being confirms that job demands and a lack of job resources lead to burnout (exhaustion), which results in ill-health. The model also showed that

optimism moderated the effects of a lack of resources on burnout (exhaustion) and engagement (vigour and dedication). Job resources lead to work engagement, which result in organisational commitment. Job demands lead to exhaustion, which in turn leads to physical and psychological ill-health. Demands (work overload) also lead to engagement. This implies that workers who are engaged are enthusiastically involved in, and pleurably occupied by, the demands of the work at hand. Workers can be engaged and perceive positive benefits even when confronted with extremely demanding stressors. Cynicism was excluded from this model, because, when it was included in the analyses, the solution was not admissible.

In conclusion, an acceptable fit was found for a model in which exhaustion mediated the relationship between job demands/lack of job resources and ill-health, while work engagement mediated the relationship between job resources and organisational commitment of engineers. Unfortunately cynicism could not be included in the final model, because the solution was inadmissible.

The results of the multiple regression analysis indicated that overload, job resources and optimism contribute to exhaustion. This implies that engineers who are optimistic and have enough resources and do not experience work overload are less likely to experience exhaustion. Lack of resources contributes statistically significantly to cynicism. This indicates that engineers who have a lack of resources are more likely to experience cynicism.

Overload, optimism and job resources contribute significantly to engagement. Engineers who have resources to do their work and who are optimistic are more likely to experience engagement. Very interesting is the phenomenon indicated by the results that work overload contributes to engagement (while the opposite was expected). In the high performance culture of engineers, individuals are expected to deal with high loads of work, complex in nature. It is especially the capability of high-performing and successful engineers to look upon these as challenges rather than stumbling blocks that differentiate them from other professions. Some of the unique attributes of an engineer are to analyse, prioritise and reduce work activities and set forth the necessary results or outcomes as required by business. Work overload should thus rather be seen in a positive light as an enabler to setting a fast pace than as the root of workaholism. Engaged engineers are not workaholics. They experience pleasure in their

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Optimism can "arm" engineers with the belief that they are equipped to handle a lack of resources. Engineers that are goal-orientated and that place high value on meeting performance targets usually programme their behaviour accordingly. The more important the goal, the greater its value in a person's motivation (Carver & Scheier, 2003). When optimistic engineers are confronted with challenges, they will approach it with confidence, while

pessimistic engineers are doubtful and hesitant. Optimism is regarded as a generalised sense of confidence (Carver & Scheier, 2003). Optimistic engineers will tend to be more engaged in their work. Optimists are less likely to display signs of disengagement (Carver & Scheier, 2003).

In sum, job demands and a lack of job resources lead to higher levels of exhaustion. Job resources, in contrast, lead to engagement. In line with the COR theory (Hobfoll & Freedy, 1993) and the JD-R model (Demerouti et al., 2001), it can be argued that engineers are likely to become victims of burnout when there is an increase in job demands without any corresponding increase in job resources. Burnout was related to ill-health in this study. Dispositional optimism was found to moderate the effect of job resources on both exhaustion and engagement. Mäkikangas and Kinnunen (2003) have found dispositional optimism to be significantly negatively related to burnout, more specifically to the exhaustion component.

6.2 LIMITATIONS OF THIS RESEARCH

The first limitation of this study is that the design is cross-sectional. As a result, no causal inferences could be drawn, despite the use of advanced structural equation modelling techniques. Therefore, the causal relationships between variables were interpreted rather than established, and more complex forms of non-recursive linkages could not be examined. To deal with the limitation of the use of a cross-sectional design, prospective longitudinal studies and quasi-experimental research designs are needed.

Secondly, the results were obtained solely by self-report questionnaires. This may lead to a problem commonly referred to as method-variance. Thirdly, this research was conducted in a homogenous sample consisting of individuals of a specific profession – engineers. The engineering profession probably has some unique characteristics, such as the specific organisational culture, that could have influenced the participants' responses. The implication is that the results could not be generalised to other contexts or professions. Therefore, there is still the need for replication in other occupational groups as well as heterogeneous samples.

Another limitation of this study was that there is a possibility that some engineers who participated in this research did not entirely trust the confidentiality statement set out in the

covering letter accompanying the questionnaires. This could have influenced some of the results.

6.3 RECOMMENDATIONS

Next, recommendations are made for the organisation as well as for future research.

6.3.1 Recommendations for the organisation

Based on the results of this study, it is recommended that the MBI-GS be used to assess burnout of engineers. Item 7 and 13 should, however, be left out when administering the questionnaire.

Although this study found the MBI-GS to be reliable and confirmed the three-factor structure, it is suggested that future research should focus on the MBI-GS in other occupations samples in South Africa to verify the current findings. More young people should be included and evaluated in research regarding burnout. The impact of career counselling and orientation should form part of any future research with regard to burnout studies and proactive management thereof.

In terms of the experience of stressors by engineers, work-life balance as a stressor for engineers is a concern. The organisation can expect to find negative costs associated with continued levels of stress, because of burnout and resulting lower productivity and efficiency and also high employee turnover. Organisations are therefore advised to prioritise the issue of work-life balance. Based on the results of this study, three levels of intervention strategies should be considered (Cooper, Dewe & O'Driscoll, 2001).

The primary level intervention is the most effective way to combat ill-health to eliminate or reduce the sources of strain (stressors) in the work environment. In this case, the organisation is advised to assist engineers with work-life balance. Young engineers must have the necessary skills and capacity to do their jobs before they are appointed to supervisory positions. Purposeful job rotation will help young engineers gain experience to demonstrate their full potential. In terms of middle management it is advised to redesign job tasks (such as

increasing employee autonomy and control over job functions and work schedules). This may, however, not always be easy to achieve, in view of the fact that job structures are relatively fixed. One of the major challenges for the organisation is to create job designs that promote the achievement of organisational goals, while providing individuals with the opportunity to engage in satisfying and fulfilling job tasks that do not create unmanageable strain (Cooper et al., 2001). Performance management is an area that must be managed. More constructive feedback on job performance will enhance productivity, but this calls for clear performance indicators. This type of intervention is the most proactive and preventative approach to stress management and has been reported as being effective when implemented as a result of careful assessment of specific stressors.

The organisation can also invest in secondary interventions that focus on stress management training in order to alleviate the impact that environmental stressors exert on engineers. Training in performance management and career development could help the engineer to understand what is expected of him/her as well as how to manage his/her subordinates. Supervision training is important to young engineers as well as middle management because it is targeted at the individual changes. Supervisory courses must aim to increase the individuals' awareness of their levels of strain and to enhance their personal coping strategies. This could include relaxation, training, time management and conflict resolution strategies. The overall focus should be on the real business and personal essentials that can help the person to assimilate effective knowledge of him-/herself and the business environment, and also to gain insights into his/her leadership skills. Organisational development practitioners could focus on programmes that indicate the factors that may contribute to high levels of organisational performance. This will lead to increased organisation output and improving quality by involving employees in the decisions that affect them in their jobs.

The organisation could also assign an industrial psychologist so that individuals who have suffered ill-health or reduced well-being as a result of strain can be referred for rehabilitation. Climate studies can provide the psychologist with relevant information to designing focused wellness interventions. Interventions at this level are based on a 'treatment'. Counselling may help individuals to deal with workplace stressors that cannot be changed structurally.

Organisations could evaluate these three interventions and make a sound decision that will benefit the individual as well as the organisation. These interventions can have cost implications for both the individual and the organisation. Further research is needed to evaluate the effect of organisational interventions on organisational behaviour. Organisation development should focus on people development and align their strategic objectives with suitable interventions.

Based on the results of this study, it is recommended that the 'mismatch model' of Maslach and Leiter (1997) may be a useful framework for developing interventions, because it focuses attention on the relationship between the person and the situation, rather than on one of these in isolation. Workload, control, rewards, community, fairness and values are the six areas to focus on when interventions are developed. According to Cooper (1998), the model provides an alternative way of identifying burnout and of incorporating situational changes along with personal ones. Interventions can focus on the job design and must ensure that the workload for that specific job position is manageable. Positions must be audited to ensure that the right person with the right qualities is in the job. People must have access to experts and mentors for career advice and to discuss issues. People must be accountable for their projects and their work. This enhances decision-making and problem solving in their area of responsibility. If people are accountable for the outcomes of their work, they already have a sense of control over their work. People feel more empowered when they feel that they work independently, therefore they must develop their own specific development and performance plan of action to make sure that they have met the performance areas and outcomes of their work. Companies must be prepared to pay for performance. The only indicator or measurement is demonstrated performance. A merit-based system of rewards is very important, because people can perceive performance management as an unfair process. Companies and line managers must therefore ensure that their people are aligned with their jobs as well as with the strategic objectives of the company. This will lead to development of core competencies in order to perform well on the job and to ensure a fair measurement that will be linked with rewards. Teamwork must be encouraged so as to share ideas and to create diverse thinking. This creates greater cohesion between people. Communication is also important to establish aligned understanding and common focus. The last important indicator is values. The people must be able to identify with the company. This means that the company has to make its

priorities clear. People will then use the values as a driving force in order to reach their goals and to direct their behaviour.

The emerging science of positive psychology may help to illuminate ways to reduce the gap between person and environment variables by working on the person side of the equation to develop unrealised potential, which can then be used to influence the environment. Quality of life can be enhanced by improving the fit between the person and the environment, and this fit can be improved by either enhancing personal attributes or altering the environment to suit the attributes of the person – or both (Ranzijn, 2002).

The general issue of the locus of intervention – the person or the situation – is a particular important one (Maslach & Goldberg, 1998). When a better fit exists in these six areas, then engagement with work is the likely outcome. The potential of this approach is very promising as a means of dealing with individual burnout in its situational context (Cooper, 1998). The more you are engaged with your job, the better you will be at it. The right person-environment fit will create a healthier and more humane workplace.

Organisations should implement interventions to prevent burnout of engineers. The results suggest interventions that increase the work-life balance of engineers. Specific areas of interventions include work overload and work-life balance.

Interventions may be aimed at reducing stressors (primary intervention). Secondary interventions can be implemented to prevent employees who are already showing signs of stress from getting sick (through time management and stress management). Time management efforts focus on eliminating stressors. According to Quick and Tetrick (2003), a more holistic approach to managing health at work is building and capitalising on strengths. Distress prevention and eustress generation together provide a more holistic framework for managing occupational health issues. Preventative stress management includes activities to directly change or eliminate the stressor and would encompass job redesign efforts. This implies that it is possible to increase the demand level of a job without making it distressful so long as job discretion is also increased.

Quick and Tetrick (2003) also focus on generating eustress at work. A model of eustress generation recognises that the interpretation of and response to work demands can be either positive or negative. Managers interested in eustress generation might identify which aspects of the work employees find most engaging, and then, more importantly, identify why individuals find the work pleasurable, and consider what could be done to enhance the positive aspects of the work experience. Any assignment of positive valence to work demands must be employee-generated and should not be considered a 'one size fits all' solution. The ability to generate hope among an organisation's members may be of particular importance during radical change efforts. The key to eustress generation may be helping individuals develop competencies for recognising eustress in themselves and others to complement existing competencies for recognising distress. This implies that people must recognise and understand the presence of the positive as more than merely the absence of the negative. The organisation must identify what people feel positive about and focus on those aspects in order to alleviate burnout.

Organisations can combat burnout and promote job engagement by preventing exhaustion. Teaching people how to prioritise, as well as promoting balanced lives outside the work, creates energy within people, and this leads to better effectiveness. A fulfilling quality of work life moves people towards engagement with work and away from burnout (Leiter & Maslach, 2001).

By involving people, the organisation helps to create organisational commitment. Organisations must take a personal interest in their employees, and empower employees to influence decisions that affect their work. The organisation can create a positive work environment by looking for opportunities to give people positive feedback. The performance management process should make it possible to reward outstanding achievements. An objective performance management process, as well as a career development plan for each employee, will encourage people to find meaning and purpose in their work. The tertiary level of stress management interventions is concerned with the rehabilitation of individuals who have suffered from ill-health or reduced well-being as a result of strain in the workplace. Employee assistance programmes can be used to help these employees to improve their well-being at work.

6.3.2 Recommendations for future research

The following aspects of work-related well-being need to be considered in future research:

- The cynicism construct (which forms part of burnout) should be investigated in future studies of engineers. In this study it was not allowed in the final structural model.
- The relationship between positive psychological constructs, such as optimism, hope, resilience and self-efficacy and work-related well-being should be investigated in future studies.
- The impact of work-related well-being on the performance of engineers should be studied.
- Larger and more representative samples should be used when conducting research regarding the work-related well-being of engineers.
- The research design was cross-sectional. As a result, no causal interferences could be drawn. A longitudinal study regarding the work-related well-being of engineers should be conducted to overcome these limitations.
- The effectiveness of interventions to reduce burnout and to promote work engagement should be evaluated. The effects of individual and organisational interventions should be investigated.

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