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Job Demands, Job Resources, Safety, and Burnout in Air Traffic Maintenance Technicians

CHAPTER 1. INTRODUCTION

The air transport industry, defined as the world-wide network of commercial aircraft operators, air navigation service providers, the manufacturers and designers of aircraft, as well as the airports is a fundamental division of any nation's economy (Air Transport Action Group [ATAG], 2016). It is responsible for linking the global economy, providing millions of jobs for individuals, and is considered to be one of the most significant service industries (Alochukwu, 2016). Ultimately, this is due to the catalytic function the air transportation industry performs in most international economic activities, which has a substantial influence on local, national, and intercontinental economies (Alochukwu, 2016). According to the Oxford Economics report (2011), air transport that takes place to and from, as well as within the South African context produces three distinctive forms of economic benefits. The primary benefits produced are centred on the customer, the passenger, and the transporter utilising the available air transport service industries (Oxford Economics, 2011). Likewise, an array of networks is produced between the numerous cities and markets that exemplify a chief infrastructure asset for South Africa, that creates benefits through permitting the direct monetary investment of foreign entities, as well as other spill over influences on a nation's financial stability and productive capability (Oxford Economics, 2011).

According to ATAG (2016), air transport produces an average of US$ 72.5 billion in GDP for Africa and maintains 6.8 million jobs, with many of those jobs and occupations being highly skilled and productive. Likewise, a total of 15,300 air traffic management job positions are generated by the air transport sector. International Air Transport Association (IATA, 2016) predicts that there will be a 6.5% per year increase in the use air transport until the year 2035, which is considered to be one of the fastest rates of regional growth. The African aviation sector and market is also considered to be one of the regions that has the most potential for growth in comparison to other global aviation regions due to it being a relatively young industry that supports a large and rapidly developing population (ATAG, 2016). Generally, intercontinental air traffic and travel to and from the continent of Africa have been rapidly growing at 8% per year over the last 10 years, with an even larger growth of travel depicted in regional and domestic air traffic (ATAG, 2016). Similarly, the South African aviation sector

provides on average ZAR 50.9 billion to the South African gross domestic product (GDP). The South African aviation sector also provides and maintains around 227,000 occupational positions both directly and indirectly through the utilisation of numerous supply chain and logistic employees, as well as individuals who are employed in the tourism industry (Oxford Economics, 2011).

At the same time, the accelerated development that is taking place in the air transportation sector has placed an exorbitant amount of interest and demand on the aviation system as a whole (Alochukwu, 2016). In turn, it has been predicted that this demand will result in a further 4.7% increase in the demand for air transportation in South Africa over the next 20 years, which may heighten the risk of severe issues with air traffic congestion (Alochukwu, 2016). Ultimately, air traffic congestion may result in delays in the air transport system, economic and monetary losses for both the airlines and airports involved, and huge implications for the safety of the aircraft that are either en route or found on the airport runway (National Research Council, 2002). The access to more dependable, safe, convenient, and affordable air transportation is considered to be a long-standing goal for South Africa and other African nations due to the economic benefits that may result from an increase in the use of air transportation. For instance, the Airline Association of Southern Africa (AASA, 2016) and IATA (2016) clearly state that while safety is of outmost importance and is the foundation of any successful aviation business, only 21 African countries have implemented at least 60% of the safety-related standards and recommended practices put forth by the International Civil Aviation Organisation (ICAO). Nonetheless, South African airports and air transport organisations have employed the use of advanced radar and surveillance technologies as a means of alleviating the challenges that may arise from high air transport congestion (Alochukwu, 2016). Nonetheless, in order for air traffic congestion issues and future requirements of the South African air transport system to be met, both air traffic and traffic flow management practices must operate at optimum efficiency while taking into account the safety implications that may arise if certain technologies are not operating at optimum levels (Alochukwu, 2016). Air traffic management (ATM), as well as any type of vocation surrounding or supporting ATM are considered to be integral components of the air transportation sector because they are responsible for adequately alleviating any safety implications that may result due to air traffic congestion or technological malfunctions, as well as fulfilling South Africa's future air transportation demands (Alochukwu, 2016). Thus, for the

purposes of this research the main focus will be on ATM and the technical maintenance of the radars and surveillance systems that are fundamental for the safe and efficient navigation of an aircraft.

1.1 Air traffic management

ATM, is commonly acknowledged as encompassing all the activities involved in ensuring the safe and organised flow of air traffic (Commission of the European Communities [COM], 1996). ATM consists of three fundamental services including: air traffic control, air traffic flow management, and airspace management. In air traffic control, the main objective is to safely and sufficiently regulate the separation between aircraft both on the ground and in the air as a means of avoiding collisions (COM, 1996). Air traffic flow management focuses primarily on the safe regulation of aircraft flow as a means of avoiding the emergence of congestion in specific control sectors. Lastly, airspace management focuses on managing the routes, zones, and flight levels that are necessary in providing adequate air traffic control services (COM, 1996). Likewise, ICAO (2007) states that ATM is the dynamic management of air traffic and airspace through the provision and integration of the needed person-power, resources, services, technology, and facilities. The main purpose of ATM is to provide the abovementioned services in a safe, economic, and efficient manner through the use of both air-based and ground-based communication, navigation, and surveillance systems (ICAO, 2007). The radars and surveillance systems that are cardinal for the safe navigation of aircraft include the following: (a) primary surveillance radars (use reflected radio signals to track aircrafts), (b) secondary surveillance radars (use radio signals transmitted from other stations or radars to track aircrafts), and (c) automatic dependent surveillance systems (systems that allow the exchange or transmission of information concerning identification, aircraft position, and other relevant data between an aircraft and the ground systems (COM, 1996; Rodrigues, Silva, & Bousson, 2012). Both the radar and surveillance infrastructures employed by ATM are essential due to their contribution to efficiency of the following flight operations: departure and arrival trajectories, decreased aircraft holding times, flight level changes (due to a reduction in fuel consumption, a need to fly at levels with more favourable winds, or a need to fly at levels with less headwinds or turbulence), tracking of an enroute aircraft found within airspace, and the communication between an aircraft and air traffic controllers (Rodrigues, Silva, & Bousson, 2012). These technical systems are vital for the safe navigation of aircraft

because they also assure that an aircraft is located at a safe distance from land or other aircraft. Ultimately, both air traffic controllers and pilots rely heavily on such systems as a means of adhering to their occupational and safety requirements.

Without technical systems, an air traffic controller would not have the necessary information concerning the location of an aircraft and whether that aircraft is too close to another aircraft or in low altitude (Rodrigues, Silva, & Bousson, 2012). Likewise, the use of such technical systems allows for a certain amount of automation to be present during human-machine interaction especially in safety-critical occupations, such as that of an air traffic controller or pilot. According to Parasuraman, Sheridan, & Wickens (2000), a certain amount of automation assists in lessening the amount of mental workload that is experienced by either a pilot or an air traffic controller, which allows that individual to concentrate on more important information that is imperative to high job performance and making the most suitable decisions under time sensitive situations. Information that is provided by either a radar or surveillance system may also eliminate time-consuming searches, assist in hazard detection performance, assist in the creation of accurate mental models (knowledge structures that permit an individual to interact with his/her immediate environment), and increasing situation awareness (the awareness and perception of relevant and important elements in the environment, the understanding of their meaning, and their projection of their status within the near future) (Parasuraman, Sheridan, & Wickens, 2000). Accurate mental models assist individuals describe, explain and predict behaviours within their immediate environment. Mental models are vital in situations where there is a high workload or time pressure within a dynamic environment, such as that of a pilot or air traffic controller. Likewise, situation awareness is necessary for good job performance (Wickens, 2008). Given the importance of technical systems in the aviation sector and ATM, it is only appropriate that the proper maintenance of such systems, which is conduced by ATM technician, should be looked upon as vital to the smooth and efficient operation of ATM, as a whole. While the profession of an ATM technician is characterised by several different job titles, ranging from engineering technician to airway transportation systems technicians, the present study chose to refer to these technicians as ATM technicians because of the widespread use of this term.

According to the Federal Aviation Administration (FAA, 2013), an ATM technician is responsible for the installation, maintenance, and servicing of electro-mechanic equipment that

is essential in assuring the safe and efficient flow of air traffic. Other responsibilities include the following: servicing of equipment found within or outside airports, repairing and replacing faulty or malfunctioning equipment, and maintaining air traffic control towers, taking part in periodic and corrective maintenance of equipment, repairing and replacing faulty or malfunctioning equipment. Most importantly, ATM technicians travel throughout large geographic areas that may include remote locations or facilities when installations or repairs of equipment are needed (FAA, 2013). ATM technicians can be assigned to work with a variety of systems depending on their specialty. For instance, the specialties include, but are not limited to the following: environmental (power sources, generators, and lighting navigation systems), radar (airport surveillance radars, air traffic control beacon indicators, weather radars, and detection equipment), navigation aids (landing systems, distance measuring equipment, and tactical aircraft control systems), communications (radio communication systems), and automation (automation replacement systems) (FAA, 2013).

The whole set of services provided by ATM can be comprehended as a single system where there is a large number of components (human actors, organisational actors, and technical systems) interacting through the use of multiple intricate collaborations (Pasquini & Pozzi, 2005). These interactions rely heavily on complex causal dependencies amongst the various elements that are involved (Pasquini & Pozzi, 2005). The intricate interactions between the numerous ATM components significantly determine safety (Blom et al., 2001). Providing safety, however, involves more than simply ensuring that each of the ATM components function in a safe, proper, and efficient manner (Blom et al., 2001). For instance, the notion of safety within ATM is can be generally looked upon and analysed from the following three viewpoints:

- *Safety perception by a pilot, air traffic controller, aircraft passenger or human society.* Adopting a notion of safety through this viewpoint is subjective and relies heavily on the individual's understanding of the interrelationship between the various components that are inherently responsible to conduct safety relevant actions within the ATM system.

- *Accident risk.* This viewpoint on safety focuses on the capability of the individual components found within ATM to conduct their occupation responsibly and abide by the policies set by the aviation sector so as to avoid the occurrence of accidents.

- *Dependability of a technical system.* This viewpoint focuses primarily on the usability and reliability of a specific computer program, aircraft navigation system, radar system, or satellite-based communication system. The reliability of a technical system inherently relies upon the capability of an ATM technician to monitor and maintain a technical system efficiently (Blom et al., 2001).

Drawing upon the viewpoints on safety, it can be inferred that safety within ATM relies heavily on the capability of the numerous ATM components to coherently understand the notion of safety and work efficiently both individually and collectively so as to ensure safety (Blom et al., 2001). While both accident risk and safety perception are important viewpoints focusing on aviation safety, the dependability of a technical system may be considered of greater importance due to the necessity of such technical systems. Both radar and surveillance systems allow a pilot and an air traffic controller to perform their job in a timely and efficient manner while ensuring safety (Blom et al., 2001). Thus, the ability of ATM to ensure safety relies heavily on the proper maintenance and upkeep of the technological equipment used to assist in the interaction and communication between the various ATM components (Pasquini & Pozzi, 2005). The principal duties of ATM technicians are closely associated with retaining the safe and effective operating competency of the extensive and complex network of systems that are necessary for the world's air traffic and navigation systems (FAA, 2013). That is why the responsibilities of ATM technicians are considered to be imperative for the overall smooth operation of air traffic control and have huge implications for air navigation and safety (FAA, 2013).

ATM technicians carry out some of their duties in a wide variety of weather conditions including: heavy rain and lightning storms, high wind flow velocities, snowstorms, and high weather temperatures (Nomtshongwana, 2015). Moreover, ATM technicians are expected to travel long distances to isolated areas where the roads may not be paved with asphalt and are considered to be very hazardous. Lastly, ATM technicians are required to arrive in the designated location and repair the particular equipment failures under certain time pressures

(Nomtshongwana, 2015). Thus, there is a high risk of unsafe acts, procedural infractions, and human errors taking place since ATM technicians routinely encounter high job demands, such as time pressures, environmental extremes, shift work, and extreme heights (Nomtshongwana, 2015).

Despite the importance of an ATM technician's occupation for the efficient functioning of the ATM system, the literature and research focusing on the job duties, responsibilities, and importance of ATM technicians is scarce. Likewise, there is a shortage of literature focusing specifically on the work context (job demands, job resources, and safety issues that may arise on-the-job) within which these individuals perform their job and the possible consequences that may arise from performing their job under stressful or high-risk conditions (burnout and work-family spill-over). Thus, the objective of the following research study is to investigate the relation between job demands, job resources, safety, and burnout in Air Traffic Management (ATM) technicians. It is also of interest to determine ATM technician's perspectives on the influence of job demands and resources on job safety and work-family spillover.

CHAPTER 2. CONCEPTUAL AND THEORETICAL BACKGROUND

Each day ATM technicians are exposed to an assortment of job demands and job resources within the workplace (Nahrgang, Morgeson, & Hofmann, 2011). As has been shown by previous research, the presence of high job demands and low job resources have been associated with burnout (Bakker, & Demerouti, 2007). The presence of high job demands and low job resources, as well as the experience of negative events in the workplace setting may also result in a work-family spillover where employees bring their work-life into their family-life (Grzywacz, Almeida, & McDonald, 2002). Likewise, work environments that are considered to be potentially high-risk or have a prevalence of high job demand, which may result in the experience of burnout may increase the chance of occupational errors, accidents, and injuries taking place (Nahrgang et al., 2011). In the ATM technician work environment, the experience of adverse weather conditions, high time constraints, long travel times, and the presence of hazardous environments may result in taking shortcuts or taking part in behaviours that cause occupational injuries or accidents (Nahrgang et al., 2011). As has been stated by the World Health Organisation (WHO, 2008), the cost of safety-related outcomes is considerable and it has been appraised that workplace errors, injuries, and illnesses result in economic costs of 5% of gross national product. Apart from the possible influence that safety may have on individual employees, it also poses a threat to other employees (Nahrgang et al., 2011). Thus, the following section will focus on the following: the JD-R Model of burnout, safety in the workplace, the association between safety behaviours and Reason's swiss cheese model of human error, and the link between the JD-R Model and safety in the workplace.

2.1 Burnout

One of the most commonly investigated subject matters in organisational research is how a company's employees experience and act in response to their occupational demands. Although numerous concepts of this process have been proposed and developed, researchers over the last 30 years have put forth the notion of job burnout (Swider & Zimmerman, 2010). Despite the absence of a universally acknowledged definition of burnout, research proposes that the fundamental structure of burnout is consistent across vocations (Zellars, Perrewe, & Hochwarter, 2000; Schaufeli & Taris, 2005). For instance, burnout is commonly defined as some form of physical, emotional, and psychological exhaustion emanating from an

individual's long-term participation in occupational situations that are taxing (WHO, 2010). Likewise, burnout is described as a persistent, negative, job-related condition, characterised by a collection of physical, emotional, and attitudinal symptoms including: exhaustion, emotional distress, reduced motivation, and dysfunctional behaviours within the workplace (Jackson & Rothmann, 2005). Research has also demonstrated that burnout is a stress reaction that causes individuals to experience the following symptoms: headaches, muscle tension, high blood pressure, insomnia, and fatigue (Leiter & Maslach, 2000; Maslach, & Leiter, 2008). Conversely, burnout is also considered to be a form of mental distress typified by the following: (a) a prevalence of both psychological and behavioural symptoms as compared to physical symptoms, (b) a prevalence of emotional or physical withdrawal, fatigue, and exhaustion, (c) the expression of burnout-relevant symptoms in individuals who have not been afflicted by any preceding psychopathology, (d) symptoms that have a tendency to be job-related, and (e) reduced work productivity arising from unconstructive attitudes and behavioural tendencies (Boles, Dean, Ricks, Short, & Wang, 2000; Maslach & Schaufeli, 1993).

Despite the existence of numerous diverse definitions of burnout, it is apparent that three dimensions consistently emerge - cynicism, exhaustion, and personal efficacy (Schaufeli, Leiter, Maslach, and Jackson, 1996). Cynicism, which appertains to the interpersonal facet of burnout, has a tendency to produce negative, apathetic, and excessively aloof responses to numerous aspects of a particular job (Jackson & Rothmann, 2005; Schaufeli et al., 1996). Exhaustion concerns the reduction of emotional resources, as well as feelings of personal strain (Jackson & Rothmann, 2005). Exhaustion is the principal feature of job burnout and the most apparent manifestation of this finely balanced syndrome (Maslach, Schaufeli & Leiter, 2001). When individuals describe themselves or others as experiencing the symptomatology inherent in the syndrome, they are most often denoting the experience of exhaustion. Of the three distinct dimensions of burnout, exhaustions is considered to be the most extensively reported and most methodically examined (Maslach, Schaufeli & Leiter, 2001). Exhaustion is a necessary, but not sufficient, condition for the emergence of burnout (Jackson & Rothmann, 2005). The concept of exhaustion presupposes a prior condition of high overload. This denotes that burnout is not a response to monotonous or tedious forms of work, but a response to job conditions that make the accomplishment of tasks difficult (Sonnentag, 2015). While the concept of exhaustion manifests the stress dimension of job burnout, it inherently neglects to

fully incorporate and capture the key aspects of the relationship between an individual and his/her respective vocation (Maslach, Schaufeli & Leiter, 2001).

The noteworthiness of burnout, both for an individual as a single entity, as well as for the occupational setting, is demonstrated by its association to important outcomes (Maslach, Schaufeli & Leiter, 2001; Fischer & Boer, 2011). Most of the outcomes that have been researched are associated with occupational performance. Likewise, research has also allocated a significant amount of focus on the relationship between job burnout and the occurrence of certain health outcomes, because burnout is regarded as a stress phenomenon (Maslach, Schaufeli & Leiter, 2001). For instance, chronic exhaustion can cause an individual to emotionally and cognitively detach from their work tasks, thus becoming less receptive towards the needs of a particular job (Jackson & Rothmann, 2005). Moreover, work contexts with persistent and overwhelming job demands that have a tendency to contribute to the emergence of exhaustion and cynicism are likely to corrode an employee's sense of achievement or efficacy. Professional efficacy concerns the self-evaluation facet of burnout where employees experience feelings of competence, efficiency, and accomplishment in the workplace (Jackson & Rothmann, 2005; Schaufeli et al., 1996). Apart from the threat to an employee's functioning within an organisation, burnout negatively influences work performance, as measured by both objective and subjective performance measures (Sonnentag, 2015). Likewise, burnout has been linked to numerous types of occupational withdrawal, such as absenteeism, employee intent to quit his/her job, and actual employee turnover (Pines & Zaidman, 2014; Maslach, Schaufeli & Leiter, 2001). For individuals who choose to remain on the job, however, burnout has a tendency to be linked with a reduction in employee job satisfaction, as well as a decrease in the amount of commitment an employee may have towards his/her occupation or organisation, as a whole (Maslach, & Leiter, 2008). Ultimately, individuals who experience burnout may have an adverse influence on other employees' job performance through the disruption of organisational tasks or goals. Burnout may also result in interpersonal conflicts amongst employees either through formal or informal interactions that take place on or off the job (Maslach, Schaufeli & Leiter, 2001). Likewise, research has also indicated that job burnout may also result in a negative spillover effect on individual employee's home lives (Alarcon, 2011; Leung, 2011).

The concept of burnout was initially developed to examine the negative consequences of

occupational-related exposure to a wide range of highly demanding or stressful situations that may be experienced by employees found within the numerous human service sector occupations (Cieslak et al., 2014; Lee & Ashforth, 1996; Maslach, Schaufeli & Leiter, 2001). The experience of burnout has been shown to be highly prevalent in the following human service occupations: (a) ER nurses, (b) physicians, (c) midwives, (d) teachers, (e) counselors, (d) police officers, and (e) social workers (Adriaenssens, De Gucht, & Maes, 2015; Lee & Ashforth, 1996; Mollart, Skinner, Newing, & Foureur, 2013). More specifically, Mollart, et al. (2013) demonstrated that at least 60.7% of registered midwives employed in public hospital maternity units found within New South Wales, Australia experience moderate to high levels of emotional exhaustion; 30.3% scored below the cutoff for personal accomplishment and 30.3% experienced depersonalization. The study's results also depicted significant differences in the experience of burnout according to years of experience, type of shift work, and physical exercise. More specifically, higher levels of burnout were experienced by midwives who had approximately 6-10 years of experience in the field, worked a mixed or night shift, and did not take part in any physical exercise (Mollart et al., 2013). Similarly, Dyrbye et al. (2014) compared the prevalence of burnout across different career stages in both physicians and medical students and concluded that medical students and residents experienced a higher level of burnout as compared to early career physicians. Other variables that influenced the prevalence of burnout included: (a) age ($p = .0001$), (b) being male ($p = .0001$), and (c) being married ($p = .0001$). According to Dyrbye et al. (2014), the high prevalence of burnout in residents as opposed to early career physicians was mainly due to the presence of job stressors, such as adjusting the new work environment, years of experience in the field of practice, work-life imbalance, and a high workload.

Likewise, a meta-analysis conducted by Adriaenssens, De Gucht, and Maes (2015) focusing on the cross-national prevalence of burnout in ER-nurses and the identification of both the individual, as well as the work-related determinants of job burnout, concluded that 26% of the ER-nurses between the years 1989 to 2014 suffered from job burnout. On average, 25.9% of the nurses surpassed the cut offs for emotional exhaustion, 34.8% surpassed the cut off for depersonalization, and 27.2% surpassed the cut off for diminished personal accomplishment (Adriaenssens, De Gucht, & Maes, 2015). Nurses working in North America were found to have higher levels of emotional exhaustion and depersonalization as compared to their Dutch, Irish, Greek, Italian, and British counterparts. In terms of the demographic characteristics, the

following were concluded by the authors of the meta-analysis: (a) higher levels of education were associated with higher levels of job burnout, (b) higher age was associated to a higher risk of experiencing burnout, (c) higher levels of burnout were shown in female participants. With regards to the association between occupational attitudes and the experience of burnout, higher expectations for their job was associated with higher levels of burnout (Adriaenssens, De Gucht, & Maes, 2015). Occupational demands, such as work pressure and workload were also found to be positively associated with burnout and its dimensions while lack of occupational resources was found to be associated with a higher prevalence in the experience of emotional exhaustion and depersonalization. Lastly, quality of communication between the nursing staff and supervisors or other nurses was negatively, correlated with burnout (Adriaenssens, De Gucht, & Maes, 2015).

Likewise, Lee and Ashforth (1996) conducted a meta-analysis that assessed how demand and resource correlates, as well as behavioural and attitudinal correlates were associated to burnout in teachers, nurses, police officers, social workers, and counselors (Lee & Ashforth, 1996). The findings of the meta-analysis depicted moderate, positive correlations between the following job stressors (demands) and the emotional exhaustion component of burnout: role conflict ($r = .53$), role stress ($r = .62$), stressful events ($r = .52$), workload ($r = .65$), and work pressure ($r = .50$). Strong, positive correlations were also obtained between role stress ($r = .54$), stressful events ($r = .50$), and depersonalization while weak, positive correlations emerged between the role ambiguity ($r = .34$), role conflict ($r = .37$), workload ($r = .34$), work pressure ($r = .22$) and the depersonalization dimension of burnout (Lee & Ashforth, 1996). No significant associations between job stressors and the diminished personal accomplishment dimension of burnout were obtained in the meta-analysis. With regards to the relationship between job resources and the dimensions of burnout, the following was depicted by the meta-analysis: (a) a weak, negative association between social support ($r = -.32$), supervisor support ($r = -.37$), community bond ($r = -.48$), team cohesion ($r = -.22$), community bond ($r = -.17$), innovation ($r = -.30$), skill utilization ($r = -.26$), task orientation ($r = -.26$), organisational commitment ($r = -.43$), and emotional exhaustion, (b) a weak, negative association between social support ($r = -.21$), supervisor support ($r = -.24$), coworker support ($r = -.22$), community bond ($r = -.46$), family resources ($r = -.21$), team cohesion ($r = -.34$), innovation ($r = -.28$), skill utilization ($r = -.39$), organisational commitment ($r = -.42$), job satisfaction ($r = -.44$), and depersonalization, and (c) a weak, negative association between community bond ($r = -.26$),

unmet expectations (r = -.19), turnover intentions (r = -.16), and diminished personal accomplishment (Lee & Ashforth, 1996).

Apart from human service occupations, burnout has also been shown to be prevalent in the following physically and/or mentally demanding vocations: (a) air drone pilots, (b) first line respondents, (c) construction workers, and (d) air traffic controllers (Chapelle et al., 2014; Smith, 2014; Lingard & Francis, 2005; Richardsen, 2006). For instance, Chappelle et al. (2014) assessed the self-reported levels of job burnout amongst 1094 U.S Air Force drone pilots who are responsible for the handling of both surveillance equipment and strike mission weapons and concluded that 20% of the drone pilots reported experiencing high levels of exhaustion, 11% reported high levels of cynicism, and 3% reported experiencing low levels of professional efficacy. According to the study the following were also concluded: (a) working the night shift, working more than 51 hours per week, and serving in the current occupational position for more than 25 months predicted exhaustion, (b) pilots working the night shift were 1.89 times more likely to experience exhaustion, (c) pilots working more than 51 hours per week were 2.05 times more likely to experience exhaustion, and (d) serving in the current occupational position for more than 25 months and being between the age of 26 and 30 predicted cynicism (Chappelle et al., 2014). Likewise, a research study by Smith (2014) investigated the experience of job burnout amongst 106 first respondents (police officers, emergency medical service personnel, and firefighters) and concluded that on average the participants experienced moderate (64.2%) to high (35.8 %) levels of occupational burnout. A study focusing on the occurrence of burnout in 232 male and female construction workers depicted the following: (a) a weak, negative correlation between years in construction and the emotional exhaustion (r = -.25), (b) a weak, positive correlation between hours worked per week and emotional exhaustion (r = .22), (c) a weak positive correlation between age and personal efficacy (r = .14), (d) a weak, positive correlation between years in construction and personal efficacy (r = .21), (e) a weak, positive correlation between hours worked per week and personal efficacy (r = .17), (f) no significant associations were obtained between any of the variables and cynicism (Lingard & Francis, 2005). According to the study's results the following spillover effects arouse due to the occurrence of burnout: (a) a moderate, positive correlation between emotional exhaustion and work to marriage spillover (r = .56), (b) a weak, positive correlation between cynicism and work to marriage spillover (r = .27), (c) a moderate, positive correlation between emotional exhaustion and work to home spillover (r = .51), and

(d) a weak, positive correlation between cynicism and work to home spillover (r = .16) (Lingard & Francis, 2005). A study by Richardsen (2006), which investigated the level of burnout between 209 air traffic controllers in a Norwegean airport as compared to the level of burnout in police officers, journalists, and building constructor, concluded that air traffic controllers experience a significantly lower level of burnout as compared to the three other professions. According to the researcher, low levels of burnout found amongst air traffic controllers might be a result of the strict regulations and selection procedures found within the profession, istelf (Richardsen, 2006). The strict regulations and selection proceduresr found within the profession might have resulted in air traffic controllers who are inherently less predisposed to the experience of burnout. According to the researcher, however, more research is needed to make valid conclusions as to why the air traffic controllers were less prone to burnout (Richardsen, 2006).

In support of the research on burnout, it is appropriate to state that the occurrence and prevalence of burnout is prevalent in both the human service sector and other occupations, such as air traffic management and first responders. Nonetheless, despite the importance of ATM for the overall safety of the aviation sector and the significance of ATM technicians for the effective functioning of the ATM system, no studies to date have assessed burnout in technicians or personnel found within the ATM sector. Thus, the following study will attempt to investigate the experience of burnout in ATM technicians through the use of the Job Demands-Resources Model of Burnout.

2.2 Job Demands-Resources Model of Burnout

The Job Demands-Resources model has acquired an extensive amount of recognition from researchers (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; Schaufeli, & Taris, 2014). Presently, the Job Demands-Resources model is identified as one of the principal job stress models (Schaufeli, & Taris, 2014). It is also regarded as a comprehensive job characteristics model that focuses on the influence of job demands and resources on various employee outcomes, such as burnout and engagement (a job-related state of mind that is typified by vigour and dedication) (Bakker, van Veldhoven, & Xanthopoulou, 2010; Cabrera, 2013; Demerouti et al., 2001). Job demands pertain to the physical, social, or organisational constituents of a particular job context that necessitate a maintained state of physical and/or

mental exertion, and which are affiliated with particular physiological and psychological detriments or costs (Demerouti et al., 2001). Job demands include, but are not limited to the following: workload, time pressure, occupational insecurity, heavy physical lifting, shift work, poor or hazardous environmental conditions, high work pressure, and role reorganisation (Bakker, Demerouti, De Boer & Schaufeli, 2003; Demerouti et al., 2001).

Job resources concern the physical, psychological, or organisational elements of a job context that may entail any of the following: curtail job demands and the psychological and/or physical costs that are associated with such demands; prompt individual development and advancement; are operative in accomplishing the needed work goals (Bakker, Demerouti, De Boer & Schaufeli, 2003, Demerouti et al., 2001; Van den Broeck, De Cuyper, De Witte, & Vansteenkiste, 2010). Job resources may be situated at an organisational level in the form of career opportunities or job security, at a social level in the form of supervisor or co-worker social support, and the job task level in the form of autonomy, individual feedback on performance or skill variety (Bakker et al., 2003; Van den Broeck et al., 2010). Resources at the job task level promote crucial psychological states, such as meaningfulness, which guide individuals' attitudes and/or behaviours. Likewise, job resources may also play either an intrinsic motivational role or an extrinsic motivational role. During an intrinsic motivational role, job resources assist in the development of employee learning and growth within an organisation, while during an extrinsic motivational role they assist in the accomplishment of work goals (Rothmann, Mostert, & Strydom, 2006).

The Job Demands-Resources Model presupposes that two fundamental psychological processes play a crucial role in the development of employee burnout, regardless of the vocation concerned (Demerouti et al., 2001; Rothmann, Mostert, & Strydom, 2006; Schaufeli, & Taris, 2014). For instance, excessive job demands from which individuals do not sufficiently recuperate may expend employees' mental energies, ultimately resulting in exhaustion and burnout (the energetic constituent of burnout). Thus, high job demands may result in a higher occurrence of burnout. On the other hand, a deficit in job resources may prohibit the completion of work goals due to an inability to cope with high demands, bringing about the occurrence of withdrawal behaviour (Schaufeli, & Bakker, 2004; Schaufeli, Bakker, & Van Rhenen, 2009; Schaufeli, & Taris, 2014). Certainly, withdrawal behaviour or disengagement (the motivation constituent of burnout) may function as a self-protective

approach used to inhibit any additional energy depletion (Schaufeli, & Taris, 2014). The Job Demands-Resources model also presupposes the following: (a) job resources are negatively associated with the occurrence of burnout, (b) high job demands will result in burnout if the job resources are in a deficit, and (c) high job resources will buffer the influence of job demands on the experience of burnout (Schaufeli, & Bakker, 2004; Schaufeli, Bakker, & Van Rhenen, 2009; Schaufeli, & Taris, 2014).

2.3 The Job Demands-Resources Model and Empirical Evidence

Thus far, the main postulations of the Job Demands-Resources model have been verified in various contexts and professions, such as call-centre employees (Bakker, Demerouti, and Schaufeli, 2003; Van den Broeck et al., 2010), nutrition production employees (Bakker, Demerouti, De Boer & Schaufeli, 2003), health care employees (Bakker, van Veldhoven, & Xanthopoulou, 2010; Laschinger, & Finegan, 2008; Schaufeli, & Bakker, 2004), white-collar workers, blue-collar employees (Hu, Schaufeli, & Taris, 2011), telecom managers (Bakker, & Van Rhenen, 2009), home care employees (Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003; Xanthopoulou et al., 2007), and academic staff (Rothmann et al., 2006). For instance, it has been consistently shown that job demands and job resources are weakly to moderately negatively associated (Bakker et al., 2003; Schaufeli, Bakker, & Van Rhenen, 2009). It has also been shown that job demands are positively associated with burnout, particularly with its sub-component exhaustion (Bakker, van Veldhoven, & Xanthopoulou, 2010; Demerouti et al., 2001; Schaufeli, Bakker, & Van Rhenen, 2009). Likewise, Bakker, Demerouti, De Boer & Schaufeli (2003) demonstrated that job demands were direct predictors of both burnout and absenteeism, while job resources were direct predictors of organisational commitment in nutrition production employees. Another study that has supported the assumptions put forth by the Job Demands-Resources Model is a research study conducted by Prieto, Soria, Martínez, and Schaufeli (2008). In this research study, the researchers assessed the robustness of the Job Demands-Resources Model to predict burnout in an academic setting by incorporating the following: personal resources, job resources, and job demands. Occupational demands were positively associated with burnout and negatively associated with work engagement (Prieto et al., 2008). On the other hand, both job and personal resources were positively associated with work engagement and negatively associated with burnout. The researchers further concluded that occupational demands emerged as significant, positive predictors of burnout while

occupational and personal resources emerged as significant, negative predictors of burnout (Prieto et al., 2008).

Bakker, Demerouti, and Schaufeli (2003) have also applied the model to call centre employees and found that job demands (emotional demands, changes in work tasks, and work pressure) were predictors of health problems, such as burnout. Bakker et al. (2003b) examined the Job Demands-Resources Model in a research study amongst 3,092 home care organisational employees and demonstrated that job demands were positively associated with exhaustion. The study's results also found that job resources were negatively associated with the cynicism constituent of burnout and positively associated with professional efficacy (Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003). Similarly, Xanthopoulou et al. (2007) applied the model to 830 home organisation employees and found that high job resources buffered the influence of high job demands on the experience of job burnout, this, provides evidence for the assumption put forth by the Job Demands-Resources Model which states that a deficit in job resources may prohibit the accomplishment of occupational goals due to an inability to cope with high job demands (Schaufeli, & Bakker, 2004; Xanthopoulou et al., 2007).

Hu, Schaufeli, and Taris (2011) conducted a comprehensive study to investigate the interactions and effects of job demands and resources on burnout and work engagement in Chinese blue-collar employees. The findings of the study showed that the blue-collar employees who were subjected to high job demands and low job resources demonstrated higher risks of burnout and reduced work engagement, while job resources buffered the influence of job demands on burnout (Hu et al., 2011). Another study that has provided support for the Job Demands-Resources Model is a study conducted by Korunka, Kubicek, Schaufeli, and Hoonakker (2009). In this study, both white-collar and blue-collar employees from Austrian organisations were used as a way of examining the validity of the exhaustion component of burnout as proposed by the Job Demands-Resources Model in a heterogeneous work sample (Korunka et al., 2009).

Although the Job Demands-Resources Model has been extensively validated in numerous settings and vocations, the model suffers from limitations (Barbier, Dardenne, & Hansez, 2013). For instance, one of the main criticisms of the research studies that have assessed the effectiveness of the Job Demands-Resources Model to predict burnout and overall employee

wellbeing is the reliance of such studies on cross-sectional research designs. A cross-sectional research design does not inherently represent a stringent assessment of the Job Demands-Resources Model's causal chain hypothesis (Barbier et al., 2013). Nonetheless, the framework has also obtained similar results in longitudinal studies (Boyd et al., 2011; Hakanen, Schaufeli, & Ahola, 2008). For instance, a three-year follow-up research study conducted amongst Finnish dentists demonstrated that job demands were strong predictors of burnout, while job resources were strong predictors of future work engagement (Hakanen et al., 2008). Likewise, Boyd et al. (2011) utilised the model of burnout and engagement in a sample of Australian university academics as a means determining the following: (a) the capability of the both job demands and resources to predict employee's experience of both psychological stress and workplace commitment over two times periods across three years, (b) the existence of reverse causal influence between wellbeing and job demands. The results of Boyd et al.'s (2011) study demonstrated that job resources during Time 1 directly predicted the onset of Time 2 workplace commitments. Moreover, it was also depicted that Time 1 job resources fully mediated the capability of Time 1 job demands to predict Time 2 workplace stress (Boyd et al., 2011). Thus, Boyd et al.'s (2011) research study provides support for the argument put forward by the Job Demands-Resources Model with regards to the influence of low job resources in conjunction with high job demands on job burnout. More specifically, the assumption stating that the presence of high job demands and low job resources will result in burnout (Rothmann et al., 2006). Lastly, Schaufeli, Bakker, and Van Rhenen (2009) conducted a longitudinal study on telecom managers and found that an increase in job demands (overload and work-home interference) and a decrease in job resources (social support, autonomy, and performance feedback) predicted the appearance of burnout.

Even though these studies employed a longitudinal research design to provide some empirical evidence for the Job Demands-Resources Model's causal chain hypothesis by repeatedly observing and examining the same variables and individuals across different time period, they simply used one means of measuring the participant's job demands and resources (Barbier et al., 2013). More specifically, both the longitudinal and cross-sectional studies focusing on the Job Demands-Resources Model have employed the use of quantitative methods to assess an occupation's job demands and resources through the use of self-report measures (Barbier et al., 2013). However, no studies utilising the Job Demands-Resources Model have focused on the following: (a) the relationship between an occupation's job demands and resources and the

work-family spillover, (b) the importance of utilising qualitative methods in conjunction with quantitative methods to obtain a more comprehensive image of both an occupation's job demands and job resources and the influence of those job demands/resources on an individual's overall wellbeing, (c) whether the Job Demands-Resources Model of Burnout is applicable in the occupation of ATM technicians, and (d) whether the perception of high job demands is negatively associated with safety behaviours and the perception of high job resources is positively associated with safety behaviours specifically in the occupation of ATM technicians. Thus, in light of the abovementioned limitations, the following study will attempt to build upon the Job Demands-Resources Model with regards to the influence of the model on both safety behaviours and work-family spillover in the occupation of ATM technicians through the use of a mixed methods approach so as to obtain a more wide-ranging image of both an ATM technician's job demands and job resources and the influence of those job demands/resources on an ATM technician's overall wellbeing, safety behaviours, and work-family spillover.

2.4 Job Demands-Resources Model and Safety Outcomes

Apart from the empirical evidence provided for the assumptions put forth by the Job Demands-Resources Model, high job demands and the emergence of burnout have also been shown to have an effect on job safety (Sonnentag, 2015). More specifically, it has been shown that employees with high levels of burnout encounter more adverse or negative events, accidents, and injuries in the workplace (Nahrgang et al., 2011; Sonnentag, 2015). For instance, Goldenhar, Williams and Swanson (2003) assessed the relationship between numerous job stressors and safety outcomes (occupational injury and near-misses) in 408 construction employees. According to the study, ten work-related stressors emerged as significant predictors of either occupational injury or near-misses, including: vocational control, job demands, job certainty, on-the-job training, organisational safety climate, the under-utilisation of skills, an employee's responsibility of safety for other individuals, working hours, safety compliance, and occupational tenure (Goldenhar et al., 2003). The researchers also found the following occupational stressors to have an indirect relationship with occupational injuries through physical symptoms, as well as an indirect relationship with near-misses through psychological strain: social support, occupational harassment and discrimination, employee tenure in construction, occupational certainty, employee

responsibility for safety, and safety compliance (Goldenhar et al., 2003).

Likewise, another research study that has supported the relationship between job demands, job resources, and safety outcomes is a study conducted by Turner, Chmiel, Hershcovis, and Walls (2010). In this study, the researchers assessed whether railway system employees' job resources (employees' perceived support for safety from colleagues, senior managers and supervisors) would reduce the relationship between high job demands (role overload) and the number of unsafe work events taking place (Turner et al., 2010). According to the study's results, high job demands were associated with an increase in the number of hazardous events taking place in the workplace, while job resources (colleague, senior manager and supervisor support) for safety was related to a decrease in the number of hazardous events. Lastly, perceived colleague support for safety emerged as the strongest predictor of employee safety behaviours in the presence of high job demands (Turner et al., 2010).

Chen and Chen (2014) examined the causal relationship between job demands (work overload and emotional demands), job resources (autonomy), and safety behaviours in airplane cabin crew members and found the following: (a) cabin crew members where less likely to take part in safety behaviours when they perceived the job demands to be high; (b) cabin crew members were more likely to take part in safety behaviours when they perceived the job resources to be high; and (c) high job resources acted as a buffer towards the negative influence of job demands on safety behaviours. Li, Jiang, Yao, and Li (2013) assessed the relationship between job demands (physical and psychological workplace demands) and job resources (decision latitude, supervisors on-the-job support, and colleague on-the-job support) with safety outcomes (occupational injuries and near-misses) in oil-production employees working in three sub-organisations in an oilfield company situated in China. The study's results denoted that job demands and job resources influenced employee emotional exhaustion and compliance with safety regulations, which in turn had an effect on the incidence of on-the-job injuries, as well as near-misses (Li et al., 2013). Nonetheless, the researchers also depicted a positive correlation with job demands and safety compliance. One explanation for this positive relationship as opposed to a negative relationship between job demands and safety compliance as proposed by the study's researchers is that safety compliance is contingent upon the rules and regulations put forth by an organisation itself (Li et al., 2013). More specifically, employees were more likely to follow or comply with an organisation's safety rules and

regulations the less stringent those regulations were. According to the researchers, safety compliance also relied upon the amount of monitoring that took place by supervisors or managers. Thus, higher amounts of monitoring resulted in a higher number of employees following the safety regulations (Li et al., 2013).

Similarly, Hansez and Chmiel (2010) examined the relationship between occupational demands (job overload and role ambiguity), occupational resources (occupational support, occupational quality, and decision latitude), occupational engagement, and work-related stress/strain and the following safety outcomes: situational violations and routine violations. Situational violations refer to safety violations where employees have the tendency to take the path of least effort or corner cutting behaviours that may become habitual after some time (Hansez & Chmiel, 2010). On the other hand, situational violations refer to safety violations that are essential with regards to getting the job done that may arise from certain failures within the organisation or the equipment that is being used. According to the results, job demands indirectly predicted routine violations in the workplace through job strain while job resources reduced the occurrence of routine violations through work engagement (Hansez & Chmiel, 2010). Lastly, a meta-analysis conducted by Nahrgang et al. (2011) revealed that job demands, such as risks, hazards, and task complexity negatively influence employee's health and are positively associated to the experience of burnout. The researchers further concluded that burnout was negatively associated with safety behaviours in the workplace, while job resources were positively associated with safety behaviours (Nahrgang et al., 2011). Across the various work industries assessed in the study, risks and hazards were the most persistent job demands to explain the most variance in burnout and the absence of safety behaviours. Likewise, burnout emerged as a predictor of safety behaviours while a supportive work environment was the most consistent job resource to explain the variance in both the experience of work engagement and safety behaviours (Nahrgang et al., 2011). Thus, it can be concluded that high job demands in the form of risks, hazards, and work overload may result in task errors or negative safety outcomes in the work context (Nahrgang et al., 2011; Sonnentag, 2015). Nonetheless, no study to date has attempted to assess whether the Job Demands-Resources model of burnout may result in the absence of safety behaviours in the occupation of ATM technicians. ATM technicians are imperative for the overall smooth operation and safety of aviation, air traffic control, and ATM, as a whole. Hence, it is of interest for the present research to shed some light on the relationship between the Job

Demands-Resources Model of burnout in terms of the following: (a) what types of safety behaviours do ATM technicians engage in, (b) whether the perception of high job demands is negatively associated with safety behaviours and (c) whether the perception of high job resources is positively associated with safety behaviours.

2.5 The Swiss Cheese Model of Human Error

Despite the evidence that is provided by the research studies that have focused on the relationship between the Job demands-Resources model and safety behaviours, the Job Demands-Resources model has been utilised to examine only a limited number of factors that may be potentially related to the absence of safety behaviours (Hansez & Chmiel, 2010; Nahrgang et al., 2011; Sonnentag, 2015). The Job Demands-Resources Model does not explain the reasoning behind the potential absence of safety behaviours that may be seen in the workplace. Nonetheless, the Job Demands-Resources model was not originally designed for the assessment of neither safety behaviours nor the safety context, in general. Thus, it may be concluded that the Job Demands-Resources Model alone is not adequate to both assess and explain the potential absence of safety behaviours that may take place within an occupational setting. One way through which human and task error may be explained thoroughly is through the use of Reason's (2000) Swiss cheese model of human error. In agreement with Reason (2000), human error may be looked upon from two broad viewpoints: the person approach and the systems approach. The person approach states that errors are a result of an individual's careless behaviour or inattention to the environment. On the other hand, the systems approach focuses on the various conditions or circumstances under which individuals operate that may result in human error (Reason, 2000). Defensive layers, barriers, and safeguards maintain a key position in the systems approach, also known as the Swiss cheese model. Reason (2000) further postulates that human error is the result of numerous holes in the defensive layers of high technology systems that provide the opportunity for errors or accidents. These holes in the defensive layers emerge for two reasons, these being: active failures and latent conditions (Reason, 2000). Active failures are considered to be any unsafe actions or behaviours that are carried out by individuals who interact with a particular system. These include, slips, violations in procedure, and mishandling of the equipment. Such active failures have an immediate yet temporary influence on the stability of the defensive layers (Reason, 2000). Latent conditions are considered to be resident pathogens that are found within the system.

These pathogens emerge from the decisions that are inherently made by top-level managers or system designers. Latent conditions result in two detrimental effects namely: conditions that promote errors (time pressure, insufficient equipment, and understaffing) and can establish long-term weakness in the defensive levels (Reason, 2000). Thus, in terms of applicability Reason's (2000) Swiss cheese model of human error may be utilised in the present study as an explanation in terms of situational factors that may inherently influence safety behaviours that may not be directly considered as demands or resources. Reason's (2000) Swiss cheese model of human error takes a more holistic viewpoint on both safety and human error through its explanation of why an error may be made even if an occupation has high resources and low demands.

Research Questions

The Job Demands-Resources Model of burnout has provided clear evidence for the following: (a) an excessive amount of occupational demands and low occupational resources may result in cynicism, exhaustion, a decrease in an employee's overall wellbeing, and potentially the onset of burnout, (b) an insufficiency in job resources may prohibit an employee from taking part in the completion of occupational goals, as well as contribute to the inability to cope with high demands adequately, and (c) the absence of job resources and an excessive amount of job demands contributes to the occurrence of negative safety outcomes (Bakker, van Veldhoven, & Xanthopoulou, 2010; Laschinger, & Finegan, 2008; Schaufeli, & Bakker, 2004; Hansez & Chmiel, 2010; (Nahrgang et al., 2011; Sonnentag, 2015). The Job Demands-Resources model has provided evidence for its ability to predict the onset of burnout or the absence of taking part in safety behaviours in a wide range of occupations, such as call-centre employees, nutrition production employees, health care employees, white-collar workers, blue-collar employees, telecom managers, home care employees and academic staff, police officers, fire-fighters, railway system employees, and airplane cabin crew members (Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003; Bakker, & Van Rhenen, 2009; Bakker, van Veldhoven, & Xanthopoulou, 2010; Laschinger, & Finegan, 2008; Nahrgang et al., 2011; Sonnentag, 2015; Schaufeli, & Bakker, 2004; Hu et al., 2011; Xanthopoulou et al., 2007). Nevertheless, no study has focused on examining whether the Job Demands-Resources model of burnout may be applicable in the occupation of ATM technicians. Likewise, no study has focused on the relationship between the assumptions put forth by the Job Demands-

Resources model of burnout and the occurrence of safety behaviours in ATM technicians. Thus, taking into account the evidence provided by the research focusing on the Job Demands-Resources model and the absence of studies focusing on ATM technicians, especially in the South African context, it is only appropriate to state that the following will be the focus of the present research study:

Hypotheses for Quantitative Component

Hypothesis 1 (*H1)*: There is a positive association between perceptions of job demands and the experience of burnout in ATM technicians.

H2: There is a negative association between perceptions of job resources and the experience of burnout in ATM technicians.

H3: Perceptions of high job demands and low job resources will predict burnout.

H4: The perception of job demands is negatively associated with safety behaviours.

H5: The perception of job resources is positively associated with safety behaviours.

H6: The experience of burnout is negatively associated with safety behaviours.

H7: Perceptions of high job demands will predict the absence of safety behaviours.

H8: Perceptions of high job resources will predict the presence of safety behaviours.

H9: The experience of burnout will predict the absence of safety behaviours.

Research questions for Qualitative Component

Research question 1 (*RQ1)*: How do ATM technicians describe the job demands and job resources that they perceive are present in their work environment?

RQ2: What types of safety behaviours do ATM technicians engage in as a result of their work

environment?

RQ3: What perceptions do ATM technicians have about their work and safety performance?

CHAPTER 3. METHOD

3.1 Research Design

A sequential mixed methods design was used to assess the relation between job demands, job resources, and burnout in ATM technicians, as well as to determine ATM technician's perspectives on the influence of job demands and resources on job safety and performance

3.2 Sample

Non-probability, convenience sampling was employed to acquire the participants of the present research study. Currently, three organisations in South Africa employ ATM technicians. The present study included participants from one of those organisations. The organisation that granted permission for the researcher to conduct the present study currently employed a total of 65 ATM technicians. The participants included 33 ATM technicians (50.77% response rate) from various geographical locations in South Africa who took part in the quantitative component of the research study and 14 ATM who volunteered to take part in the qualitative component of the study. The names of the geographical locations where the participants were employed were not requested as a means of protecting confidentiality in view of the fact that some locations only employ a small number of engineering technicians. Participants' ages ranged from 27 to 55 years (M = 38.91; SD = 8.76) and 90.1% were male (n = 30). The quantitative sample was comprised of 14 African (42.4%), 13 White (39.4%), 3 Coloured (9.1%), and 3 Indian (9.1%) participants. With regards to the participants' education levels, a total of 3 participants (9.1%) had a high school certificate, 25 participants (75.8%) had a diploma, 4 participants (12.1 %) had a master's degree, and 1 participant (3.0%) had a PHD. In terms of working experience, 5 participants (15.2%) had worked as ATM technicians for 1 to 5 years, 9 participants (27.3%) had worked for 6 to 10 years, 5 participants (15.2%) worked for 11-15 years, and 14 participants (42.4%) worked for more than 16 years as ATM technicians. These biographical details were not collected for the qualitative component in order to protect confidentiality and encourage participants to talk more openly. The sampling procedure for the interviews consisted of adding a section to the end of the quantitative survey, which requested whether a participant would be interested in taking part in an interview process focused on their line of work. Overall, a total of 14 participants volunteered to take

part in the interview process. This section also incorporated the use of a consent form for both the interview process and the recording of the interview process.

3.3 Procedure

The present research study requested the permission from the organisation in question before data collection took place through the use of an access letter requesting permission to conduct research (Appendix A). After permission was obtained from the relevant organisation, participant information sheets (Appendix B) were sent to potential participants by the organisation, electronically through the use of email. The participant information sheets contained information regarding the purpose and objectives of the study, as well as information concerning both the quantitative and qualitative components of the study. The participant information sheets included a link that directed the participants to an online platform that contained the questions found within the survey. Upon completion of the abovementioned questionnaires focusing on the JD-R model, burnout, and safety behaviours, participants were asked whether they would like to take part in an interview session regarding their line of work and safety. Participants who wished to take part in the interview process were also provided with a consent form requesting permission to record the interview process (see Appendix D), the participant's contact details, as well as information regarding the manner through which the participants would like conduct the interview process (telephone or Skype) (see Appendix C). Participants were then contacted through email or telephone depending on the contact details they provided. Once an interview date and time was agreed upon, participants were contacted through the method that they stated would be most convenient for them. Interviews lasted on average about 10 to 40 minutes depending on the length of the answers provided by the participants. The interview process ranged from 10 to 40 minutes because of the very busy work schedule of the ATM technicians. Most of the volunteers who chose to be part of the interview process did so either on their breaks or in between shifts. Due to the initial low rate of responding, both the administration of questionnaires and the interview of participants also took place on a face-to-face basis where questionnaires were administered by the researcher at the participants' place of work and interviews took place with participants who also volunteered to be a part of the interview process.

The present study incorporated the use of semi-structured interviews in order to understand working conditions, to identify any unusual aspects, and to determine ATM technician's perspectives on the influence of job demands and resources on job safety and performance. This interview process was combined with the information acquired from the questionnaires as a means of obtaining a more comprehensive perspective regarding the working conditions and safety issues that ATM technicians were faced with during normal and challenging workdays. Interviews also provided the needed information concerning ATM technicians' perspectives on the specific safety issues that may come up during the completion of work goals and how safety issues may be overcome.

3.4 Measures

3.4.1 Job Demands–Resources Scale (JDRS)

The present study utilised Jackson and Rothmann's (2005) original JDRS for the assessment of the job demands and resources that may be found within the profession of ATM technicians (see Appendix E). The JDRS originally contains 40 items that pertain to the following: work pace and amount of work, mental workload, variety in work, opportunities to acquire or lean new information, independence in the work context, relationships with direct supervisors and other colleagues, work ambiguities, possibilities for contact, monetary compensation (remuneration), carreer growth and possibilities, uncertainty about the future, communication, and participation in decision-making. The 40 items that are found within the JDRS are categorised into subscales that include the following two factors: job resources (growth opportunities, organisational support, and advancement) and job demands (job insecurity and overload). Out of the 40 items originally found within the JDRS, a total of 39 were used to measure job demands and resources, namely: Organisational Support (17 items), Growth Opportunities (7 items), Advancement (5 items), Overload (8 items), Job Insecurity (2 items). The item deleted was found within the Job insecurity sub-scale, 'Do you need to be more secure that next year you will keep the same function level as currently?.' The item was deleted because it appeared to be examing a function level rather than job insecurity. Items were adapted by altering certain English terms that appeared to be specifically designed for individuals who consider English to be their first language. Thus, simpler terms were chosen and used through out the questionnaire. All scale items were scored on a 4-point scale ranging from

Never [1] to Always [4]. Reliability analyses were run for each sub-scale used in the present research. Estimates of internal constistency (alpha) consisted of weak (Cronbach α of 0.10 to 0.69), modest (Cronbach α of 0.50 to 0.69), acceptable (Cronbach α of 0.70 to 0.79), and high (Cronbach α of 0.80 and above) scores.

Growth opportunities refer to having an adequate amount of variety, autonomy, and opportunities to acuire new information in the workplace (Rothmann et al., 2006). Organisational support concerns the relationship that employees have with their colleagues and supervisors, the communication and flow of information between employees, and the participation of employees in certain decision-making processes. Advancement refers to the amount of remuneration that is paid out to employees, as well as the career posibilities and training opportunities that are provided to employees (Rothmann et al., 2006). Job insecurity concerns the amount of uncertainty that an employee may have about his/her future. Overload concerns the amount of work that employees must carry out, as well as the mental or emotional load that may result from an employee's job duties or responsibilities (Rothmann et al., 2006).

The questionnaire contained the following sub-scales:

Organisational Support. Seventeen items were used in the following sub-scale as a means of assessing organisational support, which included the following: 'Can you count on your colleagues when you come across struggles at work?', 'If required, could you ask your colleagues for assistance?', 'Do you get along with your colleagues?', 'Can you rely on your superiors when you come across challenges in your work?', 'Do you get along with your manager?', 'In your line of work, do you feel valued by your manager?', 'Do you know precisely what others expect of you in your line of work?', 'Do you know precisely what you are responsible for?', 'Do you know precisely what your direct manager thinks of your performance?', 'Do you receive the necessary information on the objective of your work?'. The seventeen items found within the organisational support sub-scale were measured for internal consistensy. Cronbach alpha revealed a good reliability for the sub-scale (Cronbach α= 0.89).

Growth Opportunities. Seven items were used to assess growth opportunities, namely:

'Do you have enough variation in your line of work?', 'Does your job offer you prospects for personal progress and development?', 'Does your work give you the impression that you can accomplish something?', 'Does your job offer you the opportunity to take part in independent thoughts and actions?', 'Do you have autonomy in carrying out your work duties and activities?', 'Do you have influence in the preparation of your work activities?', and 'Can you partake in making the decision about when a particular duty must be completed?'. Cronbach alpha showed that the sub-scale reached an acceptable reliability (Cronbach α= 0. 70).

Advancement. Five items were used to assess advancement, namely: 'Can you live comfortably on your salary?', 'Do you think you are paid adequately for the work duties that you do?', 'Does your job offer you the prospect of financial growth?', 'Does your organisation provide you with opportunities to participate in training courses?', and 'Does your work give you the opportunity to be promoted?'. Cronbach alpha revealed that the sub-scale reached an internal consistency is modest yet questionable (Cronbach α= 0.50). The questionable Cronbach alpha may have resulted from the use of simpler terms to describe certain words found within the original JDRS. For instance, "pay" was changed to "salary" and "follow training courses" was changed to "participate in training courses". A lower Cronbach alpha may have also been the result of using more diverse items for the sub-scale, thus capturing the breadth of the construct as opposed to using more similar items, which could have artificially increased the value of alpha.

Overload. Eight items were used to assess overload, specifically: 'Do you have too many work duties to accomplish?', 'Do you have to work to tight deadlines?', 'Do you have to pay attention to many different things at the same time?', 'Do you have to concentrate for long periods of time on your work?', 'Do you have to remember a large number of things in your work?', 'Are you confronted in your job with situations that influence you personally?', 'Do you have contact with challenging individuals in your line of work?', and 'Does your line of work put you in emotionally distressing situations?' Cronbach alpha showed that the sub-scale reached a high internal consistency (Cronbach α=0.82).

Job Insecurity. Two items were used to assess job insecurity, namely: 'Do you need to feel more secure in your job?' and 'Do you need more security about being in the same job next year?' Cronbach alpha depicted that the sub-scale reached a high reliability (Cronbach

α=0.83).

In order to incorporate the demands and resources that are specifically found within the ATM technician job position, sixteen items were also added to the original JDRS scale. These sixteen items where separated into the following sub-scales: shifts, weather conditions, travel, and equipment. All sub-scale items were scored on a 4-point scale ranging from Never [1] to Always [4]. Reliability analyses were also run for each sub-scale used in the present research. Estimates of internal consistency (alpha) consisted of weak (Cronbach α of 0.10 to 0.69), modest (Cronbach α of 0.50 to 0.69), acceptable (Cronbach α of 0.70 to 0.79), and high (Cronbach α of 0.80 and above) scores.

Shifts. Three items were used to assess shifts, specifically: 'Do your shift cycles allow you enough time to recover from days that are challenging?', 'Do your shifts sometimes change from daytime to evening or night time shifts (rotating shifts)?', and 'Are the times you start and finish work flexible?' Cronbachalpha showed that the sub-scale obtained a weak internal consistency (Cronbach α= 0.11). This could be due to the low number of questions utilised, as well as the use of questions that measure different aspects of shifts.

Weather Conditions. Four items were used to assess weather conditions, namely: 'Do you have to complete work tasks outside during rain or thunderstorms?', 'Do you have to complete work tasks outside during heavy winds?', 'Do you have to complete work tasks outside during very hot or cold weather conditions?', and 'In your perception, do weather conditions hinder your ability to accomplish your work tasks or goals?' Cronbach alpha revealed that the sub-scale reached a high reliability (Cronbach α= 0.86).

Travel. Four items were used to assess travel, namely: 'Do you have to travel for work when visibility is poor?', 'Do you have to travel in areas that you would consider dangerous?', 'Do you have to use any dirt roads that are rough?', and 'Do you have to travel long distances to complete your work tasks?' Cronbach alpha showed that the sub-scale reached a high internal consistency (Cronbach α= 0.85).

Equipment. Five items were used to assess equipment, namely: ‘‘Do you struggle to access the equipment needed to do your job?’, ‘Are the necessary tools and equipment available for the completion of work tasks?’, ‘Do you have to work with complicated equipment?’, ‘Do you have to work with any hazardous or dangerous equipment?’, and ‘Does the completion of work tasks require the use of heavy equipment?’ Cronbach alpha revealed that the sub-scale reached an internal consistency that is modest yet questionable (Cronbach $\alpha = 0.52$). The questionable Cronbach alpha may be a result of the items used in this sub-scale to measure the availability of equipment, which differ from other items focusing on the possible hazards nature of the available equipment

3.4.2 Burnout Scale

Schaufeli et al.’s (1996) Maslach Burnout Inventory-General Survey (MBI-GS) was incorporated to assess ATM technicians’ work-related burnout (see Appendix H). The MBI was originally constructed to examine the three diverse constituents found within burnout: exhaustion, cynicism, and personal efficacy. The MBI-GS consists of 16 items scored on a 7-point likert scale ranging from never [0] to daily [6].

Exhaustion. Four items were used to assess the exhaustion subscale, namely: ‘I feel emotionally tired from my work’, ‘I feel worn-out when I get up in the morning and have to face another workday’, ‘Working all day is really straining for me’, and ‘I feel burned out from my work’. Cronbach alpha showed that the sub-scale reached a high reliability (Cronbach $\alpha = 0.89$).

Cynicism. Five items were used to measure cynicism, namely: ‘I have become less interested in my line of work since I started this job’, ‘I have become less eager about my line of work’, ‘I just want to do my job and not be disturbed’, ‘I have become more cynical about whether my work contributes anything’, and ‘I doubt the importance of my work’ Cronbach alpha revealed that the sub-scale reached a high reliability (Cronbach $\alpha = 0.82$).

Personal Efficacy. Six items were used to measure personal efficacy, namely: ‘I can efficiently solve the problems that arise in my work’, ‘I feel I am making a valuable contribution to what this organisation does’, ‘In my opinion, I am good at my job’, ‘I feel

elated when I accomplish something at work', 'I have achieved many important things in this job', and 'At my work, I feel confident that I am successful at getting things done'. Cronbach alpha showed that the sub-scale reached a high reliability (Cronbach α=0.82).

3.4.3 Safety Behaviour Scale

ATM technicians' safety behaviours were examined through the adoption of nine items measuring safety compliance and safety participation, which were drawn from safety behaviour scale developed by Neal and Griffin (2006). Five items measuring upward safety communication were also obtained from a safety behaviour scale developed by Hofmann and Morgeson (1999) (see Appendix F). All scale items were scored on a 7-point scale ranging from strongly disagree [1] to strongly agree [7].

Safety Compliance. Three items were used to measure safety compliance, which consisted of the following: 'I use all the required safety equipment to do my job', 'I use the appropriate safety procedures for carrying out my job'**,** and 'I provide the highest levels of safety when I carry out my job'. Cronbach alpha revealed that the sub-scale reached a modest yet questionable internal consistency (Cronbach α= 0.50). The questionable Cronbach alpha may have resulted from the use of simpler terms to describe certain words found within the original JDRS. For instance, necessary was changed to required and correct to appropriate.

Safety Participation. Three items were used to measure safety participation, namely: 'I encourage the safety program found within my organisation', 'I put in extra effort to increase the safety found within the workplace', and 'I voluntarily carry out tasks that may help improve the safety of my colleagues and me'. Cronbach alpha showed that the sub-scale reached modest internal consistency (Cronbach α= 0.60).

Upward Safety Communication. Five items were used to measure safety participation, namely*:* 'I feel comfortable discussing safety behaviour with my managers, 'I try to avoid talking about safety issues with my managers, 'I personally believe that my managers openly receive ideas for improving safety', 'I am hesitant to discuss safety-related problems with my managers, 'I feel that my managers encourage open communication about safety. Cronbach alpha showed that the sub-scale reached a high internal consistency (Cronbach α= 0.92).

3.4.4 Work-Family Spillover Scale

Work-family spillover. Based on a previous conference presentation by an ATM technician and a discussion with a senior ATM technical manager, a potential need was identified for the need to measure the possible occurrence of a work-family spillover in the ATM technician occupation (see Appendix G). In order to assess whether there was a spillover effect between the work microsystem and participant's family microsystem, three items were developed, namely: 'My job interferes with life outside of work', 'My job interferes with my leisure time', and 'My job interferes with time off work.' All scale items were scored on a 4-point scale ranging from Never [1] to Always [4]. Cronbach alpha showed that the sub-scale reached an acceptable internal consistency (Cronbach $\alpha = 0.70$).

3.4.5 Interview Guide

Upon completion of the abovementioned questionnaires focusing on the JD-R model, burnout, and safety behaviours, participants were asked whether they would like to take part in an interview session regarding their line of work and safety. Participants who wished to participate in the interview process were later contacted so that a suitable time could be agreed upon. The present study incorporated the use of semi-structured interviews in order to identify unusual working conditions and to determine ATM technician's perspectives on the influence of job demands and resources on job safety and performance. This interview process was combined with the information acquired from the questionnaires as a means of obtaining a more comprehensive perspective regarding the working conditions and safety issues that ATM technicians were faced with during normal and challenging workdays. Interviews also provided the needed information concerning ATM technicians' perspectives on the specific safety issues that may come up during the completion of work goals and how safety issues may be overcome.

Interview Questions. The semi-structured interview process employed the use of open-ended questions to discuss the following issues: job tasks, job demands, job resources, burnout, job safety, work-family spillover, and performance (see Appendix I). The semi-structured interview process was chosen because it consists of a predetermined set of open interview questions that prompt discussion (Fylan, 2005). Semi-structured interview questions

do not limit interviewees to a set of prearranged answers, as opposed to the use of structured interview questions. This allows the interviewer a more versatile means of gathering data as a means of exploring the interviewees' responses to a greater extent (Fylan, 2005). Interviews took place during a specified time that was suitable for the participants and lasted approximately 10 to 40 minutes. The interview process was initially conducted telephonically. Due to the initial low rate of responding, however the interview of participants also took part on a face-to-face basis at the participants' place of occupation. Sample interview questions included: 'Please could you tell me what the purpose of your job is?', 'How would you describe your job in terms of safety on a normal day? How is this different from challenging days?' During the interview process, various probes were used as a means of stimulating the interviewees to produce more information on their own accord. The main purpose of probes was to motivate participants to articulate their personal views and opinions while preventing the occurrence of interview questions that lead the interviewees.

3.5 Analyses

For the quantitative component of the study, descriptive statistics were used, followed by Pearson's correlations, simple regression, and multiple regressions to investigate the relation between job demands, job resources, and burnout in ATM technicians. With regards to the present study's scales, interval data was assumed due to the utilisation of Likert scale items, (Crawford, 2006). As stated by Jaccard and Wan (1996), Likert scale items may be regarded as interval despite the absence of equal distances between the scale items. Furthermore, the researchers also argue that Likert scale items may be considered as interval primarily because such assumptions do not negatively affect Type I or Type II errors in any manner, especially if a 5 or 7-point Likert scale is utilised.

Variables were evaluated for normality by running normal probability plots, histograms, and Kolmogorov-Smirnov $\chi 2$ tests. No issues with normality arose in any of the variables utilised for the Pearson's correlations, simple regression, or multiple regression analyses. Hence, all variables were approximately normally distributed as indicated by the use of normal probability plots, histograms, and Kolmogorov-Smirnov $\chi 2$ tests. Linear relationships between the variables were also examined through the use of scatterplots. All variables obtained linear relationships. For the multiple regression analysis, multicollinearity was also assessed. No

multicollinearity was found in the data. Thus, the independent variables are independent of each other. Correlation, simple regression, and multiple regression analyses were used because these types of analyses focus on relationships between interval variables and can specify how and to what extent two or more variables are associated with one another (Crawford, 2006). However, bivariate correlations can indicate how two variables are related and the direction of that relationship. Correlation specifies a unitless measure of relation between two separate variables, which ranges from -1 (representing a perfect negative relation) to 0 (representing no association) to +1 (representing a perfect positive relation). Neither variable used in a bivariate correlation is considered to be either the predictor or outcome (Crawford, 2006). Regression is utlised as a means of assessing the capability of one or more variable (independent variable) to predict another variable (dependent variable) and the strength and direction of that causal relationship. As opposed to correlation, regression analyses consider one variable to be an outcome variable (dependent variable) and the other the predictor variable (one or more independent variables). The present research study used both correlation and regression because it was interested in assessing both the association between the variables under question and their causal relationships (Crawford, 2006).

For the qualitative component of the study, upon the completion of the participants' interviews all the audiotaped data was professionally transcribed into word format. Upon this, thematic content analysis was utilised to pinpoint, reveal, and investigate the recurring themes found within the data obtained from the participants' interviews (Braun & Clarke, 2006). Thematic analysis is considered to be one of the most frequently used forms of analysis in qualitative research. This type of analysis involves acquiring a summary of the interview material and pinpointing key patterns and themes arising from the participants' interviews.

Themes summarise an important relationship between the interview data and the proposed research questions, symbolise some level of recurrent response that is found within the data set, and become the categories that are used for further analysis. Numerous steps were undertaken to pinpoint and construct the themes found within the interview data set. Some of the themes were evident immediately and other themes were pinpointed upon further analysis of the date set. Each of the themes was provided with a label that was descriptive of the main content found within each specific theme. Each theme was further reviewed numerous times in an attempt to reduce the researcher's own interpretation of the findings (Braun & Clarke,

2006). Thematic content analysis was performed through a six-step coding process, which included the following steps: (a) familiarisation with the interview data, (b) generating the primary codes, (c) searching for recurrent themes amongst the codes generated, (d) reviewing the themes, (e) naming the themes, (f) and reporting the themes (Virginia & Clarke, 2006). The main purpose of thematic content analysis is to identify the possible themes found within a specific interview data set, compare and contrast the recurrent themes, and use those themes to build a theoretical model. Focusing on the information provided by the participants of the present study regarding the occupation of an ATM technician found within the South African context, the analysed data set revealed several chief themes that were distinguishable (Virginia & Clarke, 2006). The present research study used thematic content analysis as a means of building upon the quantitative research analysis and attempt to build a theoretical model concerning the job demands and resources, burnout, and safety in ATM technicians.

3.6 Ethical Considerations

All personal information and responses to both the questionnaire and interview questions were kept confidential. Interviews were conducted at times that suited the participants so that the interviews did not interfere with work or other activities. All identifying information was erased and participants were given numbers to ensure that their responses were kept confidential. All information gathered from the questionnaire and interview process remained anonymous. Participation in the following study was completely voluntary where participants had the choice to withdraw from the study at any moment if they felt uncomfortable for any reason. Participant information sheets (Appendix B) were sent to all potential participants by the organisation, through the use of email. The participant information sheets contained information concerning the purpose and objectives of the study and information about both the quantitative and qualitative components of the study. Participants who wished to take part in the interview process were also provided with a consent form requesting permission to record the interview process, the participant's contact details, as well as information regarding the manner through which the participants would like conduct the interview process (telephone or Skype) (see Appendix C). The present research study was approved by the ethics committee of the SHCD and was provided with an ethics clearance certificate (Appendix J).

CHAPTER 4. RESULTS

The following section will focus on the both the quantitative and qualitative analyses that were used for the present research study. The quantitative results are separated into the following sections: descriptive statistics, bivariate correlations and regression analyses. Tables are used as a means of illustrating the main findings of the quantitative results. The qualitative results are separated into categories depending on the main themes that emerged during thematic content analysis. The main themes include: job description, title, and responsibilities, perceptions of job resources, perceptions of job demands, burnout, spillover effect, influences on job performance and safety, safety behaviours and policies.

4.1 Quantitative Results

4.1.1 Descriptive Statistics

Means, standard deviations, minimum, maximum, and internal consistency values for the Job Demands-Resources model, safety behaviour, work-family-spillover, and burnout constructs are found in Table 1. Most of the variables are approximately normally distributed, with the exception of the following: organizational support (M = 53.33; SD = 6.59), exhaustion (M = 17.12; SD = 7.14), cynicism (M = 17.67; SD = 4.85), and professional efficacy (M = 29.85; SD = 4.78). The dispersion of participant's answers in the above variables appears to be higher with respect to the variability than the variables with lower standard deviations. However, the maximum and minimum data points are also higher for these variables as compared to the variables with a lower variability in the data. As indicated by the use of normal probability plots, histograms, and Kolmogorov-Smirnov $\chi 2$ tests, however, all variables were approximately normally distributed.

Table 1

Means, Standard Deviations, and Internal Consistency Scores for the Measurement Items Utilised

Variable	M	SD	Min.	Max.	Cronbach α
Organisational Support	53.33	6.59	41.00	66.00	.89
Growth Opportunities	19.94	2.95	13.00	26.00	.70
Advancement	11.39	2.36	7.00	16.00	.50
Total Job Resources	84.67	8.87	67.00	102.00	.86
Overload	24.85	3.75	16.00	30.00	.82
Job insecurity	5.00	1.37	3.00	8.00	.83
Sub-total Job Demands	29.85	4.21	20.00	36.00	.78
Shifts	6.42	1.48	3.00	9.00	.11
Weather Conditions	10.15	2.61	4.00	16.00	.86
Travel	11.12	2.29	7.00	16.00	.85
Equipment	13.27	1.99	9.00	17.00	.52
Safety Compliance	13.79	1.47	11.00	15.00	.50
Safety Participation	13.06	1.67	9.00	15.00	.60
Upward Safety Communication	14.76	1.80	11.00	18.00	.92
Total Safety behaviour	41.60	3.67	34.00	46.00	.81
Work-Family Spillover	7.30	1.65	3.00	10.00	.70
Exhaustion	17.12	7.14	5.00	30.00	.90
Cynicism	17.67	4.85	11.00	31.00	.82
Personal Efficacy	29.85	4.78	16.00	35.00	.82
Total Burnout	64.64	10.90	46.00	89.00	.76

4.1.2 Bivariate Correlations and Regression Analyses

A Pearson correlation was carried out to determine whether there was a positive association between the participants' perceptions of job demands and the experience of burnout (hypothesis 1), as well as whether there was a negative association between the participants' perceptions of job resources and the experience of burnout (hypothesis 2). The findings depicted a weak, positive correlation between the perception of job demands and the experience of burnout ($r = .376$, $p < .05$) and a weak, negative correlation between the perception of job resources and the experience of burnout ($r = -.383$, $p < .05$). This provides full support for hypothesis 1 and hypothesis 2. Multiple regression analysis was used to test whether perceptions of high job demands and low job resources predict burnout (hypothesis 3). The results showed that the two predictors explained 37.3% of the variance in safety

behaviours, $F(2, 30) = 8.924$, $p < 0.05$. It was found that job resources significantly predicted the experience of burnout (β = -.494, p = .002), as did job demands (β = .489, p = .003). The experience of burnout increased as the perception of job resources decreased and the perception of job demands increased. This provides support for hypothesis 3. Results of the multiple regression analysis are reported in table 2.

Table 2

Multiple Regression Analysis for Job Demands, Job Resources, and Burnout

Predictor	***B***	**SE (B)**	**β**	***t***	***p***
Job demands	.629	.191	.489	3.291	.003*
Job Resources	-.606	.182	-.494	-3.327	.002*

*Note. *Statistically Significant at p* < .05, *Dependent Variable = burnout*

A Pearson correlation was also used to assess the following: (a) whether the perception of high job demands was negatively associated with safety behaviours (hypothesis 4), (b) whether the perception of high job resources was positively associated with safety behaviours (hypothesis 5), and (c) whether the experience of burnout was negatively associated with safety behaviours (hypothesis 6). The findings showed no correlation between the perception of job demands and safety behaviours; a moderate, positive correlation between the perception of job and safety behaviours emerged ($r = .514$, $p < .01$); and no correlation between the experience of burnout and safety behaviours. This provides no support for hypothesis 4, full support for hypothesis 5, and no support for hypothesis 6. Results for the Pearson correlation are reported in table 3.

Table 3

Pearson Correlation for Job Demands, Job Resources, Burnout, and Safety Behaviours

Variable	1	2	3	4
1. Job Demands	--			
2. Job Resources	.227	--		
3. Burnout	376*	-.383*	--	
4. Safety Behaviours	.329	.514**	-.224	--

*Note. *Statistically Significant at p* < .05, *** Statistically Significant at P* < .001.

Simple regression analysis was used to examine the following whether the perceptions of high job demands predicted the absence of safety behaviours (hypothesis 7). The results revealed that perceptions of job demands were not significant predictors of the absence of safety behaviours (R^2= .108, $F(1, 31) = 3.77$, $p > 0.05$). Hence, providing no support for hypothesis 7. Simple linear regression was also utilised to assess whether the perceptions of high job resources predicted the presence of safety behaviours (hypothesis 8). The participants' perceptions of job resources explained 26.5% of the variance in safety behaviours, (R^2= .265, $F(1, 31) = 11.16$, $p < 0.05$. This provides full support for hypothesis 8. Lastly, simple linear regression was used to examine whether the experience of burnout predicted the absence of safety behaviours (hypothesis 9). The results revealed that the experience of burnout did not emerge as a significant predictor of safety behaviours, (R^2= .05, $F(1, 31) = 1.64$, $p > 0.05$). Consequently, providing no support for hypothesis 9. The results for the simple regression analyses for job demands, job resources, burnout, and safety behaviours are reported in Table 4.

Table 4

Simple Regression Analysis for Job Demands, Job Resources, Burnout, and Safety Behaviours

Predictor	*B*	SE (B)	β	*t*	*p*
Job demands	.143	.074	.329	1.942	.061
Job Resources	.213	.064	.514	3.341	.002*
Burnout	-.076	.059	-.224	-1.28	.210

*Note. *Statistically Significant at p* < .05, *Dependent Variable = safety behaviours*

4.2 Qualitative Results

Data that was collected from the transcribed and coded interviews produced a rich understanding regarding the participants' line of work, their job resources, job demands, and their on-the-job safety procedures and behaviours. Likewise, a rich insight was also provided concerning the possible work-family spillover effects. Findings also revealed the impact of an ATM technician's responsibilities and duties on his/her overall wellbeing. Due to the scarcity of information and research that is available focusing on the occupation of ATM technicians, the following section will focus on the key themes that emerged from the thematic content analysis of the transcribed data set with regards to the specific job description and titles provided by the participants, as well as provide information for the following research questions:

RQ1: How do ATM technicians describe the job demands and job resources that they perceive are present in their work environment?

RQ2: What types of safety behaviours do ATM technicians engage in as a result of their work environment?

RQ3: What perceptions do ATM technicians have about their work and safety performance?

4.2.1 Job Description, Title, and Responsibilities

Overall, 100% of the participants provided the title of technician or engineering technician to describe their occupation. Likewise, every technician was provided with one of the following titles depending on his/her specialization, as well as the equipment that individual is responsible for: (a) systems specialist, (b) software specialist, and (c) electrical specialist. With regards to the occupational responsibilities of an ATM technician, 80% of the participants stated that they are mainly responsible for the maintenance of computers, radar, technical, navigational, and surveillance equipment. Likewise, 20% stated that they are responsible for the maintenance of any faults that may arise, as well as responsible for any type of technical support needed. Likewise, each technician was responsible for the maintenance of all the equipment found within designated sites outside the airports, as well as the technical equipment found within the airport itself. For instance, one participant stated that they, as technicians, are also responsible for the air conditioning equipment found within the airport, as well as the computers and equipment that may be found within their organisation or the air traffic control tower. Thus, the ATM technician are responsible for a wide range of technical maintenance ranging from the fixing of faults and maintenance of certain surveillance, radar, and navigation equipment found within and outside the airport to everyday technical support for other employees of their organisation. The following quotes provide an illustration of the job description and the occupational responsibilities of an ATM technician as provided by the participants:

> *"Our job basically consists of three major disciplines, which is communications, navigations and surveillance. We as engineering technicians are supposed to be competent in all three disciplines, in other words we should be able to be just as competent in working on a radar system as you work a display system, as you would have a communication system or as would a navigational beacon or a navigational age. So we have to maintain and keep those running, make sure that they all working within specifications that are filed under Civil Aviation as well as conforming to our current specifications, and all this, bearing in mind with the safety that's all behind it and what are the consequences of these things being all serviceable or if they're unserviceable what the consequences will be on that. We also are involved with installing new equipment with the relevant project managers and original software. So we do get involved in installations as well."* [Participant 10]

> *"So what we do is we maintain the systems. The ATM systems around here. So that would be your flight planning systems, your messaging systems, your controlling systems that they use at the top and the bottom here for tower and also the ones for the slots, we also take care of them. We also take care of the ATM network. And then the hardware. A bit of everything, almost."* [Participant 9]

> "*What we do on each and every airport and in between the airport there are navigation equipment required by aircraft and what we do we maintain this equipment with service ability level of 99.8 percent."* [Participant 12]

And similarly:

> *"My job it's me attending to problems that we have, like most, actually we are here to attend to faults, if there's any faults that is happening that we've got, that is my job. I need to go out and fix."* [Participant 6]

4.2.2 Perceptions of Job Resources

According to the Job Demands-Resources model, job resources assist employees accomplish their work goals and tasks, as well as help alleviate the pressures or stress that may be created by the existence of too many occupational demands (Demerouti et al., 2001). Job resources refer to the physical, psychological, or organisational components of an occupation that may decrease the negative influence of job demands, prompt individual development and are necessary for the accomplishment of work goals (Demerouti et al., 2001; Bakker et al., 2003). With regards to the occupational resources that appear to assist the participants of the present study to accomplish their job responsibilities, most of the participants stated that autonomy, satisfaction and personal accomplishment with fixing faulty equipment, and working with technology were the most important prerequisites that assisted them in accomplishing their work tasks. For instance, one participant stated the following with regards to autonomy: *"I think the freedom that it gives me, that I mostly work, independently, ja and I'm not being micro managed. As long as I put out the reports that I need to put out timeously, then everything seems, ja and I'm happy with that."* [Participant 13]. Likewise, another participant stated the following: *"It's a bit of a relaxed, you're your own boss rather."* [Participant 3].

Thus, one may conclude that having the capability to make decisions based on one's own judgment is an important resource cornering the occupational responsibilities and duties performed by ATM technicians. Likewise, the ATM technicians of the present study also appeared to be putting great emphasis on the satisfaction that is derived from having the intellectual capability to fix a faulty piece of equipment. For instance, one participant stated that following quote: *"Yes, you get joy when something works and especially when you get a challenge. When you get to make it work after, my job is not straightforward. It's not something that you can read out of, just Google it. You have to have your own intuition. You have to have your wits about you. It's not something that somebody can really teach you in school. You have to think what the problem can be, out of the box. So then when you get work then it gives you that personal satisfaction"* [Participant 9]. Likewise, another participant declared the following: *"I enjoy seeing the services that are all running smoothly and I like to, if I don't understand something I like to take the time out in an effort to try and figure out what makes it tick or its quirks."* [Participant 8]. Additionally, working with technology and working with technological challenges emerged throughout the interview data set as being an important resource. For instance, one participant stated that working with technology and having to solve challenging faults provides him with the satisfaction of keeping his mind active as illustrated in the following excerpt: *"Ja, the technology, being a technical guy, the kind of technology, that's quite challenging that we are having here so it keeps your mind active"* [Participant 5]. Other resources that emerged as being important include teamwork, compensation, non-repetitiveness, and travel. For instance, one participant stated the following with regards to the non-repetitiveness of the job: ***"****I think what is very rewarding is the fact that you do a lot of different things. It's not like very repetitive necessary; you know on a daily basis you would do so many things but it's constantly changing so you don't get bored easily. But on the other hand, you know, on the reward system, you also feel a lot of times, thank you for, I don't know how to say it"* [Participant 4]. Thus, the occupational resources that emerged are distinct from the occupational resources that were assessed through quantitative measures. As can be depicted, ATM technicians allocate more importance on having the ability to make their own decisions when it comes to accomplishing their work goals and tasks, on the accomplishment that may be derived from having the ability to fix a fault found within a piece of equipment and having the chance to work on challenging faults.

4.2.3 Perceptions of Job Demands

As stated by Demerouti et al. (2001), job demands concern the physical, social, or organisational elements of a particular occupation that demand a sustained state of physical and/or mental exertion. These demands are usually associated with certain physiological and psychological costs (Demerouti et al., 2001). With regards to the job demands that are present in the occupation of an ATM technician, the majority of participants stated the following challenges: (a) weather conditions and terrain, (b) shifts consisting of long travel distances, and (c) time pressure. For instance, one participant mentioned the following with regards to the weather conditions and terrain he/she experienced: *"Well, there is a particular site that is almost ten thousand feet above sea level, so getting to the area is a challenge on its own, because you need four by four driving experience in the first place and then secondly, between the snow and the wind that are there, it's very challenging in the first place and then when you get to site and you still have to carry equipment up and down stairs and that, you struggle to breathe because of the altitude"* [Participant 10]. Likewise, another participant stated the following quote: *"Challenges like, there's a lot greater in winter time when we need to protect sites and there's a very high altitude and we encounter snow, high winds and that obviously makes it difficult to reach the site, first of all. It's quite dangerous when travelling to those sites, travelling through snow on the high mountains where the roads are very narrow, sometimes, it's only just two tracks up the mountain through the snow there"* [Participant 3]. Another participant stated weather conditions that included high winds, cold weather, and lighting, which can be depicted in the following excerpt: *"Oh, okay. I've got one thing actually, especially on the site I'm working at. It's in a high how can I put it, a high lightning strike area. But there's always wind. I normally get sick there, you know with a cold or sore throat but it's because of the temperature difference, up the mountain, I think it's probably, we're usually walking there and you think, oh it's nice and warm inside the building and then you look at the air cons and they're actually twenty degrees so then you realise, okay, outside it must be maybe fifteen or sixteen."* [Participant 1]. As can be depicted from the participants' excerpts, ATM technicians are faced with weather conditions consisting of high winds, the possibility of lightning, and cold weather or snow, as well as terrain that may only be crossed through the use of four by four vehicles that is considered highly dangerous by the participants.

With regards to the challenge of the shifts, most of the participants stated that they worked long shifts, which mainly consisted of traveling long distances. For instance, one participant

stated that most of the staff is scheduled into standard shifts that rotate through out the week and that every technician also takes part in call out shifts where he/she may be called in to fix a faulty piece of equipment at any time of the day or night. This can be illustrated in the following quote: *"They are standard times. The call-outs can be during the day if we are skeleton staff. Sometimes we have to go into a skeleton staff shift rotation due to people on courses and sick and outside sites and so forth. Then we work skeleton staff, which ups the frequency of night shift and shift work, and call-out as well. So we've got this standard time roster or a shift roster that people are scheduled for, to work shifts and are on call-out and then obviously if we are now reduced to a skeleton staff that frequency amended or changed and the people are then working more frequent shifts and to cover for the ones that are not available"* [Participant 14].

Lastly, a job demand that consistently emerged from the interview data set was that of time pressure. Due to the necessity of radar, navigational, and surveillance technical systems for aviation safety in general, ATM technicians are required to fix a faulty piece of equipment under high time pressures. For instance, one participant stated the following with regards to the pressure that is experienced when fixing a fault: *"The pressure of, which is the nature of the work because it's time critical, it's time sensitive, also the safety aspect of it because should the air traffic management system go down, you need to get it up as soon as possible because there's planes in the skies. People's lives will be in danger and except for that if it's systems that are controlling air crafts which are on the ground, the delays, you costing people money and then also the stress is cascading, it will be from the pilot to the air traffic controller that contracted the assistant to the person who supplied the flight plan to actually people who would depend on the system rope them so they will be breathing down my neck. So I have to ensure that it works."* [Participant 9]. This excerpt depicts both the importance of an ATM technician's job with regards to aviation safety in general, as well as the individual pressure that is felt by a technician to fix a specific fault in the least amount of time. What appeared to also emerge with reference to time pressure was the fact that the participants felt that they had a personal responsibility to fix such faults due to the possible implications that may arise if a technical system was down for too long. They personally felt responsible for any repercussions that may arise from making a mistake or taking too long to fix a fault.

4.2.4 Burnout

As has been stated by Jackson and Rothmann (2005), burnout can be referred to as a negative, occupational-related condition, which is characterised by physical, emotional, and attitudinal symptoms including: exhaustion, emotional distress, and reduced motivation. Looking upon the interview data set for the present study, the majority of the participants stated that they experienced at least one of the following: stress, exhaustion, frustration, and fatigue. For instance, one of the participants stated that he/she regarded the occupation of an ATM technician as being stressful because you always need to stretch yourself and spend large amounts of time away from home. Likewise, another participant stated the following: *"Ja and when we start having failures, like big system failures where things are getting serious now, then the stress level just goes off the chart because you're going to have meet with the strain as well. A lot of people looking at you trying to see what's going on, why aren't you at the service. We need to do this and then we can't do it and then the frustration levels creep up and then your stress levels go mad. It takes a lot of self-control to keep all of that in check."* [Participant 10]. Lastly, one participant stated the following with regards to fatigue: *"Guys are fatigued, come December you cannot take leave because there's no-one to fill the shifts."* [Participant 13].

4.2.5 Spillover effect

According to Grzywacz, Almeida, and McDonald (2002) work-family spillover takes place when work related issues or problems spill into their family life, as well as when employees bring their work life into their family life. Looking upon the information obtained from interviews with the participants in the present study, a spillover effect does take place primarily when participants are on call out or standby. For instance, one participant stated the following: *"Look we, in the technical area have been working on standby but obviously there is impact, we work normal office hours from 8 to 5 but then there are also standbys that we have to work and if we do stand by hours we can be called out but we repair, it does impact on your personal life as well it doesn't matter where you are or what area you have to respond on it. I can recall one, years ago, I was called out of a movie. I was relaxing with my wife in the movie theatre and I was called out of the movie theatre to go to a repair but I think that does happen and yes it does impact."* [Participant 12]. The occurrence of a spillover effect taking place primarily when participants are on standby may also be illustrated in the following: *"It's tough because quite often they clash with one another. I'll give you a scenario. When I first*

started working here, I worked shifts like back to back. Back to back shifts where you cannot even take leave and you know the little things that I used to do before joining the organisation, like going to church those things fell away because I'm on stand-by or I'm supposed to work that Sunday or I'm coming in that evening and in so saying, that also talks to your social life. I mean you cannot attend your friend's weddings, you cannot, family. Everything becomes secondary" [Participant 13]. One participant stated that the technicians had the ability to change the individual that has to go to a specific site when on standby if serious family challenges did arise. This can be illustrated in the following: *"At any point in time that you are called to go to work but then if something very urgent happens, they will allow the technician to contact, maybe your boss, to tell them that you have serious challenges, to a point that you can't actually commit to your job at that time and then they can actually find someone else for the call."* [Participant 4].

4.2.6 Influences on Job Performance and Safety

High performance levels are imperative in an occupation, such as that of an ATM technician where the safety of aviation relies on the ability of technicians to perform at optimal levels. ATM technicians must have the ability to fix any given fault without compromising both their safety and the safety of aviation, as a whole. As can be deduced from the excerpt that emerged within the job resources theme, ATM technicians have a tendency to derive personal satisfaction from having the ability to fix any faulty piece of equipment. Ultimately, this may a positive influence on performance, as a whole. Other influences that appeared to emerge from within the interview data set with regards to what influences the performance and safety of ATM technicians include: (a) understanding the risks of the job, (b) weather conditions, (c) safety equipment, (d) the knowledge and understanding of the repercussions that may arise from mistakes, and (e) mood. Looking upon the interview data set, it was evident that the participants held the perception that knowing the risks of the job influenced both their behaviour on a site, as well as their safety and performance, in general. As was stated by one participant, knowing the risks associated with the job had an influence on how the technicians attempted to tackle a specific fault and how they would approach a specific site. The safety clothes and equipment that the technicians where provided with by their organisation assisted

in protecting themselves during any given situation. For instance, this can be illustrated by the following quote: **"***Safety clothes, shoes, equipment and everything that we have to have, it's upon you to have those so if you get to a site, it's raining depending on whether it's heavy or not, they critically solve the problem. You just have to, if your manifest is rain, you will have to, as long as it doesn't actually impact, or get electrocuted or something like that."* [Participant 5]. Thus, while the participants were well aware of the dangers of going to a specific site with regards to the weather conditions, the safety clothes appeared to protect them from any incoming safety hazards, as well as assist them in performing their job tasks adequately. Likewise, other participants stated that their mood could inevitably have a negative influence on both their performance and safety if they are unable to separate their personal from their professional lives. Other factors that may influence performance and safety can be illustrated by the following: "*Everything, actually influences performance of a person from your mood on the day to your physical capacity, to your training, to your relationship with the clients and other people and your colleagues and your supervisors, managers and things like that to even political issues in the country so everything, even the weather. So things like that actually do contribute but you have to make a choice even if they do contribute but how do you respond. So you have a choice in responding of things that happen, even the weather even your body, even your mind, even your home, if I fought with my wife or whatever. It shouldn't be something that you know, affects my work but we are human beings but we can limit to according to our mind and our professionalism to say that we're here to do a job and it needs to be done*." [Participant 9]. Lastly, numerous participants stated that the repercussions that may arise from making mistakes had a large impact on their safety behaviours and performance primarily because of the understanding that one deviation from their safety could influence the safety of aviation safety, as a whole.

4.2.7 Safety Behaviours and Policies

As can be understood from both the literature on ATM technicians and the interview data of the present study, safety has a large influence on the behaviours of ATM technicians. The safety of the ATM technicians is influenced both by individual elements that are reliant on the technician's mood, as well as influences that are due to weather conditions. However, polices and regulations are in place as a means of protecting the technicians from any safety issues that may arise on the job. Ultimately, these rules and regulations influence the safety

behaviours of the technicians. For instance, the majority of participants stated that they are required to wear their safety clothes, as well as carry their safety equipment with them at all times when traveling to and from sites and when they are on the sites, which can be depicted in the following: *"It's the company's policy that we are permitted from going single person to site."* [Participant 10]. Another participant stated the following: *"To be honest with you, as I say, you know, we are working at a very high standard to make sure that the environment is safe and we've got amongst others, myself, a safety office here so we've got our meetings regularly and so on but then again I think that there can be more awareness around the impact of working safe."* [Participant 6]. As was stated by the majority of the participants, the policy of having two technicians on a site rather than one at any given time was for the following safety reasons: (a) having another individual to assist with carrying equipment, (b) having some form of assistance when configurations must be remembered, and (c) having another individual there to call for assistance in case of any accidents. For instance, one participant stated the following quote: "*when we work in pairs, we need to have somebody that can assist in the case of injury and then also the safety precautions, the normal occupation that we comply to which we climb masts and high up to the mast so if we make mistake somewhere it needs to have safety precautions in place."* [Participant 3]. ATM technicians also appear to take part in the following safety behaviours: (a) consistently communicate with management and air traffic controllers as a means of knowing exactly what the problem is before they go to a site and to get permission for any deviations from the proposed safety behaviours, (b) participate in training programs so as to always be up to date with the latest ways of fixing new equipment, (c) attend safety meetings, (d) communicate with management on how to improve safety, (e) make sure that vehicles are running properly, and (e) make sure that first aid kits are always taken to the sites.

4.3 Qualitative Results Summary

The findings of the qualitative interview show that every technician was provided with the title of engineering technician with a subtitle depending on their specialization (systems specialist, software specialist, electrical specialist). With regards to providing information for research question 1, the job resources that emerged include the following: autonomy, satisfaction and personal accomplishment with fixing faulty equipment, and working with technology. Likewise, the job demands that appeared to be the most prevalent include the weather

conditions and terrain that take place in the sites visited by the ATM technicians, shifts consisting of long travel distances, and the time pressure experienced to fix a fault. In terms of research question 2, the ATM technicians took part in the following safety behaviours: they consistently communicated with both management and air traffic controllers as a way of knowing exactly what the problem is before they went to a site, they took part in training programs as a means of keeping up to date with the latest technological knowledge, attended safety meetings, always communicated with management on how to increase safety, and made sure that a first aid kit was always available. With respect to research question 3, ATM technician's safety and performance appeared to be heavily influenced by their own personal understanding of the occupation's risks, the weather conditions that take place on each specific site, the safety equipment that is worn, the knowledge of the possible repercussions that may arise from making any mistakes, and their own individual mood or disposition.

CHAPTER 5. DISCUSSION

The aim of the present research study was to investigate the relation between job demands, job resources, and burnout in ATM technicians employed in differing geographical areas found within South Africa. More specifically, it was of interest to assess (a) whether there was a positive association between perceptions of job demands and the experience of burnout, (b) whether there was a negative relation between perceptions of job resources and the experience of burnout, (c) whether the perception of high job demands was negatively associated with safety behaviours, (d) whether the perception of high job resources was positively related with safety behaviour, and (e) whether the experience of burnout is negatively associated with safety behaviours. It was also of interest to investigate whether: (a) the perception of high job demands and low job resources predicted burnout; (b) high job demands predicted the absence of safety behaviours, (c) high job resources predicted the presence of safety behaviours, and (d) burnout predicted the absence of safety behaviours. Lastly, the present research study focused on determining ATM technicians' perspectives on the job demands and resources that may be present in their occupational environment, their participation in safety behaviours, and their perceptions regarding their work and safety performance.

Results pertaining to the relationship between job demands and the experience of burnout provide support hypothesis 1, in that job demands positively influenced the experience of burnout. The emergence of a negative relationship between job demands and burnout also provide support for the assumption put forth by the Job Demands-Resources model, which postulates that job demands are positively associated with employee burnout (Demerouti et al., 2001; Schaufeli, & Taris, 2014). This association is also in line with numerous research studies focusing on the Job Demands-Resources model of Burnout where job demands have consistently been found to obtain a weak to moderate, positive association with burnout (Bakker, van Veldhoven, & Xanthopoulou, 2010; Demerouti et al., 2001; Schaufeli, Bakker, & Van Rhenen, 2009). In agreement with hypothesis 2, a significant, negative association between job resources and the experience of burnout was obtained. Thus, providing further support for the assumption put forth by the Job Demands-Resource, which clearly states that job resources are negatively associated with the experience of burnout (Demerouti et al., 2001; Schaufeli, & Taris, 2014). These results are also in line with most of the studies that have utilised the Job Demands-Resources model of Burnout in numerous occupational settings

ranging from the academics to home organisation employees. More specifically, most of these studies have demonstrated that job resources result in a weak to moderate association with burnout or any of the facets found within burnout (Bakker, Demerouti, and Schaufeli, 2003; Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003; Xanthopoulou et al., 2007; Van den Broeck et al., 2010; Rothmann, Mostert, & Strydom, 2006; Bakker, van Veldhoven, & Xanthopoulou, 2010; Laschinger, & Finegan, 2008; Schaufeli, & Bakker, 2004).

In agreement with hypothesis 3, the results of the present study provide support for the assumption that high job demands result in burnout if the job resources are in a deficit (Schaufeli, & Bakker, 2004; Schaufeli, Bakker, & Van Rhenen, 2009; Schaufeli, & Taris, 2014). In particular, it was found that both job demands and job resources predicted the occurrence or absence of burnout. More specifically, the results of the present study depicted that the participants' experience of burnout increased as their perceptions of job resources decreased and their perceptions of job demands increased. These results also provide evidence for the notion put forth by the Job Demands-Resources Model asserting that a deficit in job resources may prohibit the accomplishment of occupational goals due to an inability to cope with high job demands (Schaufeli, & Bakker, 2004; Xanthopoulou et al., 2007). Similar results have also been obtained by Bakker et al.'s (2003) study on 830 home organisation employees and Boyd et al.'s (2011) longitudinal research study on Australian dentists. In particular, both research studies found that low job resources in conjunction with high job demands predicted the experience of job burnout.

The results of the present study provided no support for hypothesis 4. In particular, no negative relationship between participants' perceptions of job demands and safety behaviours was found. Likewise, perceptions of job demands were not significant predictors of the absence of safety behaviour. Thus, the results provide no evidence for the causal relationship between job demands and safety behaviours and hypothesis 7. These findings contradict the results obtained by Turner et al. (2010) and Nahrgang, Morgeson, and Hofmann (2011), as well as Chen and Chen (2014). For instance, the study conducted by Turner et al. (2010), which focused on the relationship between job demands, job resources, and safety outcomes in railway system employees reported that high job demands were associated with an increase in the number of hazardous events. Nahrgang, Morgeson, Hofmann (2011) found that job demands explained the most variance in both burnout and the absence of safety behaviours.

Likewise, Chen and Chen (2014) reported that cabin crewmembers where less likely to perform safety behaviours when they perceived the job demands to be high. One possible explanation for the occurrence of a non-significant association between participants' perceptions of job demands and safety behaviours could be the difference in occupations. For instance, the safety policies that are already in place for ATM technicians may differ to the policies of railway workers or cabin crewmembers. Ultimately, the safety policies that are in place for ATM technicians may result in the technicians taking part in safety behaviours despite the occurrence of high or low job demands. Another explanation may be the difference in the items/subscales used to measure job demands. For instance, Turner et al. (2010) assessed participants' role overload as a measure of job demands, while Chen and Chen (2014) assessed participants' work overload and emotional demands. Nahrgang, Morgeson, Hofmann (2011) focused primarily on an occupation's risk and hazards as a measure of job demands. On the other hand, the present study focused on participants' job insecurity, overload, shifts, weather conditions, travel, and equipment as a means of examining the job demands that may be present in the specific occupation of ATM technicians.

The present research study also obtained a low Cronbach alpha for the shifts subscale, which may have had an influence on the obtained results. However, the shifts subscale did measure three differing types of shifts, which may explain the low Cronbach alpha. Another explanation for the difference in results between the present research study and that of Turner et al. (2010) and Chen and Chen (2014) is the use of the Job Demands-Resources model to examine safety behaviours. The Job Demands-Resources model was not originally developed for the examination of safety behaviours and the research utilising the model for the assessment of such behaviours is scarce and most of the available research on this association are primarily cross-sectional., However, one solution could be to utilise a longitudinal research method where participants' safety behaviours are examined at numerous differing times. Another solution may be to incorporate certain items pertaining to an organisation's safety policies or an organisation's safety climate and investigate whether these variables moderate the relationship between job demands and safety behaviours. Further research is needed, however, before any concrete assumptions pertaining to the relationship between job demands and safety behaviours can be made.

In line with hypothesis 5, the present study obtained a significant, moderate, positive association between participants' perceptions of job resources and safety behaviours. This relationship is also in agreement with numerous studies that have examined the association between job resources and safety behaviours. For instance, Chen and Chen (2014) found that cabin crewmembers were more likely to take part in safety behaviours when they perceived the job resources to be high. Hansez and Chmiel (2010) found that job resources were both associated with and predicted the occurrence of routine violations. Likewise, Nahrgang, Morgeson and Hofmann's (2011) meta-analysis revealed that job resources were positively associated with safety behaviours across numerous work industries. Likewise, the present study also found that participants' perceptions of high job resources predicted the presence of safety behaviours, thus providing evidence for hypothesis 8. This further suggests that as a participant's perception of job resources increases so does his/her safety behaviour.

With respect to the relationship between the experience of burnout and reduced levels of safety behaviours, no evidence was found to provide support for hypothesis 6 and 9. In particular, no relation between the experience of burnout and safety behaviours emerged. Participants' experience of burnout did not predict participants' safety behaviours. The present study's results contradict Nahrgang, Morgeson and Hofmann's (2011) meta-analysis where burnout was negatively associated with safety behaviours in the workplace and emerged as a significant predictor of safety behaviours. Nevertheless, a non-significant relationship between burnout and safety behaviours might be due to the ATM technician occupation, where safety behaviours are followed regardless of the experience of burnout. Another explanation might be the possibility of a moderating effect of safety policies on the relationship between burnout and safety behaviours as was stated above for the relationship between job demands and safety behaviours. Ultimately, ATM technicians may take part in safety behaviours regardless of either the experience of burnout or high job demands primarily due to the nature of their job.

Due to the scarcity of information available pertaining to the occupation of ATM technicians, the present research study also aimed its focus on providing information with regard to the following through the use of a qualitative interview process: (a) the job demands and job resources that ATM technician perceive are present in their work environment, (b) the types of safety behaviours ATM technicians engage in as a result of their work environment, and (c) the perceptions ATM technicians have about their work and safety performance. With regards

to research question 1, it was evident that ATM technicians considered the following as helpful when accomplishing their work tasks (job resources): autonomy, satisfaction and personal accomplishment with fixing faulty equipment, and working with technology. The majority of ATM technicians obtained personal satisfaction from being able to fix any fault or maintain a piece of technology. More specifically, it was evident that most of the technicians considered their autonomy to be the most important factor that allowed them to complete their job. The job demands that emerged included the following: weather conditions and terrain, shifts consisting of long travel distances, and the time pressure experienced to fix a specific fault. It was also evident that the job demands stated by the participants also had some influence on their experience of exhaustion and stress. In particular, some of the participants stated that the time pressure that was experienced, as well as the shifts consisting of traveling long distances put a little extra pressure on their feelings of stress and exhaustion. Likewise, the experience of burnout was enhanced when ATM technicians were expected to fix multiple faults at the same time while under time pressure. The themes that emerged during the thematic content analysis with reference to burnout and job demands support the claims put forth by the Job Demands-Resources model of burnout concerning the negative influence of job demands on an individual's experience of stress and exhaustion. As can be seen, the job demands that emerged from the qualitative analyses do play some role in the experience of stress and exhaustion, despite the non-significant relationship that was obtained for this relationship during the quantitative analyses. Shifts and the experience of pressure during working hours also appeared to have some spillover effect into the participants' family life. This spillover however, was only evident when the participants were on callout or standby. Thus, the spillover effect where work life spilled over into family life was only apparent when participants were on callout duty.

With regards to research question 2, it was evident that the ATM technicians took part in the following safety behaviours: (a) they communicated with both management and air traffic controllers as a means of knowing exactly what the problem is before they travelled to any given site, (b) they took part in numerous training programs that focused on providing them with the most relevant and up-to-date technological knowledge, (c) attended safety meetings, (d) communicated with management on how to possibly increase safety, and (e) made sure that a first aid kit was always available when traveling to a specific site. With regards to research question 3, it was apparent that ATM technicians' safety and performance was

influenced by the following: (a) their own personal understanding of their vocation's risks, (b) the weather conditions that may take place on a specific site, (c) the safety equipment that is provided by management and must be worn at all times, (d) the knowledge and understanding of the possible repercussions that may arise from making any mistakes when fixing a fault, and (e) their own individual mood or disposition. As can be deduced from the information used to answer research question 2 and 3, it is evident that the safety climate that has been established by the organisation employing the ATM technicians promotes safety as the number one priority. This promotion of safety may provide some understanding as to why the technicians' job demands did not negatively influence safety behaviour. Ultimately, safety climate or safety policies may buffer the effect of high job demands on safety behaviours. On the other hand, one explanation for the participants' strong adherence to safety codes and regulations might be due to a social desirability bias or the tendency of the participants to answer both the questionnaire items and interview questions in a manner that may be viewed favourably by others. Thus, the strong adherence to safety regulations as mentioned by the participants may be a form of over-reporting good safety behaviours and under-reporting negative safety behaviours. Another explanation may be that the participants were reluctant to report any negative safety behaviours for fear of experiencing possible adverse outcomes from the organisation. More research is needed, however, before any concrete conclusions can be made.

These findings provide an important insight on the occupation of ATM technicians primarily because of the scarcity of research that is available focusing on technicians found either within the aviation or ATM sector. As is evident to the researcher's knowledge, the present study is the first of its kind with regards to providing some insight on the specific profession of an ATM technician in the South African context through the use of both quantitative and qualitative research methods. As is apparent from the interview process, ATM technicians take part in a wide range of safety behaviours regardless of the job demands or resources that may be present. As was apparent in the majority of interviewees, numerous rules and regulations guide the safety behaviour of the ATM technicians at all times. For instance, the policy of having two technicians on a site rather than one at any given time provided the ATM technicians with another individual to assist with carrying equipment, having some form of assistance when configurations must be remembered, having another individual there to call for assistance in case of any accidents, and provide further knowledge or insight if one of the

technicians was not capable of tackling a specific issue or problem. While having another individual on site was not regarded as having any influence on performance, it is evident through the interview process that such a policy could have an influence on both an ATM technician's overall safety and his/her ability to fix a given fault.

With regards to the applicability of Reason's (2000) Swiss cheese model of human error in the present research study, it is appropriate to state that the model of human error may provide a more holistic viewpoint on both safety and human error. Both the Job Demands-Resources model of burnout and Reason's (2000) Swiss cheese model are distinctly dissimilar models focusing on different types of human behaviour. Nevertheless, the Job Demands-Resources model of burnout was not specifically made for the investigation of safety behaviours. Thus, the Swiss cheese model may be used to explain the emergence of the safety themes that emerged in the present study. In particular, the organisation employing the participants of the present study appeared to be promoting a positive safety climate through the use of safety policies, training programmed focused on safety, and safety meetings (Reason, 2000). This type of climate may have had an influence on the non-significant relationship between job demands and safety behaviours. Nonetheless, no assumption found within the Job Demands Resourced model can account for this non-significant relationship. The Swiss cheese model, however, postulates that human error is the result of various holes in the defensive layers of high technology systems that warrant the opportunity for errors or accidents. These holes in the defensive layers emerge for two reasons including: active failures and latent conditions (Reason, 2000). Active failures are unsafe behaviours that are carried out by individuals who interact with a particular system. In the present study the ATM technicians did not partake in any unsafe acts and the organisation itself put heavy emphasis on safety (Reason, 2000). Latent conditions are resident pathogens that emerge from the decisions made by top-level managers or system designers. There appeared to be no such conditions and top-level managers appear to put great care into promoting safety (Reason, 2000). Likewise, as stated in the Swiss cheese model, latent conditions can promote errors when the following are present: time pressure, insufficient equipment, and understaffing. Nevertheless, only time pressure emerged as a job demand. The absence of a significant influence of job demands on safety, however, may be due to the existence of a safety climate that promotes safety behaviours. More research is needed to test the assumption that safety climate buffers the influence of job demands on safety behaviours (Reason, 2000).

5.1 Limitations

The present research study had several limitations that must be taken into account. Firstly, the sample for the quantitative component was predominantly made up on male individuals (90.1%). However, one key reason for the low number of female participants in the present study is because of the low number of female ATM technicians, in general. At the time of the data collection, the ANSP only employed 4 female ATM technicians. While it is apparent that the ATM technician occupation is male dominated, the absence of a more proportionate sample does pose some threats with regards to the generalisability of the sample.

Another issue that emerges is the employment of a non-probability convenience sample, which may result in sampling bias. Likewise, the use of a convenience sampling method has been looked upon by research as providing a sample that may not be representative of the population under question. This may also result in a higher chance of having low external validity, as well as low population validity. Concerns with reference to the present research study's internal validity include the following: (a) the lack of a control and experimental group and (b) the non-randomisation of participants into differing groups. Lastly, a limitation that may have had an influence on the present study's results is the relatively low Cronbach alpha that was obtained for the following sub-scales: shifts, equipment, advancement, safety compliance, and cynicism. The shifts subscale measured three differing types of shifts, which might explain the low Cronbach alpha. The length of a scale or sub-scale also influences Cronbach alpha. Ultimately, this may explain the low Cronbach alphas that were obtained for the rest of the subscales, which consisted of a maximum of 5 items.

5.2 Recommendations for Future Research

Future studies should make use of a longitudinal research design as a means of examining participants' safety behaviours at varying time points. The use of a longitudinal research design may provide some insight into whether the relationship between job demands and safety behaviours differs in any manner during varying time periods. Researchers should also assess whether safety policies and safety climate moderate the relationship between job demands and safety behaviours. Future research could possibly focus on employing a pilot study to examine the questionnaire sub-scales used in the present study as a means of

improving both the internal consistency and validity of the subscales. While the present study obtained some low internal consistency measures for some of the sub-scales used, it was of more importance for the researcher to grasp the full depth of the constructs used by utilising more diverse questionnaire items, as opposed to creating sub-scales that obtained a higher internal consistency by including highly similar items. Lastly, future research should utilise the job demands and resources that emerged during the qualitative interview process and possibly develop a questionnaire encompassing the following as variables: (a) autonomy, (b) satisfaction and personal accomplishment with fixing faulty equipment, (c) working with technology, and (d) time pressure.

5.3 Conclusions

The present study provides support for the assumptions put forth by the Job Demands-Resources Model of burnout, as well as for the ability of job resources to predict the occurrence of safety behaviours in ATM technicians. While no direct relation between job demands and safety behaviours was obtained, results attained from the interview process suggest that the safety policies or an organisation's safety climate may have an influence on the ATM technician's safety behaviours. Nonetheless, given the importance of the occupation of ATM technicians with relation to the overall smooth operation and safety of aviation, air traffic control, and ATM the present study has shed some light on the ways through which similar organisations found within the ATM sector can enhance or increase their employees' safety behaviours, in general.

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PSYCHOLOGY
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Appendix A-Access Letter Requesting Permission to Conduct Research

To Organisational Manager

Dear ….

I am a Master's student in the Department of Psychology at the University of Witwatersrand and my supervisor is Professor Fiona Donald. I would like to request permission to invite technicians in your organisation to participate in my research. At the Second African Safety and Human Factors in Aviation Symposium last year, an interesting presentation was given on the challenges faced by maintenance technicians in air traffic and navigation system management. This prompted my interest in the special demands faced by maintenance technicians and how these relate to safety and burnout on the job. In addition to these aspects, my study includes questions about the positive aspects of the job and working environment.

If you grant consent for me to conduct research at your organisation, I am hoping that about 20 to 30 technicians will agree to complete an online questionnaire that will take about 15 minutes. In addition, I am hoping that about 5 technicians would be willing to participate in a telephonic or Skype interview (10 to 30 minutes). Participation would be voluntary, confidential, and would be arranged at times that suit participants. The name of your company and specific details (e.g., airport names) will not be mentioned in any reports. I have attached a copy of the questionnaire for your information.

If you grant consent, please could you let me know whom to contact regarding the way forward. Your permission to conduct this research study will be highly appreciated and hopefully the study will add value to your organisation.

Yours sincerely,

Eleni Anna Kalaitzis

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PSYCHOLOGY
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Appendix B-Participant information Sheet

Participant Form:

Good Day,

My name is Eleni Anna Kalaitzis and I am an Organisational Psychology Masters student in the University of the Witwatersrand. As part of my degree I am required to do a research project. My research aims to identify the challenges that technicians in air traffic and navigation services face, and to see how these relate to safety behaviours and fatigue. Technicians in this industry play an essential role in aviation safety but have been neglected in academic research. The supervisor for this study is Professor Fiona Donald. I would like to invite you to participate in this study.

If you agree to participate, you will need to complete an online questionnaire, which will take about 15 minutes. There are no right or wrong answers - I am interested in your views. You can complete the questionnaire at a time that suits you. In addition to completing the questionnaire, I would appreciate it if you could participate in a short interview that will help me to understand your job and work environment. The interview would be conducted telephonically or on Skype at a time that suits you, and would take about 20 minutes. However, if you are only available to complete the questionnaire, that would still make a significant contribution to the study. Submission of the questionnaire will be considered as consent to participate. If you also agree to be interviewed, you will be asked to give consent for this and for an audio-recording of the interview at the end of the questionnaire.

Your personal information and responses to both the questionnaire and interview will be kept confidential. In the questionnaire I have asked for your name and contact details in the event that you agree to be interviewed. However, these details will be deleted once I have finished

collecting data for the study. Information about individual participants (e.g., your name or place of work) and the name of your organisation will NOT be included in any reports All information will be confidential and only my supervisor and myself will have access to the original data. There are no advantages or disadvantages to you participating in this study, but the study could add value to your company. Your participation in the study is voluntary and you may withdraw at any point until you submit the questionnaire or complete the interview.

If you wish participate, please click on this link: >>>>>>.

Thank you for reading this. Please feel free to contact me if you have any queries.

Yours sincerely

Eleni Anna Kalaitzis
Industrial/Organisational Master's student
Email address: eleniannakalaitzi@gmail.com

Professor Fiona Donald
Research supervisor

Appendix C- Interview Consent Form

Good Day,
I would like to request your consent for the interview process.
All the information obtained from the interview process will remain confidential and your identity will not be revealed in any reports.
Your participation in this interview process is voluntary and you may abstain from answering any question at any point during the interview.
The information obtained from the interview process will not be used to identify any participant in the written research report.
If direct quotes are utilised in the written research report they will be allocated pseudo names, such as participant A or B.
Thank you for your consent to take part in the interview process.

Consent to be interviewed

I would like to take part in the interview process. I understand that the purpose of the study is to focus on the work context of technicians in Air Traffic Management.

Yes	**No**

* Please fill out the information concerning your preferred method for the interview process:

Skype	**Telephone**

I, _____(name) hereby give permission for the recording of the interview for the study entitled "Job Demands, Job Resources, Safety, and Burnout in Air Traffic Management Technicians" conducted by Eleni Anna Kalaitzis. I understand that the all the information obtained from the interview process will remain confidential and my identity will not be revealed in any written research reports.

Signature: _____
Date: _____

Appendix D- Interview Recording Consent Form

Permission for Interview Recording:

Good Day,

I would like to request your consent to record the interviews. The reason for recording the interviews is so that they can be transcribed accurately at a later stage.
All the information obtained from the interview process will remain confidential and your identity will not be revealed in any reports.
Thank you for your permission to record the interview process.

Eleni Anna Kalaitzis

I, _____(name) hereby give permission for the recording of the interview for the study entitled "Job Demands, Job Resources, Safety Behaviours, and Burnout in Air Traffic Management Technicians" conducted by Eleni Anna Kalaitzis. I understand that the reason for recording the interviews is so that they can be transcribed accurately at a later stage. All the information obtained from the interview process will remain confidential and my identity will not be revealed in any reports.

Signature: _____

Date: _____

Appendix E- Job Demands-Resources Scale

In the survey that follows, please answer the questions as honestly as possible, keeping in mind your job. It will take about 15 minutes to complete the questionnaire. Your participation in the survey is confidential. Your name will not appear in any reports.

INSTRUCTIONS: Please select the answer that best suits you as an individual. Please choose ONLY ONE answer for each question. The initial questions are for statistical purposes only:

1. **How old are you??**

   _____

2. **What is your gender?**

Male	Female

3. **Please specify your ethnicity.**

African	Coloured	Indian	White	Other

4. **Please specify your education level.**

Primary School	High School	Diploma	Bachelor's Degree	Master's Degree	Doctoral Degree

5. **How long have you been working as a technician in this industry?**

0-11 months	1- 5 years	6-10 years	11-15 years	16+ years

Organisational Support

6. **Can you count on your colleagues when you come across struggles at work?**

Never	Rarely	Often	Always

7. **If required, could you ask your colleagues for assistance?**

Never	Rarely	Often	Always

8. Do you get along with your colleagues?

Never	Rarely	Often	Always

9. Can you rely on your superiors when you come across challenges in your work?

Never	Rarely	Often	Always

10. Do you get along with your manager?

Never	Rarely	Often	Always

11. In your line of work, do you feel valued by your manager?

Never	Rarely	Often	Always

12. Do you know precisely what others expect of you in your line of work?

Never	Rarely	Often	Always

13. Do you know precisely what you are responsible for?

Never	Rarely	Often	Always

14. Do you know precisely what your direct manager thinks of your performance?

Never	Rarely	Often	Always

15. Do you receive the necessary information on the objective of your work?

Never	Rarely	Often	Always

16. Do you receive the needed information on the outcomes of your work?

Never	Rarely	Often	Always

17. Does your direct manager inform you about critical issues within your department/organisation?

Never	Rarely	Often	Always

18. Are you kept sufficiently informed about critical issues within your organisation?

Never	Rarely	Often	Always

19. Is the decision-making procedure of your organisation coherent and understandable?

Never	Rarely	Often	Always

20. Is it clear to you with whom you should speak to within the organisation for particular problems?

Never	Rarely	Often	Always

21. Can you discuss work obstacles with your direct manager?

Never	Rarely	Often	Always

22. Can you count on your colleagues when you come across struggles at work?

Never	Rarely	Often	Always

Growth Opportunities

23. Do you have enough variation in your line of work?

Never	Rarely	Often	Always

24. Does your job offer you prospects for personal progress and development?

Never	Rarely	Often	Always

25. Does your work give you the impression that you can accomplish something?

Never	Rarely	Often	Always

26. Does your job offer you the opportunity to take part in independent thoughts and actions?

Never	Rarely	Often	Always

27. Do you have autonomy in carrying out your work duties and activities?

Never	Rarely	Often	Always

28. Do you have influence in the preparation of your work activities?

Never	Rarely	Often	Always

29. Can you partake in making the decision about when a particular duty must be completed?

Never	Rarely	Often	Always

Advancement.

30. Can you live comfortably on your salary?

Never	Rarely	Often	Always

31. Do you think you are paid adequately for the work duties that you do?

Never	Rarely	Often	Always

32. Does your job offer you the prospect of financial growth?

Never	Rarely	Often	Always

33. Does your organisation provide you with opportunities to participate in training courses?

Never	Rarely	Often	Always

34. Does your work give you the opportunity to be promoted?

Never	Rarely	Often	Always

Overload

35. Do you have too many work duties to accomplish?

Never	Rarely	Often	Always

36. Do you have to work to tight deadlines?

Never	Rarely	Often	Always

37. Do you have to pay attention to many different things at the same time?

Never	Rarely	Often	Always

38. Do you have to concentrate for long periods of time on your work?

Never	Rarely	Often	Always

39. Do you have to remember a large number of things in your work?

Never	Rarely	Often	Always

40. Are you confronted in your job with situations that influence you personally?

Never	Rarely	Often	Always

41. Do you have contact with challenging individuals in your line of work?

Never	Rarely	Often	Always

42. Does your line of work put you in emotionally distressing situations?

Never	Rarely	Often	Always

Job Security

43. Do you need to feel more secure in your job?

Never	Rarely	Often	Always

44. Do you need more security about being in the same job next year?

Never	Rarely	Often	Always

Shifts

45. Are the times you start and finish work flexible?

Never	Rarely	Often	Always

46. Do your shifts sometimes change from daytime to evening or nighttime shifts (rotating shifts)?

Never	Rarely	Often	Always

47. Do your shift cycles allow you enough time to recover from days that are challenging?

Never	Rarely	Often	Always

Weather Conditions

48. Do you have to complete work tasks outside during rain or thunderstorms?

Never	Rarely	Often	Always

49. Do you have to complete work tasks outside during heavy winds?

Never	Rarely	Often	Always

50. Do you have to complete work tasks outside during very hot or cold weather conditions?

Never	Rarely	Often	Always

51. In your perception, do weather conditions hinder your ability to accomplish your work tasks or goals?

Never	Rarely	Often	Always

Travel

52. Do you have to travel long distances to complete your work tasks?

Never	Rarely	Often	Always

53. Do you have to use any dirt roads that are rough?

Never	Rarely	Often	Always

54. Do you have to travel in areas that you would consider dangerous?

Never	Rarely	Often	Always

55. Do you have to travel for work when visibility is poor?

Never	Rarely	Often	Always

Equipment

56. Does the completion of work tasks require the use of heavy equipment?

Never	Rarely	Often	Always

57. Do you have to work with any hazardous or dangerous equipment?

Never	Rarely	Often	Always

58. Do you have to work with complicated equipment?

Never	Rarely	Often	Always

59. Are the necessary tools and equipment available for the completion of work tasks?

Never	Rarely	Often	Always

60. Do you struggle to access the equipment needed to do your job?

Never	Rarely	Often	Always

Appendix F- Safety Behaviours Questionnaire

The following section of the questionnaire focuses mainly on safety behaviours that take place in the workplace.

Please answer the following questions with as much honesty as possible.

Safety compliance (in-role safety behaviour)

1. **I use all the required safety equipment to do my job.**

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

2. **I use the appropriate safety procedures for carrying out my job.**

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

3. **I follow the highest levels of safety when I carry out my job**

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

Safety participation (extra-role safety behaviour)

4. **I follow my organisation's safety program.**

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

5. **I put in extra effort to improve my workplace safety.**

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

6. I voluntarily carry out tasks that may help improve the safety of my colleagues and me.

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

Upward Safety Communication

7. I feel comfortable discussing safety behaviour with my managers.

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

8. I personally believe that my managers openly receive ideas for improving safety.

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

9. I am hesitant to discuss safety-related problems with my managers.

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

10. I feel that my managers encourage open communication about safety.

Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree

Appendix G- Work-Family Spillover Questionnaire

1. **My job interferes with life outside of work.**

Never	Rarely	Often	Always

2. **My job interferes with my leisure time.**

Never	Rarely	Often	Always

3. **My job interferes with time off work.**

Never	Rarely	Often	Always

Appendix H-Burnout Questionnaire

The following survey focuses on your personal feelings at the end of your working day. Please answer the following questions with as much honesty as possible, while keeping your work in mind.

Questions	Never	A few times per year	Once a month	A few times per month	Once a week	A few times per week	Every day
1. I feel emotionally tired from my work							
2. I feel tired at the end of the workday							
3. I feel worn-out when I get up in the morning and have to face another workday							
4. Working all day is really straining for me							
5. I feel burned out from my work							
6. I have become less interested in my line of work since I started this job							
7. I have become less eager about my line of work							
8. I just want to do my job and not be disturbed							
9. I have become more cynical about whether my work contributes anything							
10. I doubt the importance of my work							
11. I can efficiently solve the problems that arise in my work							
12. I feel I am making a valuable contribution to what this organisation does							
13. In my opinion, I am good at my job							
14. I feel elated when I accomplish something at work							
15. I have achieved many important things in this job							
16. At my work, I feel confident that I am successful at getting things done							

Appendix I-Interview Guide

The following interview will briefly focus on your personal experiences and perceptions regarding your work environment, the demands that you may face in your job, the resources that assist you to do your job, how you personally feel at the end of your working day, safety behaviours during your work, and your personal perceptions regarding work performance. The interview will take about 10 to 30 minutes.

Please answer with as much honesty as possible and feel free to use as much time to answer each question.
Thank you in advance for taking part in this interview process

Job Description and Work Environment

- Please can you tell me briefly what a typical day at work involves?
- **Probes**: How would you describe your job? What does your job entail?
- How does your work differ from that of technicians in other settings/industries?
- **Probes:** What differences do you think your job has compared with other technicians' jobs in other settings?

Job Resources

- What do you enjoy about your job?
- **Probes**: What helps you to perform your job?

Job Demands

- What challenges do you face at work?
- Please could you tell me about a day that was particularly challenging?
- **Probes**: What features of your job do you consider as challenging? What obstacles do you face in your job?

Burnout

- What helps you to deal with these challenges?
- How do you feel at the end of a demanding day?
- **Probes**: How do you feel at the end of a workday where you were faced with challenges?

Safety

- How would you describe your job in terms of safety?
- **Probes:** How would you explain your line of work when it comes to safety?
- Could you please describe a day where safety has been an issue and explain how you overcame the upcoming safety issues?

Performance

- In your opinion what influences your performance on both challenging and typical days?
- **Probes**: How would you define your performance on the job on challenging days? In what manner is this performance different from a typical day?

Appendix J-Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: MORG/16/009 IH**
PROJECT TITLE:	Job demands, job resources, safety behaviours, and burnout in air traffic management technicians.
INVESTIGATORS	Kalaitzis Eleni
DEPARTMENT	Psychology
DATE CONSIDERED	29/06/16
DECISION OF COMMITTEE*	Approved

This ethical clearance is valid for 2 years and may be renewed upon application

DATE: 29 June 2016

CHAIRPERSON
(Professor B. Bowman)

cc Supervisor: Prof. Fiona Donald
Psychology

DECLARATION OF INVESTIGATOR (S)

To be completed in duplicate and **one copy** returned to the Secretary, Room 100015, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure, as approved, I/we undertake to submit a revised protocol to the Committee.

This ethical clearance will expire on 31 December 2018

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES