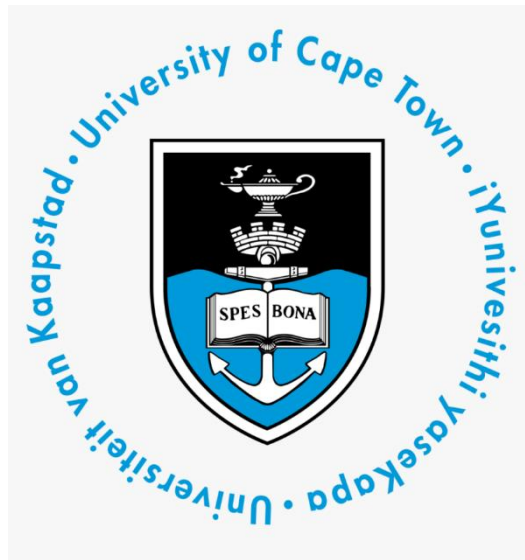




Mindfulness and Job Performance: How is mindfulness perceived to affect job performance, employee well-being, and organisational performance in the engineering sector in South Africa?

Master's of Philosophy in Engineering Management

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Abstract

Engineering practice can be demanding and challenging. Recent reports from around the world suggest that there is a global mental health crisis and that many engineers struggle with their well-being, productivity, and job performance, which has the potential to undermine the productivity of engineering organisations. It is important to ensure that engineering employees and organisations deliver high levels of performance to ensure that engineers can continue to contribute value to society. This research study aims to understand mental health in the South African engineering sector, while gaining insights into common sources of stress in the industry, perceptions of mindfulness, and investigating how performance can be enhanced. The research questions for this study aim to investigate how mindfulness could be used to enhance employee well-being, mental health, and individual and organisational performance. The data for this study were collected using a mixed methods approach. Qualitative data were collected through structured interviews and analysed using content analysis, and quantitative data were collected through a survey instrument, and analysed using descriptive statistics and regression analysis. Findings revealed that the South African engineering sector was perceived to be highly productive, but also a high stress environment, characterised by tight deadlines and high workloads. Participants suggested that successful engineers should demonstrate effective time management, attention to detail, and ability to learn. Participants perceived mindfulness to be an effective tool for improving the abovementioned traits, as well as productivity, emotional intelligence, focus, teamwork, communication, stress management, resistance to fatigue and burnout, physiological and mental health, quality of work, awareness, and balance to life. Through an improvement in these characteristics and traits, it was proposed that mindfulness could lead to improved employee well-being, individual job performance, and organisational performance. These findings indicate that mindfulness-based interventions could be introduced in engineering organisations and universities to enhance employee well-being, mental health, and individual and organisational job performance. This would allow engineering employees and organisations to continue to contribute value to society and offer solutions to increasingly complex problems.

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List of Abbreviations

BSc	Bachelor of Science
CLD	Causal Loop Diagram
COVID-19	Coronavirus Disease of 2019
FAI	Fatigue Inventory Assessment
FMI	Freiburg Mindfulness Inventory
MAAS	Mindfulness Attention Awareness Scale
MBSR	Mindfulness-Based Stress Reduction
MRI	Magnetic Resonance Imaging
MS	Microsoft
MSc	Master of Science
SA	South Africa
UK	United Kingdom

Glossary

Attention	The act of directing one's awareness and focus towards something – either internal or external.
Awareness	The state of being conscious of passing phenomena and stimuli, both internal and external.
Burnout	A syndrome that results from chronic workplace stress that has not been successfully managed.
Collective Mental Health	The generalised mental state shared by a large proportion of the members of a group, organisation, or population.
Constructionism	A philosophical theory which posits that individuals or learners do not acquire knowledge and understanding by passively perceiving it within a direct process of knowledge transmission. Rather, they construct new understandings and knowledge through experience and social discourse.
Equanimity	A state of psychological stability and composure that remains undisturbed by any internal or external experience, pleasant or unpleasant.
Fatigue	A state in which individuals experience extreme tiredness and exhaustion, often resulting from mental or physical exertion, illness, or lack of sleep.
Internal Phenomena/Experience	Highly personal and subjective mental or emotional experiences that are constructed within an individual's mind.
Interpretivism	A philosophical system that holds the belief that reality is subjective, socially constructed, and a composite of multiple perspectives.
Instrument	A means through which to collect data. In this research study, the term refers to a self-report survey that was completed by respondents.
Job Performance	The extent to which an individual performs their job successfully and effectively in the eyes of their supervisor/manager.
Mindfulness	An awareness that emerges through paying attention on purpose, in the present moment, and practicing non-judgment of the experience throughout each moment.
Organisation	An entity comprising one or more people that have a particular purpose (for example, a company, institution, government department, or association).
Organisational Productivity	The capacity of an organisation to produce desired results with a minimum expenditure of resources such as time, money, and human resources.
Personal Mental Health	An individual's condition encompassing their emotional, psychological, and social well-being.
Positivism	A philosophical system that recognises only that which can be scientifically verified, or the philosophical belief that there is a single, objective reality.
Presence	The state of being aware, focused, and absorbed in the present moment, observing internal and external experiences and phenomena as they unfold

	naturally, in a non-judgmental, calm manner.
Productivity	The capacity of an individual to produce results in an efficient manner, while minimising the time, energy, and other resources spent on the task.
Stress	The state of mental or emotional strain or tension resulting from adverse or demanding events unfolding.
Transience	The attribute of being brief or fleeting, the knowingness that everything is temporary and will pass eventually.

1. Introduction

1.1. Background to the Research

Given the challenges faced by individuals, organisations, and society, there have been growing calls to improve occupational mental health around the world. Reports have been emerging which claim that many professions, particularly engineering, are currently suffering from widespread mental health crises (e.g. Flaig (2020), McCabe (2019), Lang (2019)). Given the adverse effects that mental health problems can cause, the possibility of a mental health crisis is a cause for concern for engineering employees and organisations alike. The engineering sector is also challenged with developing innovative and creative solutions in response to the complex problems that present themselves through rapid advancements in technology, developing societies, and new challenges that present themselves as natural resources begin to dwindle. This ever-changing, dynamic, and challenging workplace environment creates sets of problems that require insight, innovation, creativity, and divergent thinking (Rieken et al., 2019) to develop coherent solutions to ‘ill-structured’ problems, and to keep up with the rapid advancement of the industry. In order to contribute towards exploring appropriate solutions and ways of engaging with complex problems, high levels of cognitive functioning, focus, and mental alertness are required by engineering professionals.

To maintain the levels of job performance that are required for engineering practice, higher-level mental functioning and attentional focus would be beneficial to both employees and organisations. Achieving states of mental well-being can be challenging in the engineering profession, since workloads are often high, and it is reported that the chances of engineers encountering fatigue (Hulsheger et al., 2018), high stress levels, burnout, turnover intention (Dane and Brummel, 2014), and emotional exhaustion (Hülshager et al., 2013) are significantly higher when compared to other professions. Considering the high rates of mental ill-health within engineering industries around the world, it is proposed that more concerted efforts should be directed towards improving the mental health, employee well-being, and stress management practices amongst engineers. Should engineers encounter any of these detrimental mental states, their job performance is likely to be adversely affected. This could be due to lower productivity, a decline in work quality, poorer time management, higher stress, and intensified feelings of fatigue and burnout. This, in turn, has the potential to adversely impact entire organisations when the job performance of multiple employees is affected negatively. If the mental health crisis across the engineering sector is as widely spread as some sources suggest (e.g. Flaig (2020), McCabe (2019), Lang (2019)), then there is the possibility that the entire engineering sector may be struggling in terms of innovation, creativity, productivity, task output, individual job performance, and organisational performance.

The mental health and well-being of employees are important for productivity and job performance. Existing research has shown that the practice of mindfulness holds potential benefits in improving individual and organisational job performance, employee mental health and well-being, mental health, stress management, and quality of life (e.g. Bajaba et al. (2018), Dane and Brummel (2014), Good et al. (2016), Hülshager et al. (2013), Hulsheger et al. (2018), Kersemaekers et al. (2018)). The mental health, well-being, and job performance of multiple individual employees is likely to contribute to organisational performance and productivity – assuming external factors (such as economic, political, and competitive factors) remained constant. An improvement in mental health, well-being, and job performance amongst many individual employees could have the potential to reinforce the organisation’s position within the industry, which could lead to an enhanced reputation, improved financials, and better company culture, while giving them a competitive edge in the industry. Again, this is assuming external factors remain unchanged,

when in reality, this is often not the case. When engineering organisations within an industry collectively operate more productively and efficiently, the entire industry has the potential to be uplifted and improved, as the high-performing, more productive organisations set a competitive example for other organisations to follow suit, as the global competition pushes other organisations to follow suit. In the process, new standards and expectations can be set for what the modern-day engineering workplace should look like. As a country's engineering industry is improved, they may find themselves at the forefront of technological advancement through contributions to the global evolution of technology, and the development of solutions to increasingly complex societal problems that arise. In this way, addressing the mental health crisis in the engineering sector through the implementation of mindfulness practice could potentially bring about positive change in several areas.

Mindfulness is a practice that has been used for millennia, with its roots being traced back to ancient Buddhist psychology (Brown et al., 2007). In more recent years, scholarly research in the field of mindfulness has significantly increased, as it becomes more evident with current research that mindfulness has the potential to offer numerous benefits to regular practitioners (e.g. Bajaba et al. (2018), Dane and Brummel (2014), Good et al. (2016), Hulsheger et al. (2013), Hulsheger et al. (2018), Kersemaekers et al. (2018)). Developments in magnetic resonance imaging (MRI) has further contributed to scholarly interest in mindfulness. Through medical imaging techniques, objective data has been obtained by researchers in the neuroscience fields which shows that mindfulness can lead to beneficial changes both physically and physiologically in the structure and the size of the brain. This has helped researchers explain more clearly how mindfulness can lead to a wide range of benefits in practitioners (Cacioppe, 2017). While there is still limited research into mindfulness in the context of the engineering workplace, sufficient research has been conducted into mindfulness in the fields of cognitive performance (Good et al., 2016), psychology (Shapiro et al., 2006), organisational science (Hulsheger et al., 2018), neuroscience (Davidson, 1998), and education (Rieken et al., 2019), such that the theory was transferable to the context of this research study.

The general aim of this study was to understand the current mental health situation more clearly and identify notable sources of stress within the engineering sector in South Africa. Additionally, the perceptions of mindfulness amongst South African engineers were also explored, which assisted in answering the research questions that pertained to mindfulness and: individual job performance, mental health and well-being, and organisational performance. Ultimately, the data collection and data analysis allowed for a systems model to be developed for each of the three research questions, which aimed to paint a clear picture as to how mindfulness could potentially affect individual job performance, mental health and well-being, and organisational performance.

1.2. Value of the Research

Existing research has shown that through the implementation of mindfulness practice in an organisational context, numerous benefits could be experienced by practitioners on both an individual and organisational level. Mindfulness has been shown to hold value for individuals and organisations to help respond to a challenging and changing workplace environment (Ray et al., 2011), such as the dynamic working environment that is frequently encountered by engineering professionals. Reb and Choi (2014) found that mindfulness provided benefits to organisations which included improved learning, increased job satisfaction, and reduced employee turnover and absenteeism. If significant improvements could be implemented across multiple organisations, then the entire engineering industry could be more productive, innovative, and effective at finding solutions to complex problems. Given the position that engineers hold

in terms of contributing value to society, the optimisation of engineering organisations could potentially benefit society as a whole.

Despite growing concerns over the well-being and mental health of engineering employees, limited research into this particular field has been conducted. This research study therefore aims to research and understand the mental health crisis within the engineering sector (specifically in South Africa) more clearly. Through drawing attention to this topic through this research study, there is the hope that more researchers engage in the scholarly and practical conversation surrounding mental health in the engineering sector. As new data concerning the reported mental health crisis emerge, and ways of managing and improving the mental health situation are empirically tested, effective changes may start to be implemented.

Lastly, this research study aims to investigate the possible effects that mindfulness practice could potentially have on individual job performance, organisational performance, mental health, and well-being. Through studying the effects of mindfulness on engineering employees' well-being and job performance, as well as organisational performance, emergent data can be used to predict the success and feasibility (or lack thereof) of implementing a mindfulness-based intervention at engineering organisations in South Africa.

1.3. Research Aims and Questions

The overall aims of the research study are:

- To gain insight into the mental health situation amongst engineering practitioners in South Africa,
- To investigate the perceptions of mindfulness among engineers working in the engineering sector in South Africa,
- To understand which stressors contribute to stress and mental health problems in the engineering sector in South Africa.

These aims will be realised through answering the following questions:

1. How is mindfulness perceived to affect job performance in the engineering sector in South Africa?
2. How can mindfulness contribute to mental health and well-being amongst employees in the engineering sector?
3. How can mindfulness affect organisations in the engineering sector in South Africa?

Existing peer-reviewed literature was used to understand the effects of mindfulness on mental health, employee well-being, job performance, and organisational performance, as well as to learn about the previous empirical studies that had been conducted in the field of mindfulness-based interventions. Existing literature, including articles, conference papers, dissertations/theses, and journal entries, were used to gain a coherent, well-rounded understanding of mindfulness in the context of this research study. Existing data were also used to critically compare results from this research study to what had already been researched. Additionally, a survey instrument was distributed, and structured interviews were conducted using engineering employees and engineering management personnel as subjects, to gain a deeper understanding of the current issues that engineering professionals are having to deal with, as well as to gain insight into the levels of mindfulness, mental health, stressors, and job performance characteristics that they perceived to be of importance.

1.4. Scope and Limitations

This research study aims to develop an understanding of the current mental health situation among professionals working in the South African engineering sector, while investigating the perceptions of mindfulness, and how it could be used as a means to improve mental health and overall job performance as an engineering professional, as well as organisational performance. The research study focuses on the role that mindfulness plays in enhancing mental health, well-being, and job performance as an engineer, as well as organisational performance. Through the improvement of organisational mindfulness, it is proposed that organisations are likely to experience numerous benefits that may build upon their position in their industry.

This study covers the topics of mental health in the engineering organisation context, mindfulness, organisational mindfulness, engineering job performance, and employee well-being. Within the mental health category, the indicators investigated in greater detail are personal mental health, collective mental health, stress, and fatigue. The research does not focus on mental illness and its effects on job performance, but rather general mental health. The mindfulness category involved eliciting data from participants about their personal mindfulness and their perceptions of mindfulness. A definition and conceptualisation of mindfulness was included, and a working model for mindfulness in the context of this research study was developed. Additionally, the salutary effects of mindfulness in the contexts of mental health, well-being, job performance, and organisational performance were investigated. Participants were questioned about what defined successful job performance as an engineer, and productivity was investigated in greater detail and used as a focal topic to indicate job performance. Turnover intention was used as an indicator to predict job satisfaction and employee well-being, and information was elicited from participants surrounding employee well-being, company culture, and company support offered to employees.

The research study was limited to engineering professionals living and working in South Africa and did not include any research participants residing in any other countries. Most of the participants involved in the interviews were based in Cape Town, South Africa. The virtual nature of the data collection allowed for instrument responses to be collected from individuals throughout the country.

The subject matter for this research study was professionals working in the engineering sector in South Africa. This includes all employees within the engineering sector and was not strictly limited to individuals who were qualified as engineers. Other professionals, such as technicians and technologists, were also perceived to contribute valuable insights into the engineering sector and the current challenges it faces. The study does not include individuals working in any other sectors.

The research study was to be completed between February 2021 and November 2022. The literature review was updated throughout the duration of the research study as new literature was uncovered. A pilot study conducted between September 2021 and November 2021 allowed for testing of the methodology, data collection methods, and data analysis methods. The methodology was completed by March 2022, and the data collection for the formal research study was conducted between February 2022 and April 2022. Data analysis began in April 2022 and was completed by May 2022. Following the data analysis, findings of the research study were reported between June 2022 and August 2022, after which a discussion was completed where findings were critically compared to existing literature, and Causal Loop Diagrams were constructed to gain systems models of the data that were presented. Data

collection timeframes were restricted by public holidays and participants taking leave, specifically over the festive season.

This research study was centred around a constructionist-based research paradigm, given the interpretive, personal nature of the research being conducted. A mixed-methods approach consisting of both qualitative and quantitative methods was utilised to collect and analyse the data. The qualitative aspect of this research study was comprised of structured interviews conducted using a case study approach, with the aim of eliciting rich qualitative data from participants. Content analysis was used to analyse the data and develop the findings. The quantitative aspect of this research study comprised of a 40-item instrument for data collection, which acted as a self-report measure for participants to rate their mindfulness, stress, fatigue, productivity, and job satisfaction. Statistical regression analysis and descriptive statistics were used to conduct the quantitative data analysis. Linear regression analysis was used to establish relationships could be established between the latent variables included in the instrument.

The most significant limitation to the research study was the sample size when sending out the survey instrument, as the response rates were generally quite low. The widespread distribution of a survey instrument is often costly when trying to reach a target audience. Limited financial resources when conducting this research study meant that the instrument distribution was limited and relied solely on word of mouth and sharing through email lists and social media posts. During the data collection phase, interviews took place in a virtual environment, which resulted in slight limitations since information portrayed through body language and smaller gestures may have been missed. Furthermore, only the audio of the interviews was recorded, meaning some visual data that would have been captured through a video recording may have been missed. Lastly, there was limited literature in the field of mindfulness relating to engineering, which meant that data had to be extrapolated, generalised, and transferred when attempting to understand how mindfulness related to engineering professionals during the literature review phase of the research study. This may have impacted the accuracy and validity of the literature review.

1.5. Overview of the Dissertation

The dissertation is structured as follows:

Chapter 2 presents background literature pertaining to the topic of mindfulness, including a definition, conceptualisations, and the salutary effects of mindfulness both on its own, and in the context of engineering professionals and organisations. In addition to literature on mindfulness, literature dealing with mental health in the engineering sector, employee well-being, job performance, and organisational performance.

Chapter 3 presents the methodology used in this research study, and includes the research paradigm, research approach, research design, sampling considerations, data collection, data analysis, trustworthiness and validity, and ethical considerations.

Chapter 4 presents the findings that emerged from the data analysis, where content analysis was used.

Chapter 5 presents the discussion that was conglomerated after analysing the findings and comparing them to the existing data gathered during the literature review. Using a combination of existing literature and findings from this research study, Causal Loop Diagrams were constructed to present a systems view of the phenomena being studied.

Chapter 6 presents the conclusion based on the discussion and findings of this research study.

2. Literature Review

This literature review aims to analyse existing literature that deals with the topics of mindfulness, job performance, organisational performance, well-being, and mental health, as well as mindfulness in the context of engineering job performance, organisational performance, and mental health. Although mindfulness has attracted notable scholarly attention in recent decades, literature in this specific field remains limited. Since there has been limited scholarly research conducted into the field of mindfulness in the context of engineering, it was necessary to expand the research into literature that dealt with topics such as mindfulness, engineering job performance, employee well-being, organisational performance, and mental health in order to gain the necessary insights and understanding to conduct this research study.

The aim of this literature review was to explore and understand the phenomena being studied, establish a definition and conceptualisation for mindfulness, and analyse existing literature relating to the fields of mindfulness, engineering mental health and job performance, organisational performance, and employee well-being. Existing literature was critically analysed, meaning both supporting and contradicting information was sought after so that theories and understandings of the topic were less biased (Maxwell, 2013).

The scope of this literature review included peer-reviewed, formal academic literature. Literature in the field of mindfulness offered a deeper understanding of the phenomenon being studied, as well as definitions, conceptualisations, salutary effects, and models for mindfulness. Literature that investigated workplace performance pertaining to the engineering sector was reviewed, as was literature dealing with job performance, organisational performance, mental health, and employee well-being. Lastly, adverse states experienced in the workplace (such as stress, fatigue, turnover intention, and burnout) were investigated to determine the extent of the impact they had on job performance as an engineering professional.

2.1. Mental Health in the Engineering Sector

Scholarly literature in the field of mental health and well-being of employees working in the engineering sector around the world, including in South Africa, is limited. This lack of literature and research into engineers' mental health suggests that this topic is overlooked and not given sufficient attention. This could support some of the claims that there is currently a global mental health crisis amongst engineering professionals, as some sources have suggested.

The engineering profession is notorious for being a high-pressure, high-stress, fast-paced, dynamic, and cognitively demanding profession. During undergraduate engineering degrees, there is an underpinning key assumption that engineering education is a harsh experience, tainted with constant struggle throughout the degree, where a student's level of success can be defined as their ability to 'take it on' and 'do more' (Godfrey and Parker, 2010). Godfrey and Parker (2010) compared the engineering education environment to a 'bootcamp mentality' and suggested that the excessively high workload and expectations on engineering students could lead to an environment of suffering and shared hardship. This would naturally threaten a student's mental health, and a study by Ross et al. (1999) confirmed this as it was found that high stress levels were commonplace to engineering students, who also reported a lack of sleep, fear of low grades, unhealthy competition between peers, lifestyle changes, and other stressors which were directly attributed to the high demands of the engineering degrees. This has led to a normalisation of stress within engineering degrees, and it has been reported that this *culture of stress* is passed on to incoming students. The normalisation of stress can increase students' stress levels further, while exacerbating other mental health issues and

challenges (Jensen and Cross, 2021). Danowitz and Beddoes (2018) found that engineering students were twice as likely to develop mood or anxiety disorders compared to the general student populace, and that marginalised groups (such as women and people of colour) within the engineering faculties were particularly at risk. This highlights a need to develop effective solutions to improve the mental health situation while reducing the high stress levels amongst engineering students and professionals alike. Regehr et al. (2012) reported that cognitive, behavioural, and mindfulness-based intervention methods were most effective in reducing the significant stress encountered by students.

Beyond the engineering classroom and into the engineering workplace environment, engineering culture still reflects the historical trends of the profession, which strongly reflects masculine culture (e.g. Dryburgh (1999), Seron et al. (2018)), and an underrepresentation of women and people of colour (Froyd and Lohmann, 2014). This imbalance has led to a lack of inclusion in the engineering workplace, which was highlighted in a survey conducted by McCabe (2019), who found that only 31.2% of engineers claimed to feel included in their place of work. This survey result is supported by Marra et al. (2012), who found that the primary reason for engineering students leaving the program was due to feeling a 'lack of belonging'; highlighting the lack of diversity even from an undergraduate level.

In 2019, over 800 practicing engineers partook in a survey conducted in the United Kingdom. This source was among the most recent official sources that highlighted the mental health crisis in the engineering sector. The goal of this survey was to understand the mental health situation in the engineering workplace, as well as the impact of masculinity on the mental health of engineering professionals (Lang, 2019). The survey results showed that 22.5% of engineers had experienced suicidal or self-harming thoughts, and that men were 3.5 times as likely to have reported this. Lang went on to report that 20% of engineers had lost a colleague to suicide, and roughly the same percentage of engineers had taken time off work to deal with mental health struggles. A further 37.2% of engineers partaking in the survey described their mental health state as being poor-fair. Lastly, Lang (2019) reported that less than 25% of engineers would feel comfortable discussing mental health or financial struggles with colleagues or superiors, which demonstrates a lack of company support systems, and inclusive, supportive company cultures. These findings (Lang, 2019) suggest that there is a serious problem with regard to mental health and employee well-being in the engineering sector. McCabe (2019) believes that this is due to the high pressures on employees in the engineering profession, the beliefs and stigmas surrounding masculinity and men displaying emotions and seeking help in a professional environment (the engineering sector is still largely male-dominant), and the lack of inclusivity.

Out of 163 participants who partook in a Professional Engineering survey on mental health (Flaig, 2020), 77.8% reported their work as being too stressful. A further 53.7% responded that workplace stress had a negative impact on their emotional and mental well-being, while 42.3% claimed that their work had been negatively affected by poor mental health. According to one participant, engineers have the habit of "burying stuff and carrying on until reaching their breaking point", which ties in to what McCabe (2019) believed were the main causes of mental health problems in the engineering sector. It was claimed that the masculine nature of the engineering workplace made it more difficult for engineers to seek help when needed, open up, or express their feelings and concerns. This was supported by Lipson et al. (2016)'s findings, which showed that engineering students were less likely to seek help when needed compared to students studying other fields and disciplines. Flaig (2020) suggested that one of the main sources of stress in the engineering profession is due to executives not accepting the limitations of the organisation and making unrealistic delivery demands. This may make it difficult for employees to feel positively motivated when the

challenges placed before them are insurmountable. Flaig (2020) concluded his article by suggesting that tackling the causes of stress and poor mental health at work would benefit all staff, as well as the entire organisation.

The claim that there is currently a mental health crisis in the engineering sector could be further supported by the fact that the COVID-19 pandemic and subsequent restrictions have contributed to a notable decline in the general mental health of the world's population. Usher et al. (2020) suggested that the fear, discrimination, panic, and sudden change to peoples' lives were significant stressors that had had a detrimental effect on billions of peoples' mental health. Similarly, Ren et al. (2020) found that in the case of an infectious disease spreading, particularly when the cause or progression of the disease and its outcomes are unclear, rumours grow amongst the public – exacerbating individuals' close-minded attitudes, helping drive the fear, anxiety, and panic. Levin (2019) explained that pandemics could contribute towards individuals and communities experiencing feelings of hopelessness, despair, grief, bereavement, and a profound loss of purpose – states which would significantly cause a decline in an individuals' mental health, as well as the collective mental health of a community or population. Beyond impacting employees on an individual level, the COVID-19 pandemic disrupted supply chains, which had a direct impact on organisational productivity, and therefore organisational performance (Udofia et al., 2021) – particularly in the engineering sector.

Contrary to the literature that was analysed above, Stansfeld et al. (2011) found that professionals working in the United Kingdom in the science and engineering fields displayed a lower prevalence to experiencing common mental health disorders, including general anxiety disorder, mixed anxiety and depressive disorder, depressive episode, phobias, obsessive compulsive disorder, and panic disorder. The data were collected through a self-report survey, and the study showed that women working in professional occupations generally had double the chance of experiencing common mental disorder compared to men working in the same fields. It is possible that women are more likely to admit to mental health struggles than men, as men are more likely to hide their feelings and ask for assistance when it comes to mental health issues (McCabe, 2019). Therefore, the findings reported by Stansfeld et al. (2011) may not be completely accurate given the effects of masculinity in the engineering sector.

One way of mitigating stress and poor mental health is through mindfulness (e.g. Kabat-Zinn (1990), Regehr et al. (2012)). The following sections will therefore deal with literature pertaining to mindfulness, as it is proposed that mindfulness could be used as a practice to improve mental health within individuals, communities, and organisations. The literature that is reviewed in the following sections deals with the defining mindfulness, conceptualising mindfulness and establishing a model for mindfulness, generalised salutary effects of mindfulness, and the salutary effects of mindfulness in the context of job performance, employee well-being, and organisational performance.

2.2. What is Mindfulness?

2.2.1. The Origins of Mindfulness

Mindfulness has its roots in Eastern traditions and has been a core component of Buddhist philosophy and psychology for millennia (Good et al., 2016). Mindfulness is also rooted in Jewish, Christian, and Islamic religions. Rather than a religious or spiritual practice, mindfulness can be viewed as a universal human capacity for clear thinking and open-heartedness (Trousselard et al., 2014).

In the 1970s, the work of Thich Nhat Hanh, Alan Watts, and Jon Kabat-Zinn helped bridge the gap between Eastern and Western philosophies, and mindfulness was introduced to the Western world as a therapeutic tool to help medical patients in managing chronic illness (Kabat-Zinn, 2003). The origins of Western mindfulness and meditation practices

are primarily Vajrayana, Vipassana, and Theravada trainings. Vajrayana meditation practice involves bringing the mind back to a chosen object of meditation and has a greater emphasis on neutrality and non-judgment. Vipassana begins with a sustained attention being held on the practitioner's breath, and later expands to include awareness of internal (thoughts, emotions) and external (physical sensations) stimuli. Lastly Theravada involves the movement through phases from the development of sustained attention to the capacity to perceive thoughts and feelings (Kantor, 2018).

In the context of Buddhist philosophy, mindfulness is centred around the understanding that sensations and thoughts are impermanent, and do not form any entity that one could refer to as the 'self' (one's true nature of being). Furthermore, mindfulness aims to limit habitual reactions, which Buddhist philosophers believe can lead to suffering (Kantor, 2018). Buddhist philosophers also believe that the cultivation of mindfulness can lead to insights into the nature of oneself, and life in general; particularly in understanding the transience of mental and sensory events. This can lead to a different relationship to one's feelings of pleasure or aversion in daily life and can result in the cultivation of a state called equanimity: *"a balanced state of mind in which an equal interest is taken in the pleasant, unpleasant, and neutral."*

In the 1990s, mindfulness was introduced into management literature (Weick and Roberts, 1993), and empirical research into mindfulness in the organisational and management contexts began to increase exponentially over the decades that followed. More recently, developments in Magnetic Resonance Imaging (MRI) technology has resulted in a heightened scholarly interest in mindfulness, and has encouraged further research into the field. Through this imaging technique, objective medical data in the form of highly accurate brain scans have proven that mindfulness leads to new neural pathways growing, and that the size and structure of the brain can be altered. This has helped explain how mindfulness can lead to a range of benefits in individuals (Cacioppe, 2017).

2.2.2. Definitions of Mindfulness

A widely-accepted scholarly definition of mindfulness was formulated by Kabat-Zinn (2003), who defined mindfulness as: *"an awareness that emerges through paying attention on purpose, in the present moment, and practicing non-judgment of the experience throughout each moment"* (p145). However, Kabat-Zinn's definition has been criticised for the use of the term 'non-judgmental', which can be perceived as being too vague, open to misinterpretation, used to justify self-centred behaviours, bypass experience, or encourage passivity (Amaro, 2015). Despite this criticism, it has been argued that Kabat-Zinn's definition of mindfulness describes it as accurately as possible in a Western context, given the complex task of attempting to define mindfulness. According to Singh et al. (2008), there cannot be a single definition for mindfulness since *"the definition of mindfulness will vary depending on whether one is interested in mindfulness from a social, psychological, clinical, or spiritual context, or from the perspective of a researcher, clinician, or a practitioner, and their various combinations."* (p. 661)

Dane (2011) proposed a definition for mindfulness that included an aspect of presence, describing it as *"a psychological state in which one focuses attention on events occurring in the present moment"* (p106). Brown and Ryan (2003) agreed that mindfulness involves an awareness of the presence and described it as *"a receptive attention to and awareness of present events and experiences"* (p212). Despite a surge in academic research into mindfulness over the past three decades, a consensual definition of the core construct has yet to have been achieved (Dimidjian and Linehan, 2003), supporting the claim made by Singh et al. (2008) that there cannot be a single, mutually-agreeable

definition for mindfulness. Going forward, when the term ‘mindfulness’ is used in this research study, Kabat-Zinn’s definition will be referred to as his definition holistically encapsulates the foundations of mindfulness in a clear, unambiguous manner. For this research project, when mindfulness is viewed as a practice – in other words, the act of actively and intentionally engaging in mindfulness practice. When individuals regularly engage in mindfulness, the benefits can be experienced by an individual beyond active mindfulness practice. In these cases, such individuals can be referred to as ‘mindful individuals’, who would generally be more aware while paying closer attention to internal and external stimuli.

Mindfulness as a trait versus mindfulness as a state

According to Siegel (2010), mindfulness can be defined as either, or both, a trait characteristic, or a state-like characteristic. Trait mindfulness suggests that mindfulness can be treated as a psychological trait which is influenced by genetics and environment, and that it varies between individuals. On the other hand, state mindfulness suggests that an individual’s level of mindfulness varies from day to day, moment to moment, based on the individual’s current circumstances and state of mind (Brown and Ryan, 2003). State mindfulness can be defined as the degree to which one is fully immersed in the present moment, as well as the frequency at which one is in a mindful state. Hülshager et al. (2013) argues that mindfulness varies both between, and within individuals; taking a stance that takes both trait and state mindfulness into consideration. Although there are more similarities than differences between these two perceptions of mindfulness, these differences can still lead to concerns regarding the construct validity (Hyland et al., 2015). This research study takes the stance that mindfulness can be perceived to be a state, meaning an individual’s level of mindfulness can vary over time. Using this definition also suggests that mindfulness can be practiced, and therefore enhanced, within individuals. On the other hand, describing mindfulness as a trait suggests that individuals have little to no control over how mindful they are, and that it is beyond their control.

2.3. Conceptualisations of Mindfulness

In most management and organisational literature, the bases of mindfulness are reported to be attention and awareness. Almost all conceptual models of mindfulness include these characteristics at the forefront. Brown et al. (2007) describe awareness as “*the conscious registration of stimuli, including the five physical senses, the kinaesthetic senses, and the activities of mind*”. While attention and awareness interact with one another, they are still distinctive – attention is engaged when a stimulus is strong, and it is possible to lack awareness while paying attention (Kantor, 2018). Conversely, it is possible to be aware that one is paying attention or paying attention to being aware of a phenomenon.

Shapiro et al. (2006) suggested that there are three fundamental pillars of mindfulness: Intention, Attention, and Attitude. One of the most widely-cited conceptualisations of mindfulness, proposed by a team of researchers (Bishop et al., 2004), includes an attentional component (the ability to regulate attention, honed through the intentional observation of feelings, thoughts, sensations, and any other stimuli as they occur) and an acceptance-based component (which has to do with an attitude of openness and receptivity to present-moment experiences). Good et al. (2016) used a conceptual model that suggested the key pillar of mindfulness is solely attention, and that all benefits that arise are due to the cultivation of attention; namely in the areas of stability (how consistently one can hold focus), control (directing attention amid competing demands (Ocasio, 2011)), and efficiency (referring to the economical use of cognitive resources (Neubauer and Fink, 2009)).

Gunaratana (2002), a Sri Lankan Buddhist monk, described mindfulness as being ‘bare attention’, and Das (1997) suggested that mindfulness was centred around ‘pure or lucid awareness’, which reveals what is occurring at present *before* ideas or perceptions are formulated and constructed in response to the phenomena that have taken place. This receptivity of mind is believed to allow insight into the *true* nature of reality – a reality that is purely objective and unbiased. Certain phenomena can remain hidden from conscious awareness, which is especially true if these phenomena represent threats to one’s idea of self, or to aspects of one’s self that are egocentric in nature – this owes to the mind and ego’s work to maintain self-preservation (Tolle, 2005). Therefore, mindfulness can produce a state of acceptance and non-judgment in practitioners, which in turn, can promote direct, conscious contact with uncomfortable truths, or previously threatening realities and experiences. This can facilitate insight into oneself, others, and encourages a greater understanding and acceptance of human nature in general (Brown et al., 2007).

The attention and awareness that arise when an individual is in a mindful state should be non-judgmental and non-discriminatory in nature, and as objective as possible without attaching any emotional value to any events (internal or external) unfolding. In other words, when processing phenomena in a mindful way, there is no comparison, categorisation, or evaluation of the current experiences that are unfolding; nor is there any contemplation, reflection, or rumination on events or experiences based on memory or preconditioning (Brown and Ryan, 2003). Instead, mindfulness promotes non-interference and non-judgment towards any experience that may arise, and simply allows inputs to enter an individual’s field of awareness by simply *noticing and observing* what is taking place. In addition to these qualities, the attention and awareness that is cultivated due to mindfulness is also flexible, meaning the field of awareness can be adjusted accordingly – it can move back to gain a larger perspective on what is taking place (known as clear awareness), or it can ‘zoom’ in on situational details (focused attention) (Brown et al., 2007). This feature can allow mindful individuals to alter their perceptions and limiting thoughts to obtain greater clarity and understanding in certain situations where it is required that the bigger picture is seen. This, in turn, can lead to individuals experiencing lower levels of emotional or mental distress, and in this way, mindfulness can be directly attributed for these benefits. Mindfulness involves experiential processing (Brown et al., 2007), which involves attention to both one’s internal world (consisting of thoughts, feelings, and emotions) as well as one’s external world (consisting of external stimulus and sensations) while simply *observing and noticing* what may arise. It is important, however, not to judge or to attempt to assign meaning to anything. Finally, attitude, or *how* we are present is also essential. The qualities one brings to attention (ideally non-judgmentalism, kindness, and openness) have been referred to as attitudinal foundations of mindfulness (Kabat-Zinn, 1990). Essentially, by becoming aware of, and paying attention to one’s reactions, it allows a degree of mental distancing and disengagement from self-relevant evaluations (Good et al., 2016).

When the topic of mindfulness is discussed, the construct of past, present, and future is often taken into account. Brown et al. (2007) suggests that humans’ minds oscillate between memories of the past and projections into the future. Too seldom do humans experience the present moment for what it is. This is often caused because humans ‘forget’ that we only exist in the present, and the fact that there is no tangible, direct contact with either the past or the future – they are both simply constructs of our imagination. While this ‘oscillatory time travel’ serves a useful biological purpose of protecting, maintaining, and improving the self, or one’s identity (which is a set of ideas about oneself that defines *who* they are in relation to the world), it often comes at the detriment of one’s mental and emotional well-being (by dwelling on painful past memories or excessively worrying about future outcomes).

Mindfulness helps to increase the amount of mental time spent being aware in and of the present moment, through the cultivation of *present-oriented consciousness*. Zimbardo and Boyd (1999) importantly point out that this is not to be confused with ‘living for the present’, which is associated with hedonism, impulsiveness, and fatalism. On the contrary, mindfulness has been inversely related to these characteristics.

2.4. Salutory Effects of Mindfulness

Mindfulness has been used as a practice for millennia, particularly in Eastern religions and belief systems such as Buddhism and Hinduism (Kabat-Zinn, 2003), to obtain various benefits in the practitioner’s life. In the 1970s, the work of Thich Nhat Hanh, Alan Watts, Jon Kabat-Zinn, and Ram Dass brought the practice of mindfulness to Western countries and cultures, where it was initially used as a therapeutic tool to help patients manage chronic illness (Good et al., 2016). Since then, mindfulness has gained traction particularly in the fields of clinical psychology and personality psychology (Hülshager et al., 2013) as a practice to improve a range of mental issues. Promising empirical results prompted further research into the field of mindfulness and how it can be used as a tool to enhance aspects of performance, organisations, behaviour, emotional regulation, health management, stress reduction, and communication, amongst others. This section will deal with the review of literature pertaining to the salutary effects of mindfulness, before looking at the salutary effects of mindfulness in the context of the engineering sector.

Self

One study found that as meditators continued to practice over time, their intentions shifted from self-regulation (the management of oneself and one’s behaviours without external assistance), to self-exploration (learning about oneself and accepting all aspects of oneself without judgment), to self-liberation (realising the limitless potential of oneself as a human being) (Shapiro, 1992). Shapiro et al. (2006) also stated that outcomes of mindfulness practice were strongly correlated to the intentions (desired outcomes) at the beginning, suggesting that mindfulness outcomes could be specific to individuals, in which case the benefits could theoretically be infinite.

Attention

Mindfulness can be described simply as a practice involving bare attention (Dane, 2011), which can lead to an improvement in the practitioners’ ability to focus and pay attention. Good et al. (2016) theorised that mindfulness affects human functioning primarily through the cultivation of attention, which then opens the door to a range of other domains of functioning that could be altered. Attention itself is composed of various qualities (namely stability, control, and efficiency), each of which are enhanced through the cultivation of mindfulness. Mindfulness helps individuals by improving these three qualities such that attention can be stabilised in the present moment (Smallwood and Schooler, 2015), thereby bringing more awareness and focus to the task currently at hand.

Well-being

Mindfulness has been shown to enhance personal well-being, both directly and indirectly. Well-being can potentially be directly enhanced as mindfulness can add clarity and vividness to current experiences; encouraging closer sensory, moment-to-moment contact with life without first interpreting, analysing, and judging everything that is going on (Deci and Ryan, 1985). This can reduce the emotional and mental distress that could arise due to the internal, mental judgment and discrimination towards current events unfolding, thereby allowing a state of peaceful equanimity to arise – a quality that has been found to significantly enhance an individual’s sense of well-being.

Mindfulness also holds the potential to indirectly enhance individual well-being. This can occur by improving self-regulating functioning that comes with sustained attention and awareness of psychological, somatic, and environmental stimuli (Brown et al., 2007). These claims of improved well-being have been backed up by studies, where significant correlations have been found between mindfulness and: Mental health, lower levels of emotional disturbance (such as depression, anxiety, and stress), higher levels of subjective well-being (higher positive effect and satisfaction with life), and eudemonic well-being (vitality and self-actualisation) (Brown and Ryan, 2003). Baer et al. (2006) found that mindfulness was negatively correlated to neuroticism, while Walach et al. (2006) showed that mindfulness was negatively related to psychological distress. Contrary to expectations, Baer et al. (2006) demonstrated that observation of personal experience was positively correlated to psychological distress. Baer et al. (2006) suggested that this may have been because observation of experience and psychological distress may operate as a function of mindfulness training.

Emotional Regulation

Mindfulness has been shown to hold the potential to regulate an individual's emotions (Good et al., 2016). Frijda (1988) described emotions as being 'the result of evaluative reactions to observed stimuli that serve to catalyse behaviour.' Through increased attentional capacities, the selection of observed stimuli could be influenced, and the perception and evaluation of these stimuli could then be altered to work in one's favour. In turn, there could be greater regulation and control over subsequent emotional reactions (Killingsworth and Gilbert, 2010), which, according to Davidson (1998) tend to exhibit a somewhat predictable lifecycle. Through the cultivation of mindfulness, this emotional lifecycle can be shortened – the time taken to reach the peak of the emotional response, and then return to normal, is significantly reduced. Furthermore, mindfulness can promote equanimity and a non-judgmental attitude, meaning emotions, either positive or negative, can be perceived from a more neutral, objective perspective. Disidentification from emotions can take place as emotions are viewed for exactly what they are – temporary feelings and nothing more. As Davidson (1998) suggested that emotions have lifecycles, mindfulness practitioners can note the temporary nature of emotions as they come and go; always changing. By taking note of the temporary nature of one's emotions (as skilled mindfulness practitioners often do), the prospect of experiencing any emotion may become far less daunting, and individuals are less likely to invoke intense emotional arousal.

Furthermore, mindfulness has been associated with greater understanding, acceptance of emotions, and improved ability to correct mood states (Brown and Ryan, 2003). Arch and Craske (2006) found that mindful individuals were less likely to be emotionally volatile and less negatively reactive. This was supported by Farb et al. (2010), who demonstrated that an 8-week mindfulness intervention training program reduced participants' neural reactivity and negative reaction to sadness-inducing stimuli. This has been proven not only through empirical research, but also neurologically through brain scans of the amygdala and prefrontal cortex associated with threat response (Creswell et al., 2007). The credibility and validity of mindfulness practice is enhanced through the fact that physical and physiological changes can be observed through direct scans of the brain in mindfulness practitioners.

Behavioural Regulation

Mindfulness practice can also potentially be used to regulate individuals' behaviour. This benefit can be achieved as mindfulness interrupts automaticity, the *'ability to effortlessly engage in behaviours without conscious oversight of their operational details and thus has adaptive benefits for information processing when cognitive capacity is*

constrained' (Bargh and Chartrand, 1999). This definition of automaticity suggests that stimuli are perceived through mental filters and constructs, which are created through existing habits, experiences, and mental conditioning. Mindfulness can aid the interruption of automaticity in individuals since it creates a larger mental gap between the stimulus experienced and the corresponding behavioural response (Good et al., 2016). Through heightened awareness and present-moment attention, mindfulness has the potential for individuals to become more aware of their automatic mental operations and responses, and affords practitioners the choice of whether to react automatically to a stimulus, or if conscious regulation of the behaviour will take place (Good et al., 2016). This speculation was supported by a study conducted by Tang et al. (2013), where it was proven that mindfulness leads to higher activations in the brain regions associated with behavioural self-control. The improved regulation of behaviour can change employee's workplace habits and behaviours from being counterproductive to more beneficial to producing work of a high standard in an efficient, productive manner. Examples of this could be procrastination, scrolling through social media, or excessive smoke breaks.

Interpersonal Skills

Numerous studies have been conducted to investigate the relationship between mindfulness practice and interpersonal skills, relationships, and the quality of social interactions. According to Kabat-Zinn (1993), mindfulness can promote connection and closeness in relationships, as the non-judgemental awareness that arises due to mindfulness promotes greater consideration of another person's thoughts, emotions, and well-being. Through improved attentional capacities, mindfulness can also enhance one's ability to interpret the content of their partner's communication, tone, and non-verbal behaviour (Goleman, 2006). Additionally, mindful individuals are more likely to be aware of their own cognitive, emotional, and verbal responses when communicating, and are more likely to have deeper insight into the consequences of their communication habits (Brown et al., 2007). Mindfulness has been shown to reduce the emotional distress and emotional reactivity that arises during conflict. Schutte et al. (2001) demonstrated that there exists a correlation between mindfulness and emotional intelligence, which includes aspects such as improved perspective-taking, better social skills, cooperative response patterns, and marital partner satisfaction.

Physiology

Beyond the changes that mindfulness brings about on a mental and emotional level, there are also physiological benefits that can potentially be experienced by practitioners on a physical level. These benefits are mostly in the form of stress reduction and improved sleep quality (Hulsheger et al., 2018). Through improved sleep and reduced stress, many other benefits in various aspects of an individual's life can be improved too (for example, less fatigue, lower chances of burnout, increased energy levels). Mindfulness reduces stress not only on a psychological level, but also on a physiological level as the neurobiological mechanisms produce lower levels of cortisol in mindful individuals during a stress response, while also returning the cortisol levels to baseline levels in a shorter timeframe (Creswell and Lindsay, 2014). According to Good et al. (2016), it has been well-established that mindfulness brings about changes to the physical structure of the brain, by increasing amounts of grey matter and decreasing the size of the amygdala, responsible for stress response and emotional behaviour, and the 'fight or flight' response. This has been observed through MRI scans, where it was shown that regular mindfulness practitioners had new neural pathways growing in the brain, while also experiencing alterations in the size and structure of the brain (Cacioppe, 2017).

2.4.1. Mindfulness and its Salutory Effects in the Context of Job Performance

As the previous sections suggest, there is notable evidence to support the notion that the introduction of mindfulness practice to employees could have useful benefits in the context of job performance. This section deals with mindfulness and its salutary effects in the context of job performance as an engineer.

Creativity, Innovation, and Problem Solving

As technology and scientific knowledge progresses, and as new societal problems present themselves, engineering challenges become increasingly complex, thus requiring higher levels of innovation (Sheppard, 2009). In this context, innovation can be defined as: “*encompassing skills, attributes, and actions relating to new designs and solutions that fundamentally depart from, and change thinking about, conventional practice*” (Gilmartin et al., 2017). The engineering profession is often dynamic and challenging, and requires individuals to demonstrate a high level of cognitive functioning, creativity, innovation, and problem solving. Ray et al. (2011) found that organisational mindfulness held value for organisations in that it could help employees build resilience and respond effectively to a changing and challenging environment. It has been suggested that the innovation trait can be developed and cultivated with an open, receptive mindset when approaching problems (George and Zhou, 2001) – a mindset which is a fundamental factor in mindfulness practitioners (Shapiro and Carlson, 2017). Innovation, problem solving, and creativity can be enhanced through cultivating divergent thinking skills, which are often overlooked in engineering education, and have been shown to increase creativity and problem solving skills (Rieken et al., 2019). This claim is supported by Ostafin and Kassman (2012), who demonstrated that mindfulness can be used to predict improved insight problem solving. Rieken et al. (2017) also reported that studies have revealed evidence that there is a causal link between mindfulness and creative thinking skillset. Kuncel et al. (2004) found that there is a link between creativity and job performance, suggesting that mindfulness can improve job performance through improving divergent thinking skills, which contribute towards creativity and innovation. Carbonetto et al. (2019) suggested that by incorporating a mindfulness practice in a classroom environment, engineering students would benefit from improved mental clarity, focus, and stress relief. By teaching young engineers these valuable skills early on, they are more likely to succeed not only in their career path, but in numerous aspects of life. Mindfulness would benefit an engineering organisation through the development of innovation and divergent thinking skills in engineers, thereby equipping them to efficiently solve the increasingly complex engineering problems that arise in today’s society, and mindfulness practice may effectively be able to facilitate this.

Cognitive Performance

Considerable research has gone into the field of mindfulness and its relation to cognitive performance – including both cognitive flexibility (the generation of new perspective taking and responding instead of reacting based on previous mental conditioning) and cognitive capacity (the fluid intelligence of individuals) (Good et al., 2016). Contrary to popular belief, Good et al. (2016) states that working memory and fluid intelligence is malleable, and that these qualities can potentially be cultivated and improved within mindfulness practitioners. Through improving cognitive flexibility and capacity, engineering professionals could benefit as it would enable them to develop new perspectives when solving problems. Furthermore, improved working memory and fluid intelligence would mean that professionals could recall information more quickly and may offer better insights through fluid intelligence. In this way, mindfulness holds the potential to indirectly enhance the job performance of engineering professionals.

Job Performance

Dane and Brummel (2014) demonstrated that mindfulness was associated with improved job performance, due to an improvement in various workplace outcomes, such as turnover intention, vigour, dedication, and absorption. Bond and Bunce (2003) theorised that there was a positively correlated relationship between an employee's willingness to accept emotions and thoughts, and the employee's mental health state and work performance one year later. Studies have also been conducted to prove that there exists a negatively correlated relationship between trait mindfulness and counterproductive behaviours, and a positively correlated relationship between mindfulness and workplace safety (Good et al., 2016). It is theorised that mindfulness can potentially improve employees' performance by reducing performance variability from day to day, maintaining performance under disruptive conditions, and influencing goals and motivation. Cognitive, emotional, physiological, and behavioural changes as described above may be the key mechanisms to promoting performance in the workplace, in addition to stress response and fluid intelligence (both of which can be enhanced through mindfulness practice) (Good et al., 2016). Furthermore, mindfulness could possibly improve workplace performance as employees are less prone to making errors or experiencing attention lapses. Smallwood and Schooler (2015) suggest that this is due to more stable and controlled attention that mindful individuals can experience.

Employee Well-being

Employee well-being is considered a major outcome of interest and an important aspect of job performance (Good et al., 2016). Grant et al. (2007) define employee well-being as *"the overall quality of an employee's experience and functioning at work"* (p. 52). Well-being comprises of psychological, physical, and behavioural factors, and include both eudemonic and hedonic aspects (Ryan and Deci, 2001). Research has indicated that employee well-being is related to individual and organisational job performance, through an improvement in psychological health, absenteeism, turnover intention, and in-role performance (Danna and Griffin, 1999). Furthermore, mindfulness has been linked to a number of well-being related outcomes, such as reduced instances of burnout (Flook et al., 2013), perceived stress (Good et al., 2016), work-family conflict (Allen and Kiburz, 2012), reduced negative moods (Roche et al., 2014), and greater sleep quality (Alberts and Hülshager, 2015). When individuals experience higher levels of well-being, they are more likely to feel motivated and satisfied at their workplace (Dane and Brummel, 2014), enabling them to produce higher quality work in an efficient manner. Therefore, through improving employee well-being, mindfulness is likely to improve an individual's job performance.

Emotional Regulation

Regardless of the profession that an individual works in, employees are inevitably faced with emotional labour and emotionally charged encounters between other employees or customers and clients on occasion (Hülshager et al., 2013). As a result of emotional labour, employees are more likely to suffer from emotional exhaustion and a reduction in job satisfaction (Hülshager and Schewe, 2011). Mindfulness has been shown to potentially enhance resilience amongst employees (Good et al., 2016), where resilience is defined as: *"the capacity to rebound from adversity, conflict, and failure and to develop as a result of these challenges"* (Luthans et al., 2007). Through improving their resilience, employees are more likely to be able to withstand unpleasant emotional experiences and emotional labour to a greater extent, as well as other workplace stressors. According to a study conducted by Maslach et al. (2001), emotional exhaustion is a key factor in job burnout, so it is in the best interest of individuals and organisations to limit

the amount of emotional labour experienced. This can be achieved through either reducing the amount of emotional labour to which employees are exposed, but this would be practically very difficult to implement given the nature of human interaction in the workplace. Alternatively, employees could utilise tools and coping mechanisms to healthily process emotions and deal with emotional labour effectively. Halbesleben and Bowler (2007) demonstrated that emotional exhaustion and job satisfaction relate to important organisational outcomes, which include: absence without leave, task performance, and turnover intention (i.e. how likely an employee will want to leave a job in the foreseeable future). Building on the research explained above, Hülshager et al. (2013) went on to prove that a significant positive relationship exists between mindfulness and job satisfaction, and a significant, negative relationship exists between mindfulness and emotional exhaustion, suggesting that mindfulness could be used as an effective tool to enhance an employee's workplace satisfaction and overall experience.

Interpersonal Skills

Mindfulness in the workplace has shown to improve interpersonal relationships, as it promotes active listening, more acceptance, and less judgment of others (Beckman et al., 2012). Additionally, relationships can be improved as mindful cultivation leads to lower emotional reactivity (Tang et al., 2013), and reduced negative emotion, rumination, and retaliation (Long and Christian, 2015). Good et al. (2016) reported that mindfulness led to a more positive outlook, reduced emotional reactions during conflict, less hostility and anger, and an increase in compassion and empathy towards others; all contributors toward the cultivation of healthy interpersonal relationships in the workplace. Most corporate professions require reasonable social skills among employees, but despite this, it is inevitable that conflict will arise occasionally. Employees who practice mindfulness are more likely to have better social skills, lower emotional reactivity, and improved conflict resolution, suggesting that their overall experience at the workplace would be more pleasant compared to employees who do not practice mindfulness. If an organisation has a network of employees who can effectively communicate between one another, it sets the workplace environment up to be conducive towards a successful organisation since collaboration can be enhanced (assuming external factors remain unchanged, which in reality, is rarely the case).

Stress and Burnout

A study was conducted to investigate the relationships between mindfulness, stress reduction, and health-related quality of life (Matee, 2018). The results showed that stress levels were significantly decreased, and that the health-related quality of life had increased in participants after an 8-week mindfulness-based intervention. Another study Kersemaekers et al. (2018) claimed that the leading cause of absence or leave from work was due to mental health issues. Kersemaekers et al. (2018) also went on to prove that mindfulness training increased mindfulness traits in individuals, while helping to reduce stress and burnout in an employee's job and enhancing their levels of productivity.

2.4.2. Mindfulness and its Salutary Effects in the Context of Organisational Performance

Since the turn of the millennium, there has been growing interest and research conducted into mindfulness and its effects on organisations. While there have been high volumes of clinical, medical, and psychological research into mindfulness and its benefits, it is not entirely certain whether these benefits can be translated to a workplace environment (Reb et al., 2020).

Organisational Performance

Organisational performance has been defined as a set of both financial and non-financial indicators capable of assessing the degree to which organizational goals and objectives have been accomplished as well as the success or fulfilment of the organization at end of a deliverable (Kaplan and Norton, 1992). According to Singh et al. (2016), organisational performance is fundamental to a firm's survival, and it is recognised as a central outcome variable of interest. Richard et al. (2009) proposed that organisational performance was comprised of both financial indicators (financial performance, product market performance, shareholder return), and non-financial indicators (e.g. operations effectiveness, customer satisfaction, productivity, service quality, and corporate social responsibility amongst others). While Singh et al. (2016) suggested that organisational performance could be measured using subjective measures (e.g. ratings from managers) in addition to objective measures (e.g. company statements, data from stock exchanges), it has been argued that objective measures are more robust since managers may not be willing to draw attention to shortcomings, and are more likely to overstate the performance of the organisations (Bjorkman and Budhwar, 2007). It is important that organisational performance is upheld and maintained, and efforts should be made to consistently improve it in the interest of building the organisation. Given the promising benefits mindfulness offers practitioners on an individual level, growing research has gone towards studying mindfulness on an organisational level, as it has been proposed that mindfulness can influence a wide variety of workplace outcomes (Good et al., 2016).

Team Dynamics and Interpersonal Relations

Mindfulness has been proposed to enhance team and organisational functioning through the cultivation of high-quality relationships, characterised by emotional intelligence, resilience to setbacks, and openness to new ideas (Good et al., 2016). This may promote a psychologically 'safe' environment to employees, which can promote effective communication (Fast et al., 2014), trust (Mayer et al., 1995), and psychological safety (Edmondson, 1999), which in turn, promote error correction and learning. An environment where employees can establish high-quality relationships with trust, psychological safety, and effective communication is conducive to cultivating successful teams within an organisation. If teams function more effectively in an organisation, then the entire organisation can be enhanced and uplifted. In addition, mindfulness has been shown to improve conflict management (Kay and Skarlicki, 2020), while also being associated with lower levels of conflict (Yu and Zellmer-Bruhn, 2018). This can further promote team efficacy and dynamics, which would contribute towards a higher level of organisational performance.

Management

From a management perspective, it was found that managers who had received mindfulness training showed significant improvements in job performance (as rated by supervisors) compared to a control group and their initial performances (Shonin et al., 2014). Reb et al. (2014) found that mindful supervisors had a positive impact on the well-being and work performance of their employees, while Reb and Choi (2014) found that mindfulness provides benefits to organisations which include increased job satisfaction, improved learning, reduced employee turnover and absenteeism, and better situational awareness.

Empirical Research

Many organisations around the world have been implementing mindfulness-based interventions for their employees to partake in (Schaufenbuel, 2015). It was suggested that managers who promote mindful practice with their teams create an environment of engagement and acceptance, which several of these interventions demonstrated empirically. Google has implemented mindfulness programs since 2007, and the world-leading tech company found that mindfulness

teaches emotional intelligence, which helps employees better understand their colleague's motivations. Furthermore, Google claimed that mindfulness would help employees boost resilience to stress while improving mental focus. Participants reported feeling calmer, more patient, better able to listen, better at handling stress, and defusing emotions (Schaufenbuel, 2015). Since a mindfulness program was successful at Google, a global organisation that employs many engineering professionals from all around the world, it is plausible to propose that a mindfulness-based intervention would be successful in an engineering organisation in South Africa.

Other organisations such as Aetna, General Mills, Intel, and Target have also offered mindfulness-based programmes to employees (Schaufenbuel, 2015). Among these organisations, employees were found to collectively experience the following benefits after participating in mindfulness-based interventions: Improved stress levels and heart rate measurements in stressful bodies (indicating that employees' physiological health had improved due to mindfulness), improved focus and mental clarity, improvement in employee creativity and new ideas, better quality of relationships at work, and an increased level of engagement in meetings, projects, and team efforts (Schaufenbuel, 2015). It is proposed that these salutary effects of mindfulness would significantly benefit both engineering employees and organisations, where engineering employees are constantly faced with a dynamic, high-pressured job that requires high levels of focus, creativity, cognitive functioning, processing, and innovation.

2.5. Measures

It was deemed necessary to review existing literature on how data could be collected in a valid, trustworthy manner. In addition to the structured interviews, instruments such as self-report measures, in the form of questionnaires and surveys instruments were deemed the most applicable and convenient avenue through which data could be collected. The aim was to conglomerate various self-report measures into a single instrument, so that several latent variables could be measured. Psychometrically sound self-report measures with proven validity exist for many different job performance indicators, of which stress levels, fatigue, mindfulness, productivity, job satisfaction, and turnover intention were all measured in this research project. By using existing self-report measures, the option to explore these indicators was made possible with relative ease since there was no need to develop an entirely new instrument for this research study. These self-report measures were used to elicit employees': level of mindfulness (e.g. Mindfulness Attention Awareness Scale (MAAS) (Brown and Ryan, 2003), Freiburg Mindfulness Inventory (FMI) (Walach et al., 2006)), stress levels (e.g. Job Stress Scale (Parker and DeCotiis, 1983)), and fatigue (e.g. Fatigue Assessment Inventory (FAI) (Schwartz et al., 1993)). Turnover intention was elicited by simply asking employees what the probability was that they would stay at their current employer for the next two years – a method which was proven to be a valid measure of actual turnover (Jamal and Baba, 2000). Factors such as employee well-being and productivity could be elicited by asking several questions relating to these latent variables using a Likert-scale in a survey format as the quantitative instrument.

Turnover intention and stress levels were selected as job performance predictors since they were shown to be significantly negatively correlated to job performance (Jamal (2007) and Dane and Brummel (2014)). Similarly, Hulsheger et al. (2018) showed that there exists a negatively correlated relationship between fatigue and job performance. Therefore, the latent variable 'fatigue' was also selected to be a predictor of job performance for this research study. In contrast, employee well-being was shown to be strongly positively correlated to job performance (Medina-Garrido et al., 2017), while Grant (2008) showed that a positive, statistically significant relationship exists

between job performance and productivity, suggesting the abovementioned latent variables were suitable job performance predictors in the context of this research project.

Good et al. (2016) suggested that mindfulness could be assessed using two basic approaches: self-report questionnaires and engagement in mindfulness practices. Well-established and commonly tested self-report mindfulness measures included Mindfulness-Based Stress Reduction (MBSR) (Kabat-Zinn, 2003), FMI (Walach et al., 2006), and MAAS (Brown and Ryan, 2003). By engaging in mindfulness practices, individuals can experientially observe for themselves how they may have progressed over time, as factors such as attentional focus, including the duration and quality of focus itself, begin to noticeably improve over time.

2.6. Conclusion

The literature review aimed to critically analyse existing literature and assisted in developing theories and concepts that were used going forwards in this research study. Through a careful review of the existing literature pertaining to mindfulness and job performance, organisational performance, and employee well-being in an engineering context, a gap in the field of scholarly research was identified. Through the identification of this gap, clarity was gained in terms of what exactly this research study would entail, and what the scope would consist of. Furthermore, clarity was brought to the potential methodology that could be adopted for this research study, based on the analysis of how successfully, or unsuccessfully, previous research in a similar field had been carried out.

3. Methodology

This chapter deals with the research design and the implementation of the research strategy of the research study. The chapter looks at the research paradigms, sampling design and decisions, data collection, data analysis, maintaining the trustworthiness and validity of the chosen methods, as well as ethical considerations for the study since it dealt with human participants. The diagram below shows an overview of the methodological approach for this research study:

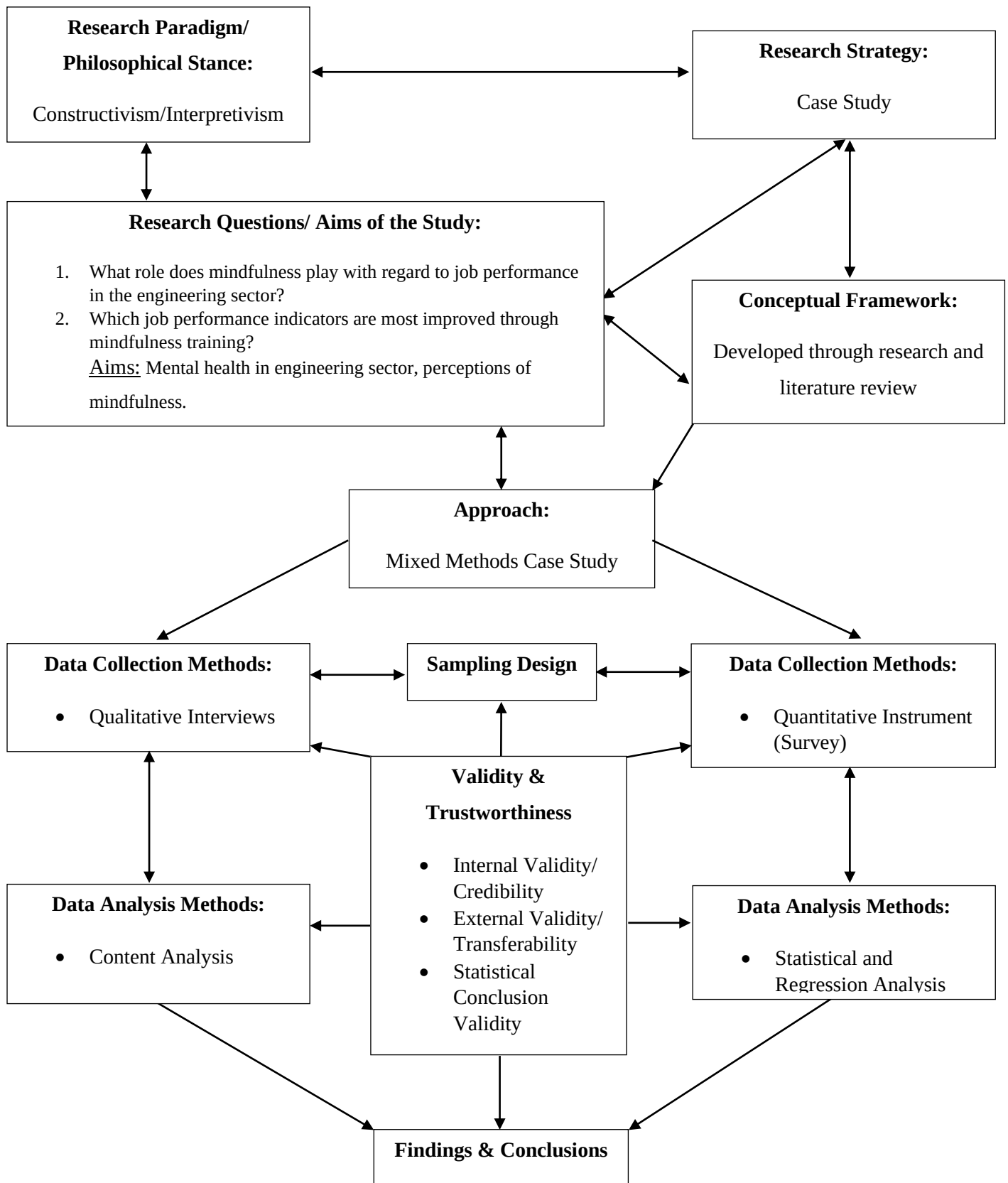


Figure 1: Flow diagram showing the research design for the research study

3.1. Research Paradigm

The research questions and aims intended to investigate topics such as mindfulness and mental health that were highly personal to individuals. The phenomena being researched were likely to differ between participants, who would each possess different psychological constructs, previous life experiences, personal beliefs, and understandings of mindfulness and mental health. It was argued that individuals would construct their own subjective, personal realities in the context of the phenomena being studied. It followed that constructivism and interpretivism would be appropriate philosophical stances to adopt, rather than a positivist-based approach.

A constructivist-based approach assumes that individuals construct new information and knowledge, building on what they already know and understand, rather than receiving knowledge via transmission from other individuals. This philosophical stance meant that participants in the research study were assumed to develop their own ideas and understandings of mindfulness and mental health in the engineering workplace. Given that this field has not been well studied, this philosophical approach allowed participants to contribute new, personalised information that was analysed using an inductive approach.

An interpretivist-based philosophical stance suggests that individuals construct their own personal realities, rather than experiencing a single, objective reality as positivists believe. Given the personal nature of the research questions and aims, and the difference in perceptions of mindfulness and mental health between participants, it was deemed an appropriate selection as it would allow in-depth insights into the lives of the participants. This rich source of data could offer explanations as to why individuals experienced life in the way that they did and would assist in answering the research questions and achieving the aims.

The constructionist/interpretivist philosophical stance, in conjunction with the research questions and aims, pointed towards utilising a mixed methods case study approach. It was deemed the most effective strategy to answer the research questions and satisfy the research aims. This was because the case study research strategy afforded the researcher the opportunity to capture the individuals' point of view on the subject of investigation, to examine the constraints in the participants' lives, and to secure rich descriptions that would help answer the research questions and aims, by conducting in-depth analyses of the issues being researched.

3.2. Research Strategy and Approach

For this research study, a mixed methods case study approach was used. A case study focuses on an in-depth investigation of a small number of cases, from which rich data and descriptions can be elicited. For this research study, the cases (entities of interest) were individuals working as engineers or technologists at engineering companies in South Africa. Individual cases were defined through job performance (including personal skills, interpersonal skills, productivity, attitude, and motivation), mental health (including personal mental health, collective mental health, stress, and fatigue), workplace well-being and environment (including company culture and support, management, turnover intention and job satisfaction), and mindfulness (including perceptions of mindfulness and perceived benefits of mindfulness in the context of job performance and well-being). The goals of this research study were to understand the mental health situation in the South African engineering sector more clearly, to understand common sources of stress amongst engineers, to understand the perceptions of mindfulness amongst engineers, and to determine the plausibility of implementation of a mindfulness-based intervention to combat mental health issues, improve employee well-being, and boost job and organisational performance. This was achieved through conducting an in-depth case

study into multiple individuals through structured interviews, and supplementing this data with responses gathered through a survey as an instrument. The knowledge that was gained through the data collection was used to gain insight into the bigger picture of the mental health situation among South African engineers, and to assess whether mindfulness practice could be used as an effective measure to improve mental health and well-being amongst engineers, while boosting individual job performance and organisational performance. Additionally, traits that were perceived to contribute to successful job performance as an engineer were elicited from participants. Emergent traits were analysed in conjunction with mindfulness, which assisted in determining the effect that mindfulness may have on job performance.

Since the approach for this research study was chosen to be a mixed methods case study, it allowed for a composite and multifaceted investigation of the research questions to be conducted, using both qualitative and quantitative aspects. A mixed methods approach was utilised so that the qualitative and quantitative methods could fill in each other's weaknesses and improve the overall validity and trustworthiness of the research study. Qualitative research methods included textual, transcribed, and interview-based data, whereas quantitative research methods included an instrument that made use of a Likert-type scale to score respondents on the respective latent variables. While having a range of different methods within the same study was intended to contribute to the validity and trustworthiness of the results, there was the risk of the research paradigms contradicting one another between the methodologies (Easterby-Smith et al., 2015).

3.3. Research Design

3.3.1. Considerations for Data Collection

There were two main considerations in designing the research study when using the mixed methods approach: sequencing, and dominance. For the sequencing, the survey instrument was sent out prior to the interview. This was done because the instrument was sent out to far more respondents compared to the interview, meaning they had more time to complete the instrument, resulting in a greater number of responses being obtained. The interviews were perceived to be dominant over the survey instrument, as they required far more time and effort than the instrument and contributed rich qualitative data to the research study. The interviews were perceived as being more important than the instrument due to the rich qualitative nature of the data that were collected, and the way in which these data assisted in answering the research aims and questions. The instrument was still important in defining and investigating statistical relationships between the latent variables of interest, namely: Stress, fatigue, job satisfaction, productivity, and mindfulness.

3.3.2. Sampling

To ensure that meaningful data were obtained through valid and trustworthy means, it was necessary to select an appropriate sampling design such that the sample was representative of the population being studied. When deciding upon which sampling design to use, representativeness and precision were two factors of interest. The accuracy of the conclusions drawn from the sample group depended on whether it had the same characteristics as the population from which it was drawn. Through the consideration of how effectively the sample group represents the greater population, validity could be upheld and maintained (Easterby-Smith et al., 2015). It was also necessary to minimise sampling bias (when some members of the population have a higher chance of being included in the sample than others) as far as possible. This was achieved through using a sound sampling design. A sampling frame was established, which

involved drawing up a list of those who would be eligible to partake in the research study, as well as those who were not eligible. This list was then defined more clearly through excluding certain groups of people, such as part-time workers, casual staff, home workers, and professionals who did not work at an engineering organisation for example.

The second factor, precision, refers to how credible a chosen sample is (Easterby-Smith et al., 2015). The precision of a conclusion depends on the relative sample size – the larger the sample size relative to the population, the more precise the results would be. It was therefore necessary to gain sufficient responses to ensure high precision of the results, meaning the margin of error in the claims and conclusions that were made would be sufficiently low to maintain the validity of the research study.

3.3.2.1. Quantitative Sampling for the Instrument (Survey)

The instrument in this research study comprised the quantitative aspect, for which a probability sampling design was better suited. The use of a survey as an instrument meant that a larger sample would be required compared to the interviews. The type of sampling used for this part of the study was Simple Random Sampling, where every sample entity has an equal chance of being part of the sample. First, the population was identified, which included professionals working at an engineering company in South Africa, as an engineer or similar profession such as a technician or technologist. The important sampling factor was that respondents worked for an engineering company, as all employees working in this sector were perceived to be able to offer valuable insights into mindfulness and mental health in the industry. A link to the instrument was shared on social media (including LinkedIn, Instagram, and Facebook) and was also sent via email to engineering organisations in South Africa for employees to complete. Respondents were asked to complete the instrument only if they matched the sampling criteria and were working as an engineer or similar position at an engineering company. Survey instrument responses were recorded on Google Forms for analysis.

3.3.2.2. Qualitative Sampling for the Interviews

The qualitative component of the research study included the structured interviews, where a mixed sampling approach, centred around purposive sampling, was utilised. Participants were not randomly selected from the population. Instead, they were selected based on their work experience, position in the organisation, and their perceived contribution to the research study. Since a purposive sampling design was used, two goals needed to be met to ensure the sampling design was valid – representativeness and comparability. Firstly, sampling had to be done such that instances found were representative of a particular type of case on the dimension of interest. Secondly, sampling needed to achieve comparability across different types of cases on the dimension of interest.

While the qualitative sampling was centred around purposive sampling, the mixed sampling approach used a combination of typical case sampling, convenience sampling, intensity sampling, and reputational case sampling. The typical case sampling approach would allow the researcher to gain a firm understanding of the typical case being studied in the research study – that of a typical employee working at an engineering company in South Africa. Convenience sampling was utilised so that suitable participants could be interviewed – those participants who were perceived to offer valuable insights into the research questions. Furthermore, convenience sampling helped to identify suitable participants more easily given the constraints imposed by the Covid-19 pandemic, which made it more difficult to find participants through virtual means. Intensity sampling allowed for a select few, rich cases to be analysed, all of which were exceptional examples of the phenomena being studied. This could be partly achieved

through the convenience sampling process. Lastly, reputational case sampling was used so that additional participants could be identified through the assistance of existing participants, who would recommend other individuals that they believed could offer useful, rich information.

The table below shows the profiles for the interviewees who partook in the research study:

Participant Number	Age Range	Gender	Qualification	Years of Work Experience
1	20-25	Male	BSc Mechatronics	2
2	25-30	Male	BSc Mechanical Engineering	4
3	20-25	Male	BSc Mechanical Engineering	2
4	30-35	Male	BSc Civil Engineering	8
5	30-35	Female	MSc Mechanical Engineering	7
6	60-65	Male	BSc Electrical Engineering	40
7	45-50	Male	BTech Civil Engineering	20
8	20-25	Female	BSc Mechatronics	2
9	30-35	Female	BSc Civil Engineering	8
10	20-25	Female	BSc Mechanical and Mechatronics Engineering	3

Table 1: Profiles of the interview participants

3.3.3. Quantitative Data Collection

When developing the mixed methods approach to this research project, it was decided that a combination of a 40-item instrument in the form of a survey would be used in conjunction with a structured interview. The instrument questions have been included in Appendix C: Instrument (Survey) Questions, and a table of the responses have been included in Appendix D: Instrument (Survey) Responses. The instrument consisted of five sections: Mindfulness, Fatigue, Stress, Productivity, and Job Satisfaction. The instrument was comprised of existing questions from existing self-report questionnaires, which had been shown to be psychometrically valid. The instrument questions elicited a score for respondents in each of the five sections. The instrument could be completed by far more respondents compared to the interviews. The instrument took less time to complete and did not require any personal contact between the researcher and the respondents. The fact that many respondents were able to complete the instrument meant that the quantitative data collected would have improved validity and generalisability (Easterby-Smith et al., 2015). Lastly, the instrument assisted in meeting the research aims and answering the research questions. The instrument provided clarity when addressing the aim of gaining insight into the mental health situation in the corporate engineering sector in South Africa, and assisted in answering the research questions: “*How is mindfulness perceived to affect job performance in the engineering sector in South Africa*” and “*How can mindfulness improve mental health and well-being amongst employees in the engineering sector?*” This could be achieved as the instrument directly questioned respondents on their fatigue and stress, which are two latent variables directly related to mental health (Hülshager et al., 2013). Statistical analysis of the instrument, using linear regression analysis, allowed relationships to be established between each of the latent variables included in the instrument. This would assist in answering the two research questions mentioned above.

The instrument questions were made up of a combination of questions from the following self-report questionnaires, dealing with the following sections: Employees' level of mindfulness (Mindfulness Attention Awareness Scale (MAAS) (Brown and Ryan, 2003), Freiburg Mindfulness Inventory (FMI) (Walach et al., 2006)), stress levels (e.g. Job Stress Scale (Parker and DeCotiis, 1983)), and fatigue (e.g. Fatigue Assessment Inventory (FAI) (Schwartz et al., 1993)). Turnover intention can be elicited by simply asking employees in an interview what the probability is that they will stay with the same employer for the next two years; a method which has proven to be a valid measure of actual turnover (Jamal and Baba, 2000). Alternatively, a 4-item self-report measure (Kelloway et al., 1999) also exists to determine employees' turnover intention. All the self-report questionnaires listed above have been previously shown to be psychometrically valid.

3.3.4. Qualitative Data Collection

The structured interview made up the qualitative aspect of the mixed methods approach and helped to gain insights into the research questions and aims. Due to COVID-19 health protocols and for the convenience of the respondents, the interviews took place in a virtual environment via MS Teams. While some of the subtler gestures and facial expressions may have been unobservable or overlooked through a virtual meeting environment, the quality of the audio and video recordings were sufficient to be able to effectively interpret what the participants were conveying.

The interviews directly questioned the mental health situation in the engineering sector in South Africa, as well as the perceptions of mindfulness among engineers working in South Africa (*"How would you describe the broad mental health situation in the engineering sector"* and *"What does the term 'mindfulness' mean to you? What do you understand by it?"*). These questions directly assisted in answering two of the research questions that were posed in the research proposal. In addition to this, the interview also helped to answer the two research questions (1) *"How is mindfulness perceived to affect job performance in the engineering sector in South Africa?"* And 2) *"How can mindfulness improve mental health and well-being amongst employees in the engineering sector?"*) as respondents were questioned about how they understood mindfulness being able to improve certain job performance characteristics.

Various interviewing techniques, such as laddering up and down were also employed as the interviews took place. This helped to elicit richer data from participants and assisted in answering the interview questions more holistically.

3.4. Data Analysis

3.4.1. Quantitative Data Analysis

The quantitative aspect of this research study involved the self-report instrument (survey). Statistical analysis (more



specifically, linear regression analysis and descriptive statistics) was used to analyse the responses. Responses were collected on Google Forms, using a linear scale of 1 to 5 to capture the response to each question. The system adopted was similar to the Likert-type scale for surveys. A rating of 5 corresponded to ‘Always’, while a rating of 1 corresponded to ‘Never’. This meant that a higher score for a latent variable would mean that the participant experienced that state more frequently or to a greater extent compared to a participant who received a lower score for a section. An image of the linear scale is shown below:

Figure 2: Image showing the linear scale rating system for the surveys.

Responses were exported to Microsoft Excel, where they were amalgamated into a spreadsheet. Respondents were given a score for each section (corresponding to the latent variables of stress, fatigue, productivity, mindfulness, and job satisfaction) of the instrument by summing each of the individual question scores (between 1-5) for that specific section. From the tables created in Microsoft Excel, the numerical instrument data was imported into *Statistica*, the statistical analysis software used for the research study. This software was used to conduct descriptive statistical analysis and linear regression analysis of the survey data, which would help in establishing relationships between each of the latent variables (Stress, Fatigue, Job Satisfaction, Mindfulness, and Productivity).

Once the instrument data had been imported into *Statistica*, a command was run to produce a summary of descriptive statistics, which would provide insights into the nature of the collected data, such as the mean, median, quartiles, range, variance, and standard deviation. Next, linear regression analysis was conducted, with each of the latent variables taking a turn to be kept as the dependent latent variable, while the remaining four sections were used as the independent latent variables that each effected the dependent latent variable. Results were exported as visual representations in the form of scatterplot diagrams and distribution curves, which made it easy to observe the emergent relationships between each of the five sections, and how accurately these theoretical relationships could predict outcomes through correlations. Additionally, box-and-whisker diagrams were constructed for each section in the instrument so that the spread of the data could be observed, which would allow for additional insights into the data.

For the linear regression analysis, the correlation, p-value, and correlation type were identified. Results were deemed statistically significant if a p-value of <0.05 was returned, indicating that the null hypothesis could be disregarded. The table below defines the correlation strengths, with correlations given as absolute values:

Correlation (absolute values)	Strength
0.0 – 0.2	Very Weak
0.2 – 0.4	Weak
0.4 – 0.6	Moderate

0.6 – 0.8	Strong
0.8 – 1.0	Very Strong

Table 2: Correlation values and categorisation for statistical regression analysis

3.4.2. Qualitative Data Analysis

Qualitative data was analysed by the researcher to develop findings and conclusions, and therefore had the potential to be influenced by the researcher's preconceived values, beliefs, and understandings. In other words, the researcher themselves could be viewed as a tool for gathering data. It was therefore important to maintain awareness of researcher bias and integrity of the research process, while limiting researcher bias and upholding the integrity of the research as far as possible.

Structured interviews made up the qualitative aspect of the mixed methods approach. The interviews were recorded using an audio recorder and saved using code numbers in order to protect the privacy of the participants. The audio recordings of the interviews were played back and transcribed verbatim into a Microsoft Word document. The transcribed interview data was imported to a software used for qualitative data analysis, called *NVivo 12*. Content analysis was used to analyse the data, which were coded using an inductive approach, meaning there were no predetermined codes prior to the data analysis. Rather, the transcribed data were analysed for any emergent codes, allowing the data to naturally unfold and tell their own story. Using an inductive coding approach, the effect of the researcher bias could be somewhat mitigated, thereby improving the validity and credibility of the research. The emergent codes from the transcribed interview data were then assigned into broader themes and categories. Emergent codes were assigned to deductive themes and categories, which had been pre-determined prior to the data analysis taking place. The inductively determined codes and sub-categories were assigned to the primary categories, which included job performance, mental health, workplace well-being and environment, and mindfulness. The coding was done iteratively, and was repeated so that emergent ideas, categories, and themes could be assigned to their respective codes. This ensured that the data analysis was performed to a higher level of accuracy and stability (intra-rater reliability).

After performing coding of the themes and categories, inductive coding of emergent relationships was performed. Whenever an interviewee related two or more themes/categories together in some way, a relationship emerged. Through coding the relationships, a clearer picture could be painted of what was being said by the interviewees, and how various categories related to one another.

Once qualitative data analysis had been completed, quotes that were used from the interviews were stylistically edited by removing filler words and phrases (such as 'like', 'and stuff like that', 'um', etc). This was done so that readability could be improved, while also reducing the total word count.

3.5. Validity and Trustworthiness

When conducting research, the validity and integrity of the study must consistently be upheld. Validity questioned *why* the results obtained should be believable – how could the results and subsequent conclusions be incorrect, and what other plausible alternatives could be used (Maxwell, 2013)? In constructionist-based research designs such as this research study, there is particular concern as to how the quality can be ensured, and here trustworthiness was an important consideration. Three criteria had to be met, namely: Authenticity (convincing the reader that the researcher has a deep understanding of the topic being studied), plausibility (research must be related and linked to ongoing

interests and concerns among other researchers), and criticality (encouragement of the reader to question any assumptions, results, and thereby offer something new (Easterby-Smith et al., 2015)). Silverman (2000) suggested that qualitative research should include a more objective approach to maintain the validity of the research, given the lack of 'safeguards' that prevent the researcher from only selecting evidence that supports their arguments and theories.

Silverman suggests that the following criteria should be achieved to obtain a more objective approach: refutability (examples that argue against current beliefs), constant comparison (looking for new cases and settings which will build upon current and existing theory), and comprehensive data treatment (involves the analysis of all data available before developing conclusions). In addition to the abovementioned criteria, results should be obtained through using a transparent methodology, while clearly stating what processes led to the selection of participants, how data was collected and interpreted, and how the researcher felt about the research (Easterby-Smith et al., 2015).

3.5.1. Validity Threats

To ensure that academic validity was maintained throughout the research study, it was necessary to be aware of any potential validity threats that may have arisen. According to Maxwell (2013), there are two main threats to validity that arise during qualitative research projects; namely researcher bias and reactivity. Researcher bias refers to the ways in which the data collection and analyses could be influenced and distorted by the researcher's preconceived ideas, beliefs, psychological constructs, and understandings of the world. Since it was impossible to fully eliminate researcher bias, the goal was not to eradicate its presence, but rather to acknowledge and understand the effects it may have on the results and conclusions obtained and aim to work around these effects.

Reactivity refers to the effect of the researcher on the setting or individuals studied. This validity threat was particularly prevalent when conducting interviews, as the interviewer had a significant and unavoidable influence on any interview data collected. What is said by the interviewee in an interview is a function of what is asked or said by the interviewer and the interview situation. Like researcher bias, the goal was not to eliminate the effect of reactivity, but rather to understand how the interviewee's responses were being influenced by what the interviewer said, and how to most productively and ethically use this influence to answer research questions (Maxwell, 2013).

According to Maxwell (2013), there are various means through which validity threats can be minimised. The first way of achieving this was through using intensive, longitudinal studies, as this would provide more complete data than any other methods (data collected in this way are more direct and less dependent on the interface, and a greater volume and variety of types of data can be collected). 'Rich data', such as the data collected in the form of interviews, can contribute towards maintaining the validity. 'Rich data' includes detailed, intensive interviews that provide a full picture of what is going on in a situation. This involved verbatim transcripts of the interviews during analysis. Respondent validation involves requesting feedback from interviewees on the interpretation of the data collected during an interview, and further contributed towards upholding the validity of the research study. This allowed interviewees to confirm that no misinterpretations came about when the researcher was analysing the data and developing the conclusions, and thereby maintained the validity of the research study. Lastly, triangulation is the process of collecting data from a diverse range of individuals and settings, using several methods. This was achieved in this research study through utilising various methods of data collection, from a range of individuals. Triangulation upheld validity as it reduced the risk of chance associations and systematic biases due to a specific method and allowed for an improved assessment of the generality of the study.

The measurement of the latent variables using the survey as an instrument may have raised validity issues. Respondents were asked questions that corresponded to the latent variables, but these could not directly measure degree to which respondents experienced the latent variables. Furthermore, some of the survey questions may have been misunderstood or misinterpreted. These factors may have posed a threat to the validity of the quantitative aspect of this research study. By using multiple questions that corresponded to a single latent variable, the accuracy of the indirect measurement of the latent variables could be improved, thereby reducing the validity concerns to a degree.

3.5.2. Contextual Threats to Validity

There are various contextual variables that have the potential to influence the validity and trustworthiness of the data collected, as participants may not answer completely truthfully given the context. Contextual variables may include political, economic, social, cultural, historical, or organisational factors. In South Africa, and indeed much of the world, the engineering workforce is dominated by men (McCabe, 2019). Culturally and socially, men are generally perceived to be less emotionally expressive, and are therefore more likely to keep mental health struggles to themselves and would be less likely to admit to struggling with mental health during an interview.

3.5.3. Maintaining Validity

To ensure that validity and trustworthiness was maintained throughout the research study, a triangulated approach was utilised. In other words, different research strategies were used so that corroborating evidence from a variety of methods could be obtained and analysed. The advantage of this was that different research strategies exhibit different strengths, and often trade-offs are made if a single research strategy is adopted. In this research study, data were collected through qualitative interviews and quantitative surveys. While surveys assisted in maximising generalisability and reliability, they were low in terms of realism of context and precision of the measurement, while also lacking depth. On the other hand, interviews maximised depth and realism of context, but were low in generalisability (Scandura and Williams, 2000). Through using a triangulated approach, the research conducted improved the ability to draw conclusions from the results, while maintaining the trustworthiness and validity of the research study.

The validity of the quantitative survey instrument could be maintained through ensuring internal validity, external validity, and statistical conclusion validity. Internal validity dealt with causality; the confirmation of cause-and-effect relationships between two variables which could be asserted if there was true covariation between the variables, the methods used to gather the data showed that the cause always preceded the effect, and alternative explanations had been discarded. External validity referred to the extent to which the results were generalisable across other contexts, including at different times, settings, and amongst different individuals (Scandura and Williams, 2000). This could be ensured by selecting a representative sample group from the population, which was ensured through the sampling design for the research study. Lastly, statistical conclusion validity referred to the ability to draw conclusions on the basis of statistical evidence of covariation through statistical analysis of the survey data. Through performing linear regression analysis, clear statistical relationships could be established between the latent variables under investigation.

The trustworthiness of the qualitative interviews could be maintained through credibility, transferability, and dependability. Credibility referred to the extent to which the results of the research accurately represent the lives and realities of the research participants in ways that the participants recognise and agree with. This aspect of trustworthiness could be maintained through the researcher's familiarity with the subject matter under investigation

(content-related credibility) and through communicative credibility, where participants were given the opportunity to review the conclusions and results drawn from the interviews and confirm the extent to which they were true (Collier-Reed, 2020). Transferability referred to the extent to which the results of the qualitative interviews could be generalised or transferred to other contexts. In this case, it was not the responsibility of the researcher to prove the transferability, but rather to offer the supporting data to suggest that the findings could be applicable in other contexts. This could be achieved through offering a thick description of the phenomenon (Lincoln and Guba, 1985). Lastly, dependability referred to the evaluation of the quality of the integrated process of data collection, data analysis, and the drawing of conclusions and theories. According to Lincoln and Guba (1985), a dependable study should be both accurate and consistent (repeatable). This could be achieved through an inquiry audit, whereby an external researcher examined the process of data collection, data analysis, and the results of the study.

3.6. Ethical Considerations

Since the data collection for this research study involved human participants, it was necessary to conduct the research while maintaining ethical considerations to a high standard. When engaging with participants and the data that were collected, whether through surveys, interviews, or any other interactions, it was critical that the correct ethical stances were assumed during the collection and analysis of the data.

Prior to any data being collected, participants were given a clear, unambiguous explanation as to what exactly the research entailed, as well as the reasons and motives as to why the research was being conducted. This helped to avoid deception surrounding the nature and aims of the research – an important aspect of ethics in management research (Easterby-Smith et al., 2015). To confirm their understanding and willingness to participate, participants were required to explicitly state their consent (during the interviews) or provide written consent (during the survey). Participants were notified that at any point, they were free to disengage from the research process, and that they were under no obligation to complete the interviews or surveys.

Given the personal nature of the research methods used (surveys and interviews), it was crucial that the dignity and privacy of the participants was upheld. For example, the privacy of individuals' and organisations' identities were kept private by using code numbers when naming files and analysing data, rather than using their real identities. This ethical consideration draws on *Rights Ethics*, which also considers the personal safety of entities involved in research.

With the Covid-19 pandemic affecting the way in which people interacted, it was of utmost importance that the correct health and safety protocols were adhered to (as stipulated by the laws put in place by the South African government) to ensure the safety of the participants. Where possible, interviews were conducted virtually to avoid face-to-face contact, thereby preventing the spread of Covid-19 and ensuring the safety of the participants. In the instances where face-to-face interviews were unavoidable, strict health and safety protocols were adhered to. Surveys were distributed virtually, and therefore posed no health or safety risk to participants. This helped to ensure that no harm was done to participants, and is in agreement with the Ethical Codes and Principles in Management Research (Easterby-Smith et al., 2015). The virtual nature of the interviews also made the interviewing process more streamlined and efficient, since neither the researcher nor the participants needed to travel and find excessive time to take part in the interviewing process.

Furthermore, this research study drew on *Care Ethics*, derived from Feminist Theory (e.g. Riley (2013)). This branch of ethics is centred around morality and decision making that involves demonstrating care and respect towards

participants. Since some of the questions in the interviews may have resulted in unforeseen or unexpected emotional responses from participants, it was important that at any time, interviewees felt safe enough to end the interview. From the interviewer's side, it was important to observe the responses from the interviewees so that emotional support, assistance and care could be offered if it was clear that the interviewees were becoming uncomfortable or were experiencing strong emotional responses invoked by a question.

4. Findings

This chapter deals with the development of the findings from the analysis of the data that were collected for this research study. This chapter aims to report the findings with consideration of the trustworthiness criteria discussed in the methodology chapter. This chapter will present the codes and categories that emerged from the initial data analysis phases, before using content analysis to establish the findings from the qualitative interviews. Statistical analysis was performed on the survey instrument data to establish the quantitative findings, using a combination of descriptive statistics and linear regression analysis.

4.1. Findings from Qualitative Data Analysis

As indicated in the previous chapter, the structured interviews were conducted using the themes of: 1) job performance, 2) well-being, 3) stress, 4) mental health, 5) workplace environment, and 6) mindfulness. Only the primary categories listed were established using a deductive approach. All sub-categories and codes were revealed through an inductive approach. The table below shows the themes and subthemes that emerged from the analysis and the frequency with which these concepts appeared in interview transcripts:

Theme	Sub-theme(s)	Example(s)	Frequency
Job Performance	Personal Skills	Learning, time management, initiative, technical ability, quality of work	78
	Interpersonal Skills	Communication, teamwork, emotional intelligence	75
	Productivity	Task completion, output, efficiency, focus	72
	Attitude and Motivation	Hardworking, quality, turnover intention, overtime, complacency, fulfilment, challenges, problem solving, enjoyment	68
<u>Total Frequency:</u>			293
Mental Health	Personal Mental Health	Burnout, overwhelm, stressors, workload, and mental state on a personal level	100
	Collective Mental health	Burnout, overwhelm, stressors, and mental state from an organisational or industry-wide perspective	32
	Stress and Fatigue	Overwhelm, calm, emotions and feelings, distractibility, vulnerability	25
<u>Total Frequency:</u>			157
Workplace Well-being and Environment	Company Culture and Support	Company culture, Company support, Care, Wellness organisations	40
	Turnover Intention and Job Satisfaction	Turnover intention, Job satisfaction, Opportunities	13

<u>Total Frequency:</u>			53
Mindfulness	Perceptions of Mindfulness	Presence, meditation, attention, awareness	36
	Perceived Benefits of Mindfulness	Personal development, interpersonal traits and skills, communication, physiology, attention, focus, learning, stress management	58
<u>Total Frequency:</u>			94

Table 3: Themes, subthemes, emergent codes, and their frequency from the findings

4.1.1. Job Performance

Participants were asked which traits or skills they perceived would contribute to successful job performance as an engineer. Three traits were elicited from each participant. The most prominent trait linked to job performance as an engineer was identified as time management, which was reported by 60% of the participants. Interpersonal skills were perceived to be the second-most important trait as 50% of the participants viewed social skills in the workplace as being fundamental to successful job performance and personal development in the workplace. In this context, the term ‘social skills’ was used to describe any traits and skills that dealt with interpersonal relationships, and included the following subheadings: teamwork, communication, and emotional intelligence. Learning or asking questions was the third-most prominent trait perceived to contribute to successful job performance as an engineer. 30% of the participants shared this view and believed that if an engineer was dedicated to consistent learning, they would be a more successful engineer. Other perceived traits to determine successful job performance for an engineer, which were proposed to a lesser extent by participants, included attention to detail, task completion, taking initiative, resource management, quality of work, self-image, problem solving, and technical ability. The primary theme of job performance was split into subthemes, including personal skills, interpersonal skills, attitude and motivation, and workplace responsibility. Each emergent code was assigned to a subtheme, which are highlighted below.

4.1.1.1. Personal Skills

Personal skills and traits included the following codes: time management, attention to detail, quality of work, technical ability, learning, resource management, and initiative.

Participants 1, 2, 3, 4, 5, and 8 believed that good time management skills would result in being a more successful engineer in the workplace. Although not all participants used the same wording, the quotes below highlighted a common theme of time management. Participant 1 believed that being able to meet deadlines was crucial, whereas participant 2 stated that ‘staying on top of things’ was a trait perceived to enhance job performance. Participant 2 argued that time management was important since it relates directly to task completion and output – an important metric utilised by the managers in the organisation they worked for. Participant 3 agreed that meeting deadlines was important for engineering professionals, and participant 4 argued that time dependency was a critical aspect of being a successful engineer. Participant 5 spoke about the importance of completing jobs timeously, and participant 8 also highlighted the importance of having good time management skills in the workplace as an engineer.

“You need to be deadline orientated, so it doesn’t really matter how much work you do, as long as you make the deadlines.”

[Participant 1]

“Output and task completion and staying on top of things – not forgetting about stuff is probably number one, at least for us, that’s how they evaluate our performance. I also think being able to tackle difficult things that you don’t know how to do without, like, being too panicked about it could help.” [Participant 2]

“As an engineer, I’d say the first one easily is meeting your deadlines, and you do that by any means necessary – if you have to stay after hours to get that done, you get it done.” [Participant 3]

“Your time dependency – whether you are delivering your project and reaching your deliverables.” [Participant 4]

“I’d say completing jobs timeously.” [Participant 5]

“Time management – you have deadlines, and you should meet them. If you don’t meet them, then it’s your fault. Luckily, I have flexible working hours, which is quite nice, so then I need proper time management to get in the hours.” [Participant 8]

Participant 2 believed attention to detail would enhance job performance as an engineer, considering the intricate details that are involved in engineering work. This was a view shared by participant 4 and participant 5, who suggested that attention to detail went together with quality of work, implying that there was a direct relationship between the two variables. Quality of work would uphold an individual’s, organisation’s, and the industry’s professional dignity and would reflect well on an individual’s technical ability. If an employee demonstrates technical proficiency and high-quality work, they are more likely to be promoted, receive salary increases and increased responsibility within an organisation. Participant 4 shared the belief with participant 5 that quality of work was another important personal skill in being a successful engineer, while participant 9 shared the belief that attention to detail was an important factor. In addition, participant 9 believed that technical ability and having a good understanding of scientific principles was important to engineers, given the complex, scientific nature of the challenges that they are expected to solve.

“Being detail oriented, and not having to do the same thing more than once. For example, if you have to apply for something and in your application you made a mistake, and the process takes 6 months to get it back to get the approval, and it has an incorrect detail, then you have to start from square one again.” [Participant 2]

“Then quality of work, and with that goes attention to detail.” [Participant 5]

“... and then quality of your work.” [Participant 4]

“Definitely attention to detail. For engineering, obviously good understanding of science, scientific principles.” [Participant 9]

Participant 3 stated that doing extra research into the task at hand was an important indicator, which was related to personal skills. Doing additional research on one’s own accord would tie in to the subtheme of learning. The participant explained that by doing one’s own research, one could avoid asking their supervisor questions. The participant believed that asking excessive questions may indicate a lack of ability on their part and believed that it might annoy their supervisor. On the other hand, by learning how to figure out things for oneself without the help of others is an effective way to learn, although significantly more effort is required. Participant 8 argued that asking

questions and learning, especially when new to a job, was an important indicator of successful job performance as an engineer – a view similar to the perception shared by participant 3. Participant 8 explained that new employees starting out in the workplace were assumed not to have sufficient knowledge to be able to do everything that their job entailed and argued that it was important to seek assistance when required. The participant believed that putting aside one's pride and ego, and being willing to ask for help, could lead to improved job performance. This is because significant time could be saved trying to figure out how to do something for oneself.

“Doing after-hours research if you're not sure about something or you're not sure about a concept; doing extra research to make sure you understand what you need to be doing, if there is anything unclear about it, if you can avoid asking your supervisor and just try figure it out for yourself if you've got the time. So, learning even when it's not part of the job description.” [Participant 3]

“At my level, mainly ask questions, because obviously you don't know anything when you first go in, so you need to find out from everyone else. A lot of the time I have been stuck at a place and I've been too scared to ask a question, so it takes me 2 days doing nothing until I eventually pluck up the courage to ask them like: “Hey, how do I do this?” [Participant 8]

To a lesser extent, participants perceived resource management and taking initiative to be important personal skills in being a successful engineer. Participant 4 perceived resource management to be a personal skill that would improve the job performance of engineers. Finances are considered an important organisational resource, so being able to effectively manage one's financials would be related to effective resource management.

“Managing your financials – whether you're making a profit or loss.” [Participant 4]

Participant 8 believed that taking initiative was an important personal skill. They explained that often as a junior engineer, supervisors and managers were too busy to constantly be assigning work and delegating tasks to them. The participant stated that by taking initiative and actively seeking work and figuring out how to complete tasks, an engineer's job performance would be improved.

“Taking initiative, but when you're in a junior position, everyone at the top is so busy that they don't always think about you, to give you work, so sometimes you need to go find it – ask people if they have anything for you to do, anything to help with, and you need to take charge of your projects.” [Participant 8]

4.1.1.2. Interpersonal Skills

The subtheme of 'interpersonal skills' referred to any skills or traits possessed by individuals which affected their ability to relate to colleagues and other people. This subtheme involved the following codes: social skills, teamwork, communication, conflict resolution, emotional intelligence, and asking for help.

Participant 1 claimed that teamwork was important in being a successful engineer. The participant explained that in the workplace, it was impossible to do everything oneself, and that it was important to seek assistance and ask for help when required. The participant suggested that this would help an individual complete their tasks and thrive in a team environment. Since organisations are built around teams, effective management, and human capital, it follows that being able to work well in a team would contribute to being a more successful engineering employee. Participant 9 shared a similar view to participant 1 that people skills in general, more specifically teamwork, would result in an individual being a more successful engineer.

“Teamwork is a big one, especially in the working environment where you can’t do everything yourself – it’s not possible. You have to rely on others to do the work they need to do.”

[Participant 1]

“Definitely people skills, in terms of working in a team. I don’t think you can be an engineer without that.”

[Participant 9]

Participant 3 suggested that responsiveness (communication) was an important factor in being a successful engineer. Communication is a fundamental interpersonal skill, particularly in an organisational context when working with others in a team environment. Participant 10 also perceived communication as an important interpersonal skill in being a successful engineer, although they referred to being able to communicate and convey ideas, rather than responsiveness as participant 3 suggested.

“Another one would be responsiveness to emails, Slack requests, anything else anyone needs help with.”

[Participant 3]

“The ability to communicate and convey ideas, and that would include conveying large ideas in a simple and easy to understand way.”

[Participant 10]

Participant 6 believed that emotional intelligence could improve an engineer’s job performance. Emotionally intelligent individuals have a greater capacity to manage interpersonal relationships through higher emotional intelligence and awareness, while also being able to manage their own emotions more effectively. Emotionally intelligent individuals are therefore more equipped to deal with stress, conflict, emotional labour, and emotional reactivity. Emotional intelligence also implies that one can relate to others’ emotions too, which would be beneficial when working in a team environment within an organisation, particularly when it comes to conflict resolution and communication. Participant 10 shared a similar view to participant 6 and perceived emotional intelligence to be the most important factor that contributed to successful job performance as an engineer. In addition, the participant believed that emotional intelligence would enhance improve one’s interactions with others, that it would assist individuals in communicating ideas more effectively, and that it would help employees in giving and receiving constructive criticism and feedback.

“Emotional intelligence, I can’t think of a better word for it than that. It’s cliché, but emotional intelligence.”

[Participant 6]

“Emotional intelligence – so being able to understand people and how they feel in certain scenarios, and the correct way to interact and communicate ideas, especially when it comes to our constructive, critical feedback. I’d say it’s the most important one to me.”

[Participant 10]

4.1.1.3. Productivity

The interview aimed to elicit responses from participants such that productivity in the engineering sector could be explored. Since productivity was directly linked to job performance, having a clearer understanding of individual and collective productivity assisted in having a clearer perspective of job performance.

Factors Affecting Productivity

Participants generally reported that their personal productivity in the workplace was reasonable, but that it fluctuated based on certain factors. 30% of the participants reported experiencing higher productivity when they had a higher workload and were moderately stressed, while 20% of participants claimed to be more productive when they enjoyed the task that they were working on. To a lesser extent, participants reported that socialising led to a decrease in productivity, as did having too much time on one's hands.

Participant 3 reported that their personal productivity in the workplace fluctuated and reported that it was average to good. They suggested that their productivity dropped when they had late nights socialising outside of the workplace. This may have led to tiredness and fatigue in the participant, which may have contributed to lower productivity at the workplace.

"My productivity in the workplace fluctuates. When I first started, it was very good, then ironically, when they lifted the curfew it started fluctuating, because socialising became a thing again. There was a little blip between December and February, but I'd say at the moment it's average going back up to good."

[Participant 3]

Participants 4 and 6 suggested shared similar perspectives in that enjoyment of the task at hand would result in an increase in productivity. Participant 6 went on to state that productivity to them meant to get more out than what they put into a certain task or project.

"If I enjoy the task that I'm doing, I'll be a lot more productive."

[Participant 4]

"I work because I enjoy work – I like managing people, I like the projects. So, I would say, productivity is what I put in, and what I get out. Personally, I get more out of it than I put in."

[Participant 6]

Participant 5 suggested that although their productivity fluctuated, they generally experienced good levels of productivity. They explained that their productivity decreased when colleagues were not around, since most of them chose to continue working remotely.

"At the moment it's been less productive because I don't have people around me, because I'm the only one working in the office while everyone else is working remotely. But, in general, I'd say my productivity is quite high. I mean you always have ups and downs, good and bad days, but in general pretty good."

[Participant 5]

Participants 2, 9, and 10 claimed that their workload and the amount of pressure on them to complete a task would affect their productivity. Generally, these participants reported that when pressure was higher and deadlines were approaching, they were more productive. Participant 2 explained that a higher workload and greater urgency would result in their productivity improving, due to the urgency of the task and the consequences of missing the deadline, which may lead to disapproval from supervisors and managers, or disciplinary action in serious cases. The participant also reported feeling less productive when they had less work to get through and the task completion was not urgent. They claimed to not work as hard when periods of lower intensity workloads arose. Participant 10 partly attributed their productivity to their ADHD diagnosis, claiming that some individuals who suffered from ADHD had the ability to focus exceptionally well. The participant also believed that there was a positive correlation between workload pressure and productivity, suggesting that at their workplace they were experiencing a lower workload compared to university, and this had reduced their productivity levels.

“My productivity is dependent on the urgency of whatever we’re doing, so when we’re very busy, I can be very productive, and when we’re not, I tend to slack off a little bit – I’m not really one to find extra stuff to do if there isn’t anything on my plate; I don’t go search for anything. I think a higher workload makes me more productive, but that’s also related to my definition of productivity.”

[Participant 2]

“My productivity varies –approaching a deadline it’s much higher, but when it’s not, it’s a bit lower.”

[Participant 9]

“I’m quite ADHD, and I can hyper-focus, and that’s why it never really affected my grades or anything, because I loved what I was doing, and the pressure on me to do what I was doing was big enough for me to be able to focus on what I was doing. In the workplace, it’s lower pressure than university I find, so in those gaps I often struggle to be productive, so I’ll mess around for half the day then finish all my work in like 2 hours. So, I think that my productivity is good, but I think that it could be better.”

[Participant 10]

Most of the participants reported that their productivity in the workplace fluctuated, and that the fluctuations were largely due to workload and pressure. A significant proportion of the participants claimed that high pressure and bigger workloads would lead to higher personal productivity, and that periods of lighter workloads and lower pressure often led to a drop in productivity and increase in complacency. Several of the participants reported that they were more productive when they enjoyed the task that they were engaged in, and they were fulfilled by the work they were doing.

Collective Productivity

The perceptions of the broader engineering sector productivity were generally positive. Most participants reported that the productivity in the South African engineering sector was above average to exceptional, with 30% of participants claiming that South African engineers were amongst the most hardworking and productive in the world. 20% of participants claimed that governmental institutions were a threat to productivity in the engineering sector, and a further 20% reported that productivity in the South African engineering sector was challenging due to the high competition between organisations.

Participant 3 noted that engineers generally seemed to be ‘on top of it’ and appeared to be productive at the workplace.

“I can’t say anything negative about it – everyone seems very on top of it.”

[Participant 3]

Participant 4 reported that productivity in the engineering sector in South Africa was challenging due to the highly competitive nature of the industry. Since the national economy had been struggling over the past few years, there was less capital available to put into developments and new, large-scale projects. This led to many organisations competing for a small number of available jobs, and in order to remain competitive in their pricing, organisations were being forced to substantially drop their profit margins. The participant reported that profit margins used to be up to 15%, whereas in the present day, profit margins are as low as 1%.

“It’s challenging because everyone is trying to outprice each other and win work – there’s a lot of pressure on, not so much productivity, but efficiency in the industry – trying to get the job done as cheaply and quickly as possible. A few years ago, contractors would price a job with a 10-15% profit margin, now companies are

pricing it with a 1% margin. The other day, we put together a tender for building a school, and 35 companies put tenders on it.”

[Participant 4]

Participant 6 shared a similar view to participant 4 with respect to competition. They reported that when it came to working on projects, their organisation's productivity was good, although when it came to preparing bids and tenders, they were unproductive and received high competition from other organisations. The participant claimed that significant work and effort was put into the preparation of bids and tenders, and the organisation would lose them frequently due to issues such as non-compliance, overpricing due to high competition, and the presentation of the bids. The participant suggested that their organisation lacked productivity in this area since the output received from the preparation of bids was far less than the time and effort required for the input.

“On this project specifically, we are very productive, and we can see the difference we're making to the final product – it's very satisfying. But when you talk about the other side of it, where we have to prepare bids for proposals – that's a different ball game; there we're very unproductive because we are preparing multi-million Rand bids, and we're losing them because of non-compliance, overpricing, and the presentation of our bids. Now the overpricing – it's not forgivable, but it's understandable because we're in this very aggressive, competitive market at the moment. So, on the project side of things, I think we're great, but on the business development side, I think we are not doing too well. Our output versus our input is not where it should be, so if we can turn that around, then that will be a game changer for us.”

[Participant 6]

Participant 7 perceived the South African engineering sector to be a productive workforce. They related productivity in the sector to problem solving, and claimed that within the engineering sector, there is likely someone, somewhere, that would be able to achieve or accomplish nearly anything. The participant linked productivity with quality of work outputs, as they jokingly said that South African engineers are not building bridges that collapse.

“I'd say we are productive. We don't make laptops or whatever, but in the premises of what we do, I'd say we are productive, because I'm sure there's someone somewhere in this industry that can do just about anything. So, in the broader sense, I'd say we are productive, yes. We're not building bridges that collapse!”

[Participant 7]

Participants 8 and 9 claimed that South African engineers were amongst the most productive and hard-working in the world. Participant 9 noted that many international companies seek out South African engineers and engineering organisations due to their competitive pricing and 'effectiveness'. Participant 9 claimed that South African engineers took pride in their work, and that this resulted in a higher overall quality of work. The participant suggested that international companies were known to approach South African engineers and engineering organisations to do work for them, given their productivity and cost effectiveness. Participant 10 suggested that the reason that South African engineers are as hardworking as they are, is because of effective South African university syllabuses. The participant believed that the rigorous engineering curricula in South Africa helped equip engineering students with the necessary skills to develop hardworking, resilient traits in the workplace.

“We are very productive. A lot of overseas companies come to us because we're cheap, and effective – effective in a time sense and a productivity sense, and we do take pride in our work. All our foreign investors and stuff, a lot of them come to South Africa, because there's lots to develop here, and the engineers are cheap.”

[Participant 8]

“I think we work hard. I think South African engineers are some of the most hardworking people, and I’ve heard that from a few different people. If you go overseas, they love South Africans, just because they know how hard we work, and I think it comes from how our university was structured – our workload was really high, so if you’re given something, you do it.”

[Participant 10]

Participant 9 believed that South African engineers were productive in the workplace but claimed that the government was a threat to productivity – a view shared by participant 2. Participant 9 explained that engineers would meet deadlines quickly, and that they were effective at managing resources, such as employees, in order to complete tasks in a timely manner. The participant also mentioned that the client was the biggest priority in the consulting engineering industry, and that the client’s needs and demands had to be met at all costs.

“Engineers are definitely productive. I think the problem is the government and that stuff that holds us back. But we meet the deadlines quickly. If we don’t have enough people on our team, we pull people from other teams to make things work. The client is always right, so we’ll always do something to meet the deadline.”

[Participant 9]

Participants generally perceived South African engineers to be moderately to highly productive in the workplace. 20% of the participants reported that South Africans were widely recognised as some of the most productive and hardworking individuals in the world, and that many international companies approached South African organisations and individuals to complete work for them. A further 20% of the participants believed that although most engineering organisations in South Africa were productive, governmental institutions threatened their productivity through poor communication and lack of productivity on their part.

4.1.1.4. Attitude and Motivation

The subtheme of attitude and motivation referred to personal skills or traits were related to employees’ attitudes towards their work and their motivating factors to produce work of a high standard. The subtheme included codes such as willingness to learn, enthusiasm, enjoyment, fulfilment, challenges, problem solving, and general attitude.

Participant 5 stated that willingness to learn and enthusiasm were especially important for young engineers in the early phases of their career. These traits would imply a healthy, positive attitude towards one’s job, which could indicate potential future success as an engineer. If young engineers were willing to learn, they would become more knowledgeable in their field compared to colleagues who did not engage in constant learning, therefore making it a beneficial trait to possess. Enthusiasm and a good attitude towards work-based tasks would make the work more enjoyable, which would encourage employees to engage with their tasks on a deeper level while producing work of a higher standard.

“For junior engineers, it’s willingness to learn and be enthusiastic about things.”

[Participant 5]

Participant 6 believed that general attitude at the workplace was an important factor in being a successful engineer. The participant claimed that through a positive self-image, employees were also more likely to experience improved job performance as an engineer.

“I think it’s attitude, and that’s a heading of many subheadings. Your self-image, if I can say that – there’s also a whole lot of subheadings under that. Self-image, and, I can’t think of a better word, but motivated.”

[Participant 6]

Participant 7 believed that when an engineering employee was doing what they loved, their job performance would be enhanced. ‘Doing what you love’ ties in to fulfilment in one’s job and enjoyment of the tasks being carried out, and if an individual feels fulfilled and gets enjoyment out of their work, they are more likely to take pride in their work while aiming to produce work of a high standard. The participant suggested that by realising the purpose of one’s work, job performance could also be improved. The participant explained that engineering work often improves someone else’s situation or life, and that being aware of the bigger picture and how one’s work influences and uplifts society, one’s purpose as an engineer can be realised.

“When you’re doing what you love [one’s job performance could be improved]. As long as you don’t have to drag yourself to get through it. When you’re purpose-driven, when you’re doing something to improve someone else’s situation or life.”

[Participant 7]

Participant 7 claimed that actively looking for challenges could push engineers to reach greater potentials and improve their job performance. The participant believed that challenges in the workplace were important in staying motivated and suggested that if one does not feel challenged in the workplace, one is more likely to become complacent and careless. Being challenged in one’s workplace can push employees out of their comfort zone and make them realise what they are truly capable of. This may be extremely empowering and liberating to many engineers as they realise that they are capable of more than they expected, uplifting their job performance as a result.

“Adding to that, I’d say looking for challenges. Sometimes when you are not challenged, I’d say you become careless. If you’re not challenged, then you’re not motivated to improve anything you are doing.”

[Participant 7]

60% of the participants perceived time management as an important trait in being a successful engineer, and a further 50% reported that social skills were vital traits to possess in the workplace. 20% of participants believed that asking questions and learning were crucial in being a successful engineer, and 20% of participants claimed that attention to detail, attitude, and technical ability were important traits to possess. To a lesser extent, participants reported that self-image, purpose, resource management, and quality of work were important traits in being a successful engineer.

4.1.2. Mental Health in the South African Engineering Sector

Mental health in the South African engineering sector was discussed with participants, both on a personal level and an organisational/industry-wide level. Participants were asked to rate their own mental health in the workplace, as well as their perception of the broader mental health situation in the engineering sector in South Africa. The primary theme of mental health was split into personal mental health, collective mental health, and stress and fatigue, which was comprised of several further subthemes, namely ‘Relationship between stress and fatigue’, ‘Stress and fatigue amongst employees’, and ‘Effects of stress and fatigue on job performance’.

4.1.2.1. Personal Mental Health

When asked about their own mental health in the workplace, participant 1 claimed to have good mental health – an improvement from when they first began at their job. They suggested that they had struggled with mental health when they first started out due to poor working habits that they learned while studying at university, where they would work unnecessarily long hours in the pursuit of academic excellence. After adjusting to their new job, they managed to develop a healthier work-life balance.

“At the moment it [mental health] is good, but when I started working it wasn’t really the best – I used to stress a lot, but I think I’ve found my feet now, and it’s chilled. I think transitioning to a new job was a source of stress, and I tried to carry over lots of the habits I had from studying, like I’d make myself work long hours, but after a while, I realised I didn’t have to do that.”

[Participant 1]

Participant 2 reported that their mental health was generally good, but that it varied over time. The participant suggested that workload at their job and issues in their personal life were factors that could influence their mental health. Participant 2 revealed that they had primarily been working from home since the nationwide lockdown had begun, and that they were now starting to integrate back to the office environment. The participant stated that while they were living with housemates, working from home was preferable compared to when they were living alone. This suggests that socialising and interpersonal relationships contribute to mental health and job satisfaction. Participant 5 shared a similar viewpoint in that workload could impact their mental health. Participant 2 explained that their work was generally not detrimental to their mental health, and that it was only a minority where it was. Participant 5 reported that there were times where they felt overwhelmed due to a high workload, and that it was important to take a step back and prioritise their well-being. The participant claimed that some of their colleagues would overwork themselves to the point they started developing health problems which were likely related to the high stress levels they were experiencing.

“It’s [mental health] pretty good overall, but it definitely ebbs and flows a little bit depending on what the workload is like and what my personal life is like. I don’t think my work is detrimental to my mental health – if anything, it’s a nice thing to be able to go and do, 95% of the time. We primarily work from home, which I enjoyed more when I was living with housemates, but now that I’ve been living alone, I’ve actually been going to the office more often, even if there’s no one else in my team there it’s nice to just be in a different space.”

[Participant 2]

“I love my job. It’s a bit tricky now with work having been remote, but I really enjoy it and think also if you’re in the consulting industry, you’re not going to go into it unless you have an aptitude for high pressure situations. If you’re someone who likes to take it slow and methodically, it’s not the industry for you. I think for me, like there are definitely times where I feel overwhelmed and I turn it back a bit, but I’m better at doing that than some of my colleagues, who will go flat out and not stop and then have other health problems come up because of stress. So, I’d say it’s definitely a thing – there are people in our industry who suffer from the extra stress that the job comes with, but then it’s dealing with the stress that is often difficult...”

I think stress manifests in different ways. For example, I’ll often have neck problems, that correlate with stress, not just sitting down behind your computer; whereas other colleagues of mine have had bowel problems, which is a physical thing that I attribute a lot to stress. It’s hard to quantify because often things that go wrong, it’s hard to say: “This is because of stress”, which was going to happen in any case.”

[Participant 5]

Participant 2 explained that in order to maintain their mental health, they developed a healthy work-life balance, engaged in physical exercise, and cultivated interpersonal relationships. The participant reported that balance was important in ensuring that all aspects of life (physically, socially, emotionally, mentally) were taken care of, which they believed could lead to personal happiness.

“I very purposefully make sure that I make time for my exercise, and like friends, and my relationship and things like that, because I know that those are the things that make me happy.” [Participant 2]

Participant 4 believed that an individual’s mental health in the workplace context was dependent on the support offered by the organisation, a similar view to that shared by participant 9. Participant 4 reported that the construction company that they had worked for did not consider the well-being or mental health of their employees. This resulted in employees being overworked and not treated with care, which may have led to mental health issues among them. Having worked at both a construction and consulting company, the participant claimed that there was more care offered to employees at the consulting company. The participant also suggested that by having supervisors and management who had their employees’ best interests at heart, in conjunction with a lighter workload compared to while they were at the construction company, the workplace environment at the consulting engineering company was more conducive to mental health. Participant 4 described the consulting engineering workplace as less intense and less emotionally draining than in the construction workplace. Participant 9 reported that the organisation they worked for had support systems in place, but many employees were unaware of them in the first place. This may suggest a lack of communication from the organisation’s side. The extract below from participant 9 highlights an instance where the participant observed that their superior genuinely cared about their mental health and well-being.

In a private conversation with participant 4 prior to the interview taking place, they had shared a story about what it was like working in the construction environment. The participant claimed to have been suffering due to high stress levels because of being overworked, to the point that they developed a nervous twitch under their eye that lasted several months. When the participant approached their superior with their concerns, the superior reportedly laughed the participant out of the office, claiming his previous employee working under him *had gone bald due to stress*, and that the participant’s concerns were invalid. This highlights the lack of awareness towards mental health, especially in the construction environment.

“It’s obviously dependent on the support around you. My first company didn’t care about well-being, so they just piled on the workload. At my new company now, they’re a lot better with delegating responsibilities and duties, so the stress is a lot more manageable. I’m now taking more responsibility at my new job, where they have our backs – we’ll see what it’s like when we get there. I’ve definitely noticed in consulting, the workload is a lot less intense, so yes, I’ve found consulting a lot less intense and emotionally draining.” [Participant 4]

“The company has a lot of support structures, but nobody really knows about them, or uses them. My cousin passed away 2 weeks ago, and I told my boss that I’m going to go to Joburg for the funeral – I’m going to take 2 days to go to Joburg, and I’ll work from home the one day. And he said: “Dude! You need to go grieve, take 2 leave days.” He also informed me to phone the company’s well-being service. But the thing is, in my company, your experience really depends on your line manager, so there’s not many line managers who are like that, and others wouldn’t have suggested that. They would have been like: “Yes, you can work the other one from home,” and they probably wouldn’t have told me to call the well-being service.” [Participant 9]

Participant 7 claimed that in order to keep their mental health balanced at the workplace, they needed to feel as if they were being productive and that they had some purpose. They claimed that when there was no work to do, they would feel demotivated and that their mental health took a toll.

We don't really check on it [mental health], but you know when you're not working on a project or, you know it's not purpose-driven, then you are going to have to push yourself, drive yourself; so, kind of demotivating. "

[Participant 7]

Participant 8 claimed that their organisation made an effort to ensure the well-being on their employees by hiring wellness and mental health professionals to come into the organisation and offer seminars and support to employees. The participant also spoke about the disparity between men and women in the engineering workplace. Firstly, women are still underrepresented in the engineering workplace, although in recent years, efforts have been made to transform the engineering sector into a more diverse, inclusive environment. The participant claimed that women were generally more emotional compared to men in the engineering workplace. Since women are still in the minority in the engineering workplace, the participant felt as if women needed to suppress their emotions in order to feel accepted and included by the men in the workplace. The participant reflected that in such situations, it was difficult to express oneself emotionally. The participant mentioned that they had established a good relationship with their supervisor, and it was suggested that this was beneficial to their mental health in the engineering workplace.

"I feel like they're really trying to be in with the times and trying to keep up to date with mental issues, and we get talks from people about anxiety and depression and all. And then because it's mostly a male-dominated industry, as a female, obviously I feel like I have a lot more emotional stuff, and I feel like I need to suppress it, because it's hard to open up to people about how you feel in an environment like that. Luckily the head of our team is female, and I have a close relationship with her, so it's easier to open-up to her, and I can tell her things and she gives me advice on what to do, and that's quite nice and very useful."

[Participant 8]

Participant 10 indicated concerns regarding the company culture at the organisation they worked for, and partly attributed this to their poor mental health in the workplace. The participant reported that they worked for a small start-up where all employees were below the age of 30. Due to the similarity in age, many of the employees had a lot in common and established relationships outside of the workplace. Since closer relationships had been established, the professional boundaries within the workplace were not respected as they should have been, which led to bullying and disrespect towards one another, with employees believing they could play off unpleasant remarks as being 'banter'. The participant believed that this contributed to their poor mental health in the workplace due to unpleasant experiences.

"There's a big issue with company culture at my workplace, so I would say that my mental health for a number of reasons is pretty bad in the workplace at the moment. I have very good relationships within my workplace, and so those obviously really help, but then there's things that have happened which shouldn't have happened. It's very young, so everyone is below the age of 30. And then everyone's keen to go out and party together, so then it becomes very cliquey, because we're interacting on a social level, and then we also have to work together. I think it leads to problems, and then you feel comfortable around each other in the workplace, and you feel like you can have whatever level of banter with them, but it's not appropriate and there's some level of professionalism that needs to be transferred at the workplace, but I understand it's hard to separate when you are all friends and you come to work and these are your mates now, and they're not just people that you work with, so it creates a problem. Some of the meetings can be quite hectic and people bully each other in meetings, and people will gang up on each other – I don't think it's okay. I've spoken to other people about it, and it affects them differently, one mate is fine with it, and another friend says: "I get so

stressed when I go into meetings.” My heartrate during the weekly wrap-ups, which is a weekly meeting we do, was like 120.”

[Participant 10]

4.1.2.2. Collective Mental Health

When questioned about their perception of the broader mental health situation in the South African engineering sector, participants 1 and 7 believed that it was in an adequate state. They gained this information through discussions with colleagues and friends who worked in the engineering sector, as well as personal observations and experience. Participant 7 implied that mental health in the context of the workplace ties into fulfilment and motivation as to *why* one is doing the job that they do.

“At my company the environment is quite relaxed, so most of the people I’ve spoken to have said it’s quite chilled – I’ve had quite a few discussions and they all say yes. But I can’t really speak about otherwise.”

[Participant 1]

“Based on my experience, I mean talking to people, you know I’d say it’s fairly okay. Unless if you’re doing things for the wrong reasons.”

[Participant 7]

Participant 2 insinuated that mental health issues do exist in the engineering industry. In smaller teams, it was reported that team members were overworking themselves and trying to excessively multitask. This was a similar view to the one reported by participant 9, who suggested that within the South African engineering sector, many employees would push themselves too hard in the interest of appearing hardworking, diligent, and competent in the eyes of their superiors. Participant 9 suggested that the motivation behind this was most likely to receive positive performance reviews, pay raises, and potential bonuses. The participant reported that the mental health situation in the engineering sector in South Africa was likely worse compared to other industries, and this may be due to the reluctance of engineers asking for assistance when they are struggling. Participant 2 stated that it was commonplace for employees to work overtime (indicating a lack of work-life balance), which may contribute to instances of mental ill-health. Due to other team members working excessively hard and often working overtime, the participant reported feeling guilty for not putting in the same effort, even when they had completed their tasks. This highlights a potential issue with the virtual working environment – easily being able to see when co-workers are online and working (through Microsoft Teams, for example) may lead to employees comparing themselves to others in their organisation. This could lead to a decrease in self-confidence and may lead to higher stress levels and individuals placing unnecessary pressure on themselves when comparing themselves to other employees.

“A lot of people do work too hard, especially in smaller teams like mine where everyone’s stretched pretty thin, everyone’s trying to do multiple things at the same time. Most of the people in my team aren’t specialists at all, we tend to be like jack of all trades – nearly master of some, but not really master of any. I think my manager works long hours, my colleagues all work overtime regularly. I try my best not to, but I can tell that I don’t get as much done as they do, which then does make me feel pressured to work. So, even when you’re trying to maintain like a healthy balance, you feel a bit guilty about it when everyone else in the team is putting in more hours than you.”

[Participant 2]

“In this industry, a lot of people push themselves over the limit. I guess it’s like any other sector – you want to perform well, you want to look good in the eyes of your boss get great performance reviews, maybe increases; but people here really push very hard, and you feel like when you’re resting, or even if you are completing your work,

you feel like you still need to stay a bit longer and stuff like that. There are very few people who are very calm in knowing that “I’ve finished my work, I’ve completed it, I can leave now.” Some of us still feel like we need to prove ourselves... more. I think the mental health situation is probably worse than other industries, but also engineers are the last people to look at that and be like: ‘I have a problem.’” [Participant 9]

Participant 9 suggested that masculinity in the engineering sector may be a reason as to why engineers overwork themselves. The participant spoke about the disparity between men and women in the South African engineering sector. The participant believes that men are more likely to push themselves to unhealthy limits compared to women. As a result, men are more likely to struggle with mental health issues compared to women in the South African engineering sector.

“But men... if no one tells them, they can really just push themselves to the limit, and that’s probably why mental health is worse with men than women.” [Participant 9]

When asked about the broader mental health situation in the engineering sector in South Africa, participant 4 claimed that the contracting industry had been tense since the market crash a decade ago. The participant suggested that possible sources of stress and mental ill-health among employees included work uncertainty (employees are unsure of when their next job will come in, and along with it, payment) and job uncertainty (employees were wary of losing their jobs and being retrenched – participant 4 reported that at their previous job working in construction, half the employees were retrenched).

“In the contracting industry I’d say it’s a very tense time, and I’d say it has been since 2012 when there was the whole market crash. Obviously, everyone’s always stressing about whether the company will get the next job, and stuff like that. And then my previous company had to lay off half their staff, so everyone was stressing around that. They even retrenched a whole lot of workers in their late 50s, and now they have to find job – like the one guy was 3 years away from retiring, and they retrenched him, a 62-year-old white male with no qualifications!”

[Participant 4]

Participants 5 and 6 spoke about the effect of age on mental health in the engineering industry. Participant 5 had observed that younger engineers were generally more open to communicating concerns, stresses, and detrimental effects of stress on health. Participant 6 believed that despite the Covid-19 pandemic and remote working for employees, the mental health situation in the South African engineering sector was generally above average, and that it had improved when compared to the mid-2000s. The participant suggested that this may have been due to the influx of younger engineers, who the participant claimed were more emotionally intelligent and aware compared to the older generations. The participant linked mental health with emotional intelligence, and therefore believed that younger engineers were more capable of managing their mental health in the workplace. Participant 5 claimed that younger engineers were more likely to ask for help or take a step back when they needed it. In contrast, they reported that senior, older engineers were far less likely to attribute any health problems to stress and were less likely to communicate their concerns and stresses or talk about emotional issues. The participant suggested that since senior engineers generally hold more responsibility in the organisational context, they may feel as if they cannot show weakness or take a step back since their position may directly relate to the performance of the organisation. Participant 6 compared the working environment when they started out compared to the present day, and how a change in organisational culture in the engineering sector had occurred. It was reported that when they first started out, senior

engineers would constantly make a fool of the younger engineers and undermine their ability until they were able to 'prove themselves.' It is likely that this would have caused work-related stress for younger engineers who had recently graduated, as well as causing them to lose confidence. The participant reported that the engineering workplace environment is no longer like that, and that notable improvements have been made.

"The younger engineers are a lot more open to talking about it [mental health] and how or what makes you stressed, and the physical manifestations of stress. The more senior engineers would not admit that problems are because of stress; and it might just be being a senior engineer that they have a lot more to take on than we do. Sometimes it's difficult to be like: "Oh no, I'm stressed, I'm going to take a step back," because when you have the financial health of the company riding on your shoulders. Whereas for us as junior engineers, it's easier for us to do that because the consequences aren't as bad if we're taking a day off." [Participant 5]

"Despite COVID, I would say mental health is most probably slightly above average – just the average person compared to a time benchmark. If you go back to 2003-2008, to now, I think we are, despite what's happened, in a better mental health position. I don't know if it's because of the entries of people into the industry, but I've got a feeling that some of the younger guys, or the next generation people were brought up differently, they have different views, and I think they're more emotionally intelligent than my cohort, if I can call it that. And I would link mental health with emotional intelligence – that 'know thyself' if I can put it like that. If you look on average, who is in the market at the moment, is it a whole lot of young people with a mix of older guys – what is the market at the moment, and what are the gaps? The people that I work with are keen to learn, they don't have chips on their shoulders, they don't have this... they don't want to make you feel like a fool, kind of thing. When I entered the industry, you were tried to be made a fool of, before they try and pick you up and make you feel good about yourself. We don't do that anymore." [Participant 6]

Participants generally reported that the mental health situation in the South African engineering sector was average to fair, with one senior participant claiming that the mental health situation is currently better than it was compared to the mid-2000s. A common theme that emerged was that engineers would often push themselves beyond their limits, and this was related to masculinity in the workplace by several participants. The general belief was that men in the engineering workplace were unlikely to ask for help, and were more likely to push through burnout, stress, and fatigue to try and demonstrate competence and strength. In several cases, participants suggested that moderate stress was beneficial, as it would aid them in improving their productivity and assist them in getting back on track if they had deviated.

Older engineers with more experience who were interviewed reported that job and financial security was a threat to mental health in the engineering industry. Multiple participants reported that the industry was experiencing extreme competition amongst organisations, and this had resulted in less work coming in. Low workload was cited as a common stressor, but at the same time, a high workload was too if it became unmanageable. 20% of participants reported that mental health and employee well-being in the construction industry was ignored and overlooked, and that employees were looked after and accommodated to a greater extent in the consulting engineering industry.

4.1.2.3. Stress and Fatigue

The interview included questions on stress and fatigue, which asked participants to comment on stress and fatigue levels in the engineering sector in South Africa, and whether they believed that the two states were related to one

another. Participants were asked to comment on general stress and fatigue levels in the engineering sector, as well as how stress and fatigue could affect job performance as an engineer.

Relationship Between Stress and Fatigue

Participants 2, 4, 5, 6, 7, 8, and 9 all believed that stress and fatigue were related to one another. Of these participants, most of them claimed that stress would come before fatigue, and that it would create a positive feedback loop between the two variables. Participants 2, 4, and 6 claimed that generally when one is stressed, there would usually be a higher volume of work to complete, resulting in longer hours being worked. Longer hours spent working mean there is less time to rest and replenish one's energy (physically, mentally, and emotionally), and therefore individuals are more likely to experience fatigue. Participant 2 also suggested that when one is stressed, task completion and work can feel more draining, even when it is the same number of hours worked. Participant 5 reported engineering as being a fast-paced, high-volume industry that required employees to be able to multitask and be able to work on various projects at a time. Naturally, these demands would lead to fatigue in individuals if they were sustained over time, and the participant warned that burnout was a risk if individuals did not monitor their workplace responsibilities and workload. The participant claimed that engineers very rarely say no to new projects or work, and that they would rather work harder and for longer hours in order to take on new projects. Participants 6 and 7 cited remote working due to the COVID-19 pandemic a source of stress, and participant 7 went on to explain that when stress became overbearing, one could start to neglect other important areas in life. Participant 8 reported that when they become stressed, they have difficulty sleeping due to constantly thinking about work commitments. When they experienced a stressed state, the participant claimed that they are unable to relax as they are consumed by thoughts regarding their work. The participant reported that stress likely did come first, and that it exacerbated the fatigue they were experiencing.

"I think they're related – partly because when you're stressed, you tend to have more work to do, so you work longer hours, you don't have as much time for R&R, but also when you are stressed, even if you still work the same number of hours as you normally do, those 8 hours or whatever are more draining."

[Participant 2]

"Yes, without a doubt. Contracting is obviously super stressful. At one point I was doing about 50-60 hours a week on site. Between the fatigue and stress, obviously the more tired you are, the more stressed you get, and the more stressed you are, the more tired you get."

[Participant 4]

"Definitely! We work in quite a fast-paced industry, where you're working on multiple different projects at a time, at different stages – it's not like you just work on one project and it's got a project life cycle - you're working on a whole lot of them. It's also a thing where you never say no to work, and it sometimes happens that you have a project that got delayed, but then it comes back again, but then you've already signed up for other projects, so a whole bunch of projects end up overlapping and you're working on 5 urgent projects all at once. So, yes, there's definitely fatigue, and it goes through cycles and you get a chilled period, although it feels like the past two years hasn't had any down periods. But yes, it's definitely a thing in our industry, where if you don't watch it, it can lead to burnout basically."

[Participant 5]

"Stress and fatigue... yes. I think if you had asked me this before COVID, I would have given you different answers, but in this time, and post- and during COVID, we have most probably had a lot of stress because of

the way we work, okay? So, yes, it is related. Stress leads to fatigue – that is my experience. You're not fatigued and now you're stressed. It is a spiralling thing, so if you're stressed, you get fatigued, and because you're fatigued, you get more stressed; but it starts with stress." [Participant 6]

"Stress and fatigue, I think especially now with, you know, remote working and all that, then they could be related because it also ties into your time management – sometimes you're just so busy, focused on work and all that, and you start to neglect your social life or things like that. And then sometimes it's something happening in your family life and all that." [Participant 7]

"They're definitely related – because if I'm stressed, I don't sleep well, I'm constantly thinking about work, and then I can't do anything that relaxes me... I feel like stress does come first for me. It definitely makes fatigue worse." [Participant 8]

"I think maybe stress can cause fatigue – definitely high levels of that in engineering." [Participant 9]

Participants 3 and 10 believed that stress could overpower feelings of fatigue, and that it could be used as a powerful motivating factor. They claimed that the feelings of anxiety and adrenaline being released during stressful states were powerful enough to counteract the effects of fatigue. Participant 10 went on to claim that for most individuals, it was plausible that stress and fatigue would be related. When an individual experienced high stress levels, the participant believed that this would lead to the individual working harder and longer hours, which would lead to fatigue.

Participant 3 believed that the above was not always the case, and that in some instances, stress and fatigue could inhibit an individual's ability to work and be productive. The participant went on to claim that they believed engineers were well conditioned to dealing with high stress levels and suggested that engineers were conditioned to use stress as a motivating factor rather than an inhibiting factor. Participant 3 suggested that stress and 'mental clutter' (defined by the participant as unwanted thoughts and feelings coming from sources external to work) resulted in mental fatigue, thereby lowering the capacity at which one can work and function. The participant mentioned that feelings of fatigue can negatively impact motivation.

"The relation is almost inversible to an extent, in that stress almost overpowers the fatigue, from what I've seen. The driving force behind stress absolutely overcomes the feelings of fatigue. I've seen that in people I work with, and in myself. I'm sure there are people out there for whom that is not the case, but I think engineers are well conditioned to let them let the stress drive them forward." [Participant 3]

"I'm a unique case where when I get stressed, I won't get tired. I'll be so stressed and anxious that it's like adrenaline basically keeping me going and I'll just work. But it makes sense that they would be related – like you're stressed out, you need to finish all your work and graft hard, and potentially work after hours to make up for whatever – like sometimes deadlines just happen, and there's nothing you can do about it, and it's not like you worked 9-5, it's like you work 9-5, but also your thing is due tomorrow and it's for a big client, like you have to do it stressed, work late, while tired." [Participant 10]

Participant 3 offered a unique comparison between fatigue and stress, where they suggested that fatigue would likely result in an individual doing the bare minimum required in completing a task, whereas stress would likely result in an individual going beyond what is required to complete a task. The participant stated that they had never observed a case where fatigue became so extreme that their output dropped below the bare minimum.

“With fatigue, it’s just doing the bare minimum – satisfying the bare minimum requirements. I haven’t seen a case where it drops below that level and you end up being behind. I haven’t experienced it, but I know that it can happen out there. And then stress just does the exact opposite actually, I’d say. You go over and above what needs to be done.”

[Participant 3]

Stress and Fatigue Amongst Employees

Participants 1 and 2 believed that engineers working in the South African sector generally experienced high stress levels. Participant 1 revealed that, like them, their brother-in-law worked as an engineer, and that they were frequently stressed while working at a large company due to excessively long working hours. Although participant 2 claimed the stress levels were not necessarily to an unhealthy degree for most employees, they were aware of several colleagues needing to take time off work due to fatigue and burnout. At an earlier point in the interview, the participant spoke about colleagues working through the weekend and not using that time to rest. This point was revisited in the passage below where the participant claimed that colleagues often appeared fatigued and strained on a Monday morning due to not having rested over the weekend.

“Engineers are quite a stressed bunch – my brother-in-law is an engineer too, and he works monstrous hours and he stresses all the time, but he works for a much bigger company. So, I think on the whole, it is quite high stress in engineering.”

[Participant 1]

“Stress in the sector is generally quite high, not necessarily for everyone or like to an unhealthy degree, but I have experienced a couple of colleagues having to take a few days off because of burnout, or you hear in their voice that they’re suffering and strained. Like on a Monday morning probably, because they haven’t rested over the weekend at all.”

[Participant 2]

Participant 5 had observed in themselves and colleagues that stress could manifest into physical health problems, which became more evident when they or their colleagues had experienced stress over an extended period of time. The participant explained that although physical health problems could be attributed to stress, this was not always the case.

“Stress manifests in different ways. For example, I’ll often have neck problems that seem to correlate with stress, not just from sitting down behind your computer; whereas other colleagues of mine have had bowel problems, which is a physical thing that I attribute to stress. It’s hard to quantify, because often things that go wrong, it’s hard to say: “This is because of stress”, which was going to happen anyway. I mean sometimes it is completely unrelated. I’m more on the side that it’s generally because of stress, but if you ask other people, they’ll say: “No, it’s just something else that I always have.” It’s tricky, because I don’t think people are often saying: “This is because of stress,” they’re not going to attribute it to stress. Then at the same time, you want to be seen as capable and being able to take on as much as you can and manage to do that.”

[Participant 5]

Participants 6 and 7 shared similar views in that they believed that financial stress was a notable source of stress in the engineering sector. Participant 6 explained that financial stress came about through stress of being retrenched, whereas participant 7 highlighted that more senior engineers approaching retirement frequently experienced financial stress out of fear that they would need to sacrifice their quality of life after retirement if they had not saved sufficiently. Participant 6 believed that this had caused elevated stress levels throughout the industry, and encouraged employees to

look into the future, and plan accordingly, given the risk of retrenchment across the industry. Participant 7 believed that in general, stress came about not necessarily due to an event itself, but rather how an individual responded to those events. Participant 7 suggested that another common source of stress in individuals is a poor self-image and the way one perceives other people seeing them. In making the statement, the participant implied that self-confidence is related to lower stress levels. The participant also claimed that it was nearly impossible to live a stress-free life, and in addition to finances, relationships, illness, finances, and workload were all significant sources of stress. Lastly, the participant stated that workload at one's job could also contribute to stress. A workload that is too high or too low could cause stress in either case, according to the participant.

“A lot of things that I find with stress, is the way people see themselves and the way they perceive other people seeing them, and that in itself is a stressor. So the stress at the moment at home... for instance, if everything is running smoothly at the house, and that could be relationships, and physical things going on at the house, then I think you are most probably one of the luckiest people on the planet – there's never a stressless house, there is always, no matter how good people are, things happen, people get sick, you worry about that and you worry about other things. And also depending on how old you are and how much experience you have. And as you get older towards pensionable age, you start thinking: “I need money, I need this, I need that,” that also adds to the stress. Then work stress at the moment is many things, but the two things that I think of is you have either too much work, or you have no work.” [Participant 6]

“If there's no work coming in, and people need to be retrenched, and that's what a lot of engineering companies are going through at the moment, and you keep thinking like: “Am I going to be here in 2-months-time or is there going to be some work coming in?” It's not like when I started with my company, the work was there – you don't have to think about where the next project is coming from and all that. So, it's not just work you're doing, you need to think broader than what you're doing at that moment.” [Participant 7]

Participants 8, 9, and 10 reported that engineering employees deal with many deadlines and time constraints, while producing work of a high standard for clients. Participant 8 claimed that employees in higher positions with more responsibility were more likely to suffer from high stress levels due to their responsibilities of having to manage subordinates. It was reported that while there were many busy periods with a lot of work coming in, there were also times where there was very little work to be done, where employees could take a step back and work at a lower capacity. Participant 9 reported that engineers will do whatever is necessary to ensure the clients are satisfied, even if it means sacrificing personal well-being temporarily. It was claimed that engineers generally do not complain about their stress or any work they have to complete but will rather sit down and work towards completing their tasks. This observation reflects a theme reported by several participants – engineers generally do not communicate when they are struggling and are less likely to ask for help when needed. In addition to deadlines and workload, participant 10 mentioned social stress and issues with company culture that contributed to their stress in the workplace, reporting that they did not always feel safe and respected at the workplace. Lastly, it was reported that ‘business stress’ could also arise when the organisation was performing poorly.

“Sometimes we'll have a lot of deadlines, and we work on a client basis, and it's very much dependent on the energy market – there's a lot of projects coming in, and a lot of people are going to be very stressed, especially in the higher positions because they have a lot more on their plate and a lot of people to manage. So, they are very stressed all the time, if there's a high amount of work coming in. And then we might have

like 3 days where everyone's just like: 'I don't have any deadlines right now – I've handed in everything I've had to hand in; let me just take this time to recoup.'" [Participant 8]

I do think it's a very high stress environment because it's always about deadlines and the client. I don't know if this is true across all disciplines or fields, but the client is the most important person here, and if they say: "We need it next week," it needs to be done next week, you know, even if you're going to not sleep, eat, and all of those things. Engineers are not huge complainers – they just do it, which really frustrates me because I'm not that person, but obviously when you're in this environment, you just adapt." [Participant 9]

"I think that there's deadlines and stress, but also if there's issues within the company culture, I think that if you feel unsafe if you go to work, if you feel like people don't really have your best interests at heart, you know, like you had a bad interaction with them, I think that creates a lot of stress for me. I'd say that there's workload stress, there's business stress if the business isn't performing well, and there's also social stress." [Participant 10]

Effects of Stress and Fatigue on Job Performance

Participant 1 believed that time management could be affected by high stress and fatigue levels. The participant claimed that when they stressed, it made it harder to complete tasks, therefore impacting their time management.

"I think time management can be affected. I've seen a lot of people, for me especially, when I stress, it makes it really difficult for me to get things done." [Participant 1]

Participants 1, 2, 9, and 10 believed that stress could be beneficial in terms of job performance as it was believed that moderate stress could motivate employees to work harder and would allow them to identify when they were behind schedule. Participant 1 reported that when they had an overwhelming amount of work, they would experience higher stress levels and a consequent drop in productivity. However, if smaller, more manageable tasks were assigned to the participant, then they claimed that the stress levels experienced were low enough such that the stress acted as a motivator, rather than an inhibitor to their productivity. Participant 2 suggested that while stress and fatigue could negatively impact job performance, moderate stress levels could motivate one to work harder and be more productive. Participant 2 believed that consistently high stress levels could lead to a reduction in quality of work, and therefore a decrease in job performance. Participant 9 claimed that stress is only a detrimental state when an individual cannot manage it effectively, and again indicated that individuals should find a way to manage their stress. They claimed that stress increases awareness in an individual. This awareness refers to being conscious of one's current progress and what tasks still need to be completed. It was recommended that individuals do not stress for extended periods of time, as the participant claimed that this could lead to detrimental or damaging side effects. Speaking from personal experience, participant 10 reported that stress could have a positive effect on them, and that it allowed them to 'hyper-focus' when working on tasks, given there is no urgent deadline by when they need to be completed. The participant claimed that short-term deadlines would create negative stress, and they may experience a lack of mental clarity and focus when a short-term deadline arose. Participant 10 reported feelings of stress arising during meetings and experiencing challenging interpersonal relations. They reported feeling overwhelmed and mental blockages, leading to further feelings of stress in the moment.

“It can go both ways – its either it will push me really hard to work, or I’ll feel really demotivated to work and do nothing. I think it depends on the scope, right, so if there’s a really huge task that needs to be done that looks really intimidating, the stress will like, kill it, but if it’s like small work packages that you need to get done, then stress can be a big motivator.” [Participant 1]

“I definitely think it decreases your performance – I think if you’re stressed for like one day, it can help you work harder. But if you’re stressed every day for a week, it reduces quality.” [Participant 2]

“I don’t think stress is generally bad, but I don’t think people have enough ways to manage that stress. Stress pushes us, it helps you out of your comfort zone and it lets you know that there are deadlines approaching, or you’re not caught up with your work, and that’s like good stress, but you cannot be in that state for too long. You need to rest, or tell your boss: “Hey, this is too much for me, can we swap out with someone else?” I don’t you should stress for long periods of time, because that’s when it’s damaging.” [Participant 9]

“Stress affects people differently, and I think there’s different kinds of stress. Stress for me actually has a positive effect, so if I’m stressed, I’m almost like hyper-focused, and it’s like: “I need to do this, and I’m going to get it done right now.” But it’s like you get stressed, like you have a short-term deadline – say I need to submit something in 30 minutes, and I haven’t done it; that kind of work stress for me is very negative, like I’ll have a mental block and I’ll be like: “Oh my gosh, there’s so much I need to do, like I can’t work!” But if I have something that’s due in a day, and I’m super stressed, hyper-focused, I work really well. And then also there’s meeting stress, which I experienced yesterday. I had this really hectic meeting, I was really stressed about the people in the meeting, because I know how they can react, and they were reacting very negatively to what I was saying, so that also has a negative impact on you, like I’ll shut down, my brain will stop working, and they’ll ask really simple questions and I won’t be able to think or answer on the spot. So, I think it really does affect people differently, and the situations affect people differently.” [Participant 10]

Participant 4 suggested that fatigue could have a negative effect on job performance as fatigued employees were more likely to misjudge situations and make poor decisions. According to the participant, this is because when one is fatigued, one is less likely to think things through properly, and one is more likely to make errors. Poor decision making and judgments, particularly in the construction environment, may lead to health and safety risks, which could result in employees being injured or even killed. Alternatively, poor decision-making could result in the organisation losing money, which may result in disciplinary action for the individual responsible.

“If you’re tired, you’re not making the right judgments, not making the right decisions, and when you stop thinking your decisions through properly, that’s when you start making mistakes, which can either end up with some getting injured as a worst-case scenario, or you could end up losing money, and then you get in trouble for that.” [Participant 4]

Participants 5 and 8 shared similar perspectives that stress could have negative effects on engineering employees, with both suggesting that stress would lead to a decrease in quality of work and task completion. Participant 5 suggested that a high volume of tasks is what usually leads to higher stress levels, and that higher stress levels may lead to a decline in work quality, task completion, and time management, and therefore a detrimental effect to overall job performance. The participant went on to claim that when an individual is under stress, learning is made significantly more difficult. Since the participant believed that learning was an important aspect of job performance, they implied

that if one's learning is inhibited, then so too is one's job performance. Participant 8 claimed that stress made them unable to think clearly and focus. Furthermore, they struggled to take note of what had been completed and what still needed to be done. Participant 8 reported that this would have a negative impact on their time management since it was harder to prioritise. In turn, this was believed to negatively affect project management and productivity. Participant 8 reported that feeling stressed in the workplace would lead to them asking more questions out of fear of misunderstanding and misinterpreting information. It was proposed that this was because one's ability to think clearly was inhibited when experiencing higher states of stress, implying that more errors may be made when performing a task, or that aspects may be overlooked and excluded.

"It's more volume of tasks that are going to make you stressed, and that's going to result in you missing deadlines or dropping the quality in order to get it out in time. And then learning – it falls out the window when you're stressed and under a lot of pressure."

[Participant 5]

"It definitely impacts time management, because if you are stressed, for me I get myself into a state, and then I can't think clearly – I don't know what I'm doing, I don't know what I've done, I don't know what I still have to do, so that's the main thing: obviously time management relates to project management, and if you're really stressed, trying to get a lot of things done, it's hard to prioritise. And then asking questions, I feel like when I'm stressed it makes me ask questions more, because when I'm very stressed, I get to a point where I need to be like: "Can anybody help me with this?" and then everyone just like... luckily, I work with really, really amazing people, so everyone comes to help basically, when needed. Obviously, that's when I'm at a point where I don't know what to do. And then taking initiative, it's not really applicable, because, like... because if you stress sometimes, your quality output isn't as good though, because you're so busy trying to get things done that you don't think clearly."

[Participant 8]

Participant 6 stated that either too much or too little work was a source of stress. If the workload was too high, stress may arise due to stress over one's capability and capacity to complete the task. Too little work tied into the participants previous point on financial stress – if there is no work available, less money can be earned. The participant highlighted that time is one's only true commodity, and that it was crucial to manage one's time effectively. They suggested that setting boundaries and knowing when to say no was important in managing one's stress, because if individuals were unable to say no, then they would constantly be working and becoming severely fatigued.

"There's no in-between [too much or too little work], and they are both very stressful for obvious reasons. So then if you have a lot of work, then it is number one your capability to do it, and number two your capacity to do it, which could also be causing you stress. What happens if you focus on the work you get, you get on it and you do it, then you set yourself time limits, you package your day, in a way – you manage your time, you manage your project, you manage who you talk to, who you don't talk to, because your time is actually the only thing you have, and you allow people to invade that space – how good are you at creating boundaries, to keep people out of your time space, and when do you want people to come into that kind of management process of that. If you cannot say no, for instance, you're going to be a stress ball, and you're going to be working 24-7, and you're going to be extremely fatigued."

[Participant 6]

Participant 7 spoke about becoming complacent in the workplace, which they believed came about due to repetitiveness and constantly doing things in the same way. It was suggested that complacency could affect job performance of engineers if left unchecked. They explained that if employees experience moderate stress in the workplace, then they are more likely to be proactive and look for things to do. In that way, the participant believed that stress could act as a useful motivator.

“But when you’re used to doing things a certain way, or things happening in a certain way, then it sort of... you have to get out of your comfort zone, and think not just about what you’re doing now, but what you’ll be doing for the next couple of months – what are you doing for the next 2 years down the line? So, you sort of... you’re not just a designer, you need to plan as well, which is sometimes something that you are not used to doing... sometimes in the workspace you become so comfortable that you think that someone else will sort out the problem. You almost become too complacent and take a step back when you become too comfortable. Stress can make you... you can look for things to keep busier if you feel stressed. More proactive.”

[Participant 7]

When asked about how stress and fatigue could impact job performance, participant 9 stated the risk of burnout if one does not manage stress and fatigue levels. The participant highlighted the importance of managing stress and finding a way to effectively do so. It was reported that stress was more commonplace than fatigue, and the participant claimed that individuals should be able to avoid fatigue by getting sufficient rest.

“Definitely in the long run there’s burnout. People here definitely have experienced burnout. I don’t think stress is bad, but you just need to find ways to manage it. I don’t think anyone should be fatigued – we should all be getting normal hours of rest, but I think stress is more normal than fatigue.”

[Participant 9]

Most of the participants believed that stress and fatigue were related to one another, with most of the participants reporting that stress came before fatigue and was often a contributing factor. A majority of participants also reported that the stress and fatigue levels were generally high in the engineering sector, which was often described as a ‘fast-paced, high intensity’ job. Participants reported a wide range of detrimental effects of stress and fatigue on job performance, and several participants reported that stress could be beneficial. This was because several participants believed that when stress increased, so did productivity. These participants also reported that an increase in stress could help individuals improve their time management and ‘get back on track’ in case they had gotten side-tracked and went through a period of lower productivity.

4.1.3. Workplace Well-being and Environment

Participants were asked to comment on their perceptions and observations regarding employee well-being at the workplace in the South African engineering sector. They were also questioned whether they thought engineering organisations did enough to ensure the well-being of their employees. 70% of participants believed that the organisation they worked at demonstrated some level of care about their employees’ well-being, and that the organisations were putting a noticeable effort into enhancing employees’ well-being. Most line managers and supervisors reportedly had an open-door policy where employees were welcome to speak to them at any point. This care and support from the organisation came in the form of support from Human Resources (HR), noticeable effort on the organisation’s part, support offered from the organisation itself, and how accommodating organisations were of the

employees' needs. A further 40% of participants interviewed reported that the organisation at which they worked conducted regular check-ins with employees to gauge how they were doing in the workplace. 20% of participants reported that while the organisation they worked for would speak about wellness and the well-being of employees, they did very little to actually implement structures that would enhance the well-being of employees. Perceptions that were reported to a lesser extent by participants were that construction companies did not care about the well-being of their employees, the organisation that one of the participants worked for contracted external wellness professionals to assist staff, asking for help in the engineering workplace was perceived to be a sign of weakness for men, engineering organisations in the South African engineering sector at present are struggling, therefore making it difficult to prioritise employees' well-being through incentives and rewarding their work.

4.1.3.1. Company Support and Culture

Participants 1, 3, and 10 reported that the organisations they worked at would hold regular check-ins with employees to see how they were doing and if they were managing. The frequency of the check-ins reported by participants ranged from weekly to quarterly, and participants reported that they were allowed to voice any concerns that may have arisen too. Participant 10 indicated that the organisation would make efforts to ensure employees were happy in the workplace and would accommodate employees as best they could. The participant reported that even if there were no issues to discuss, HR personnel would converse with employees to establish a deeper relationship, enhancing trust in the process. Participant 10 had observed first-hand that the organisation was accommodating of employees, as they allowed the participant to take time off work to attend therapy sessions, without expecting them to work back the hours that they had missed. To conclude, participant 10 suggested that their organisation had an effective mental health and well-being support system in the workplace.

"My company does a decent job. We have regular check-ins – I'd say at least once a quarter where we sit down with the manager and have a chat about how our things are going..."

[Participant 1]

"I would say from what I've observed, there is care from employers in terms of doing a check in, and where I'm working now, there's the catch up, which is to see how you're getting along, and that's twice a week, to see where you're at. And I know when I worked as an engineer, there was a Monday stand up where everyone says what they're doing, but there was always an open space to chat to your supervisor if you needed to, so from those experiences I would say yes."

[Participant 3]

"I think that they do genuinely care. I think that it's hard for them to pre-empt what's going to upset people, but as soon as you say you have a problem, they'll do things to assist you, and I do regular one on ones with HR, so I had a meeting with her this morning, and we don't even have to speak about anything if you don't want to, and you can just chat, but if there are things you want to raise and chat about, then you can do that. I brought up something that happened, and she was like: "Okay, we can do with this what you want; I'm going to bank it, and if you want me to speak to someone about it, then let me know, and if you don't, then we can just leave it," so I think I have a very decent mental health system at my workplace. If you need to go to therapy or anything like that, they're more than happy to accommodate that, and without needing to work in the extra hours. I did some therapy mid last year, and I spoke to HR and asked if they would mind if I took 2 hours off and work it in in the evening, and she said: 'No, not at all, you don't have to work in the evening, we're more than happy to accommodate it.'"

[Participant 10]

Participants 4 and 9 both reported that the wellness and mental health support systems were overlooked in the construction engineering industry. Participant 9 claimed that for an organisation as big as the one they worked for, it was vital that the organisation had structures in place that would uphold the well-being of the employees. Furthermore, participant 9 mirrored participant 4's view that engineers would rarely admit weakness and that they needed help. This ties in to the issues of masculinity in engineering, which was discussed later on in the interview. Participant 9 also shared a similar observation to the one made by participant 5 – that the support systems at their organisation were there, and highly effective, although they were underutilised by employees. The fact that wellness systems are underutilised by employees may contribute to lower rates of employee well-being in the workplace context. Participant 4 reported that employees were able to schedule meetings with HR and discuss concerns or challenges they were experiencing in the workplace, although the participant could not comment on its effectiveness since they had not utilised the service. While they believed there was an open-door policy where employees could approach supervisors or managers about any issue, they felt as if asking for help in the workplace was a sign of weakness, particularly as someone who identified as a man.

“My first company didn't care about your well-being, so they just piled on the workload, but at my new company now, they're a lot better with delegating responsibilities and duties, so the stress is a lot more manageable”

[Participant 4]

“Every company has obviously got their HR department and most companies have that open door policy, where it's like: “If you aren't feeling right, you can approach HR dept and set up a meeting.” I personally haven't done that yet, so I can't comment on whether it is successful or what kind of processes the HR dept go through, but they do have those channels, and most sites, the people I've worked with on management level, they do have an open-door policy, where they say: “Please, if there's anything on your mind, come talk to us.” They do encourage it, but I don't know, you kind of get that feeling that it's a sign of weakness though, so I don't think people, or if they do it, they wouldn't be very forthcoming about the fact that they went to go see HR about something. I suppose it's that whole manly thing about being strong enough to look after yourself.”

[Participant 4]

“For a big company like the one I work for, they definitely have to have those things in place, and they do. But when you speak to friends in much smaller companies, especially construction companies, there is no such thing as those wellness things. They don't have those support systems or even consider them. I'm just lucky to be in this company that's huge and has those things, but I know most people don't. I didn't even know I could call the wellness service if I was going through something like that, so even if the support systems are there, you barely use them or know about them. They do have refreshers like once a year or whatever, but the thing with engineers, they'll never admit that they need help!”

[Participant 9]

When further asked about masculinity in the engineering sector, participant 4 reported a lack of diversity amongst men and women, particularly in construction companies. The participant had observed that women in engineering were rarely in senior, authoritative positions, which further highlights the lack of diversity and inclusivity in the engineering sector. They reported only having seen women working as health and safety officers or as admin clerks on site, and never as a foreman or manager. In contrast, the participant reported that the consulting engineering workplace was more inclusive, with women being represented to a greater extent.

“I’ve worked with very few females on site, and mostly the ladies on site are either health and safety, or admin clerks. I haven’t really dealt or worked with other site engineers, and I’ve never seen a female foreman. In consulting, it’s a very, very good split. At my company, I’d say easily 50-50.” [Participant 4]

Participants 2 and 5 reported that the organisations they worked for ensured their employees’ well-being by contracting external organisations who specialised in well-being and mental health. Participant 2 observed that in their organisation there was genuine care towards employees from managers and seniors. Employees’ needs were accommodated, and they were encouraged to voice their concerns and do what was necessary to ensure their personal well-being. Participant 5 reported that while the wellness services were well-promoted and highly effective, it was underutilised by employees. The participant concluded that this was likely due to the well-being programme being self-imposed, rather than encouraged or mandatory.

“I do think that they try quite hard – they have regular meetings with the outside, external companies who do wellness and mental health modules with us. They have quite good HR systems, and I can only speak to my managers here, but it seems to be the same in our overseas branches, but people actually do care about whether their employees are okay. I’ve been told multiple times: “Just let us know,” and you can do what you need to do to be fine.” [Participant 2]

“Yes, our company as a whole does more to promote it than is used. We have the Discovery well-being programme that’s offered to everyone in the company. It’s an amazing programme which I don’t think enough people use it at all – it’s offered to psychologists, legal help, and it’s endless if you go look through it. So, we have that available to us, but I don’t think there are that many people who use it. Some people do, probably not as many as there should be. So yes, our company definitely offers us a lot, but it’s more self-imposed, or a company culture thing that you want to be okay. It’s all voluntary. It’s there if you want to use it, but if you don’t, then nothing’s forcing you.” [Participant 5]

Given their authority and experience in a managerial role in their organisation, participant 6 offered valuable insights into the well-being of employees in the engineering sector. The participant claimed that their organisation valued its employees and suggested the employees’ well-being was their priority. Although it was a priority of the organisation to ensure the employees were well-looked after, it was not achieved to their desired standard. Participant 6 reported that the biggest challenge standing in the way of ensuring employees were well-looked after was a shortage of work and income on the organisation’s part. They reported that the engineering sector had been struggling over the past 5 years, and that employee well-being was partially neglected since the organisation had received less income because of there being less work available. The participant suggested that one of the ways to ensure employee well-being was to make them feel valued in the workplace. They reported that this could be achieved through salary increases, bonuses, and incentives. Given the lack of income into the organisation, employees were unable to receive increases or bonuses, and the participant believed that this led to employees feeling undervalued and unappreciated, thereby negatively impacting their well-being at the workplace. The participant believed that by offering younger employees interesting projects to work on, they would feel valued and would therefore be more motivated. If there was limited work coming in, then it would be harder to assign younger engineers to projects, and the participant believed that this may also have contributed to poorer well-being in the workplace.

“I have some understanding of what my company tries to do with the employees, and I know that the company understands the value of the employees. In the consulting industry, our products are the people, so it is critical for us to make sure that they are well-looked after, and that their well-being is secured. Having said that, we can only do that properly if you have a steady flow of income, you can see the growth in the company and the future. Over the past 5 years, I would say, despite COVID, we have most probably been forced to neglect that in a way, because of what is happening in the industry. And it starts with corruption in the government, corruption in parastatals, and the lack of work coming out of that because of the systems and stuff like that that needs to be in place to protect the coffers. And despite that, there’s still people and things slipping through, which caused delays in projects being rolled out, which means that we can’t retain staff, because there’s not enough money to do that, number one, and to keep young people interested, you want interesting projects, and if the projects aren’t there, how do you keep them? It is not possible. But yes, I would say currently the whole industry is going through this process (I’m talking about the consulting industry) so, I think despite the mental well-being being above average, I don’t think we are looking after them properly at the moment. It’s not because of us not understanding it – we don’t have the clients to properly do that. So, you try and find other ways to incentivise – it’s very difficult. People want bonuses and increases.”

[Participant 6]

Participants 7 and 8 reported similar observations as the organisations they worked at would speak about doing a lot for employee well-being, but very little was done to implement these services or to assist employees. Participant 7 suggested that when no support is coming from one’s workplace, it can cause a decline in an individual’s mental health and well-being. They also reported that when support or guidance was needed, there was no one to offer it, which may lead to employees feeling undervalued and unimportant to the organisation. Participant 8 also reported a lack of support and suggested that no meetings about well-being and mental health took place between employees and supervisors. Although they did not receive support from supervisors, the participant claimed that there was support between employees working in their team.

“They talk about doing a lot, but the implementation of it is not as good... In general, we always have our own issues that we’re also dealing with, and then if your workplace... let’s say if you don’t have a support base in your workplace, then it could cause a dip, and it kind of eats at you... so, the implementation of things which I think is a general thing. When it’s still fresh and everyone is talking about it, and then it seems like something is happening, but nothing happens down the line, a couple of months later – it’s something that you know is there, but no one is really looking after you or guiding you.”

[Participant 7]

“No, I don’t think they do anything to ensure well-being at all, because like you can give a talk on anxiety and depression, but what are you actually doing? You’re not actually having a sit down, or having someone in the company looking out for you, and being like: ‘How’s it going? Are you okay?’ and all that stuff. Luckily people in my team notice if you’re stressed or upset, so then they will either ask you or not bother you.”

[Participant 8]

“People in my team are very receptive to that, but generally, I think I just got lucky. I think a lot of people, they don’t have anywhere to complain or speak about the issues that they’re having in the workplace.”

[Participant 8]

To conclude, it appears that organisations in the South African engineering sector put effort into improving and upholding employee well-being, and most participants reported that a noticeable effort is made on their part. Most participants reported that some type of support system existed in their organisation, whether it was in the form of regular check-ins with supervisors, wellness programmes that were offered by the organisation, or support offered from the HR department. A challenge that was revealed was that employees underutilised the services that were available to them – services that would enhance their mental health and well-being in the workplace. It was discovered that consulting engineering organisations were more aware of employee well-being compared to construction engineering companies, who reportedly did not take these matters into consideration. A further challenge to the well-being of employees is that organisations in the South African engineering sector have been struggling over the past few years, making it harder to incentivise employees and reward them with salary increases, bonuses, and increasing responsibility in the workplace, particularly amongst younger engineers.

4.1.3.2. Turnover Intention and Job Satisfaction

Participants were asked whether they were satisfied at their place of work and whether they were likely to seek new employment in the next 2 years. Turnover intention is related to job satisfaction, and it could reveal interesting reasons as to why employees may seek new employment. 60% of the participants claimed to be satisfied at their workplace, while a further 20% explicitly stated that they were unsatisfied, and the remaining 20% did not clearly state whether they were satisfied or unsatisfied. Among those that claimed to be satisfied at their workplace, a third of the participants indicated that they were likely to seek new employment, despite feeling satisfied. Another participant who claimed to be satisfied expressed that they would only be likely to leave if more appealing opportunities presented themselves or if their organisation required them to relocate to a remote area. 50% of the participants indicated that they were unlikely to remain in their current position with the same organisation for the following 2 years, indicating a relatively high turnover intention within the sector.

Participants 1 and 9 both indicated that they were likely to seek new employment in the next 2 years. The participants both reported that although they were not dissatisfied with the work environment, they did not feel fulfilled with the work that they were doing and wished to be doing something else.

“I probably will want to look for another job – not because I’m dissatisfied with the actual environment, but because the type of work that I’m doing isn’t what I’d like to be doing.” [Participant 1]

“I’m looking for new work in the next 2 years, but I think it’s because I realised that this line of work is not for me – I do enjoy engineering, but I want to go more in to transport planning than engineering.” [Participant 9]

Participants 2, 5, and 7 reported feeling satisfied at their current workplace, and that they were likely to remain at their current workplace for the next few years.

“I’m satisfied and I’ll probably stay for a couple of years at least, see how things go.” [Participant 2]

“I’m happy where I’m working now and planning on staying for the foreseeable future.” [Participant 5]

“I don’t think I would look for new employment. I’m happy with the things that I work with mostly, for now. Down the line I might look for new work, but at the moment I’m happy and I wouldn’t look for any other employers.” [Participant 7]

Participants 3 and 10 indicated that they were unsatisfied in their place of work. Participant 3 reportedly wished to continue studying at university and had only started working to get experience and fill their schedules until the studies commenced later in the year. Participant 10 reported that incidents had occurred at their workplace which had left them feeling unsafe and uncomfortable.

“No, but my circumstances around that issue are very unique.” [Participant 3]

“I would say I’m not satisfied, and I will definitely be looking for new employment.” [Participant 10]

Participant 4 mentioned that finding new employment was dependent on the type of opportunities that presented themselves. The participant referred to an example where their organisation wanted to send them off to a site in a small, remote town, against the wishes of the employee. The participant refused and would likely have looked for new employment had there been no alternative. Participant 4 expressed that they enjoyed working for the organisation but claimed that if the organisation tried to send them to a remote location, or if the opportunities were limited, then they would seek new employment.

“That depends on what projects there are. So, they were thinking of sending me to Kokstad for 2.5 years. And I said to them: “With all due respect, I just moved in with my girlfriend, so I’m not going to move to Kokstad for 2 years.” So, yeah, it’s project specific obviously. I enjoy working with this company, I’d like to stay with them, but if the right opportunities aren’t there for me, and they try push me to a location I don’t want to go, then obviously I will go elsewhere. I’m quite fortunate, obviously with my qualifications, and my age, I’m relatively inexpensive to a company, so to hire me is not a big expense to them at this point; and obviously I bring a lot of experience and in that regard I’m quite employable.” [Participant 4]

Participant 8 claimed to be highly satisfied at their current workplace but indicated that they were likely to seek new employment in the next 2-3 years. The participant reported that working for the same employer for extended periods of time did not excite them. They suggested that this was a sentiment shared by many young adults currently, and that many professionals starting out their careers were more likely to pursue a dynamic career working at multiple organisations over time, rather than working for a single, or very few, organisations while performing the same job.

“I think... I’m very satisfied where I’m working, but I think I probably will find new employment in the next 2,3 years, because the thought of working in one place for like 8 years doesn’t excite me – I feel like that’s our generation.” [Participant 8]

While participants were mostly satisfied at their workplace, 50% of the participants who were interviewed were likely to seek other employment in the next 2 years for a variety of reasons, including feelings of dissatisfaction towards the work they were doing, wishes to study further at university, seeking new opportunities every few years, and issues with company culture and workplace environment. Only 20% of the participants explicitly stated that they were unsatisfied at their workplace. The findings indicate that the primary reason for employees feeling unsatisfied at their job and looking to find new employment is due to employees not feeling fulfilled by the work that they are doing. Employees are therefore more likely to seek employment where they feel fulfilled, motivated, and satisfied with the work that their job demands.

4.1.4. Mindfulness

Participants were asked various questions relating to mindfulness – firstly, what they understood mindfulness to be; secondly, how they believed mindfulness could enhance job performance as an engineer; and thirdly, how mindfulness could enhance the three successful job performance traits that they mentioned earlier in the interview. The primary theme of mindfulness was split into two subthemes: perceptions of mindfulness, and perceived benefits of mindfulness.

4.1.4.1. Perceptions of Mindfulness

This section is comprised of the following codes: awareness (including self-awareness, awareness of mind/body/emotions/state), attention, meditation, and presence. Each of the codes that symbolised the participants' perceptions and understandings of mindfulness were assigned to one of the abovementioned subthemes.

Awareness

60% of the participants interviewed shared the belief that mindfulness was centred around the fundamental aspect of awareness. While there was variation in the participants' understandings and perceptions of awareness, the fundamental aspect of awareness remained. Most of the answers mentioned an aspect of self-awareness, or awareness that involved oneself (for example, awareness of one's thoughts, mind, or body). To a lesser extent, 20% of participants understood mindfulness to be centred around an awareness of one's surroundings.

Participants 2, 5, and 9 understood mindfulness to be related to self-awareness. They emphasised that mindfulness also dealt with awareness of one's state of being, and emotions or feelings, for example, by being aware of one's stress or anxiety levels in a given moment. Participant 2 suggested that by being aware of one's state of being, individuals can gain deeper insights into how they are feeling and the reasons for it. This can lead to individuals questioning how their behaviour or work is affected by the stress or anxiety. Once individuals are aware of the reasons for stress and how it can affect their behaviour and work, corrective action can be taken. Participant 5 claimed that mindfulness involved 'taking a step back' and being mindful of their state of being, which implies taking a more objective view of oneself and disengaging from one's thoughts and feelings to a greater extent. This disengagement can help individuals in managing their thoughts and feelings more effectively and can lead to increased happiness as stress and rumination may be decreased.

"I think it means to be aware of your own state of being, and conscious of how anxious am I? How stressed am I? How am I actually feeling, and why? How is that affecting my behaviour or my work or anything like that. So, just being aware of yourself."

[Participant 2]

It's being aware of yourself as a person, and what your state of being is. So, it's taking a step back and being mindful of where I'm at, what my state of being is.

[Participant 5]

"Being aware, like sometimes you can operate in like a robotic state, but just being aware of your body, your mind, your feelings."

[Participant 9]

While participant 10 believed that mindfulness was centred around self-awareness, they only considered awareness of the physical body rather than of mental or psychological aspects. They suggested that being aware of one's body made it easier to become aware of one's mental state through observing what is happening in the body (for example, clenching of one's jaw, holding on to tension in parts of the body, could indicate higher stress). Participant 10 went on

to claim that there is a clear relationship between the mind and the body, and that by focusing on this relationship, it becomes easier to identify thoughts, stressors, and manage thoughts.

“I’d say probably being aware of how your body is reacting to whatever is happening around you, you know? So, there’s mindfulness exercises which focus on tensions in your body, so I think it’s linked to understanding what your body is doing and how you can remedy it and like change how you’re feeling in that moment to make your body react better. I think that links to your mental state, so if I’m feeling stressed, and I’m clenching my jaw... often I won’t even notice until my jaw starts to hurt, you know, and that’s linked to how my brain is feeling – my body is reacting to how my brain is feeling. And then if you can catch it early enough, then you can be mindful more often, you can adjust, you can recognise: ‘Okay, this is what my thoughts are, and this is why I’m feeling stressed, and this is why my body is reacting like this, and this is how I can change my thinking state so my body and my mental state isn’t bad.’” [Participant 10]

Participant 3 believed that thought control was a fundamental aspect of mindfulness. In order to control thoughts, one would first need to be aware of the thoughts that were occurring, which too brings in an element of awareness. Participant 6 reflected a similar view and believed that mindfulness dealt with the thoughts that an individual filled their mind with, and how this mental content could be managed on a practical level. An element of awareness is involved here, as an individual would first need to be aware of what content fills their mind before it could be managed. This participant claimed that mindfulness was associated with a calm, quiet mind when talking about falling asleep and clearing one’s mind. They also claimed that mindfulness tied in to time management, as it could help to make one aware of the tasks that need to be completed, thereby assisting an individual with the prioritising of tasks.

“I would actually add into that, another point, it’s being able to control your thoughts.” [Participant 3]

“I understand mindfulness on many levels. So, for me, the practical side – if your mind is full, or it’s empty, and what you fill your mind with is what you need to manage; that’s how I understand mindfulness. So, I can be mindful of someone, but I don’t think that’s the context that we’re talking about here. So, for me, mindfulness for me is... when you go to bed, what is on your mind, how do you manage your mind to be quiet that you can sleep. When you wake up, what are you going to use your time for in the day? And what will be on top of your mind? You want to be productive in a day, so I’m going to say to myself: “I’m going to spend the next hour on this proposal, or this project, or this task,” so while you’re doing that, you’re working with people, and you have to then be mindful of what happens with them in the process. This is just a silly example, but if you think of this example – I’m sitting at the airport in Cape Town about to get on the plane and I get a Whatsapp from my sister saying she’s very upset with me, because I said something about her at a party, that I was totally unaware of. So now I’m about to get on a plane, and I’ve switched my phone off. I sit on the plane, and I think this is now a mind game – am I going to now sit and worry about her and what she said to me on my cell phone for the 2 hours until I get to the other side. What would I rather use my mind for in those 2 hours? Would I sit and pray, would I sit and meditate, would I start thinking about solving the problem – what would I do, and how will that distract me?” [Participant 6]

Participant 4 suggested that mindfulness involves a healthy balance to one’s life, and that it encompasses an aspect of well-being. In order to obtain a healthy balance to life, one would first need to be aware of what a healthy balance would be and when it is achieved. Therefore, participant 4’s perception of mindfulness can be loosely related to

awareness, although their answer referred more to benefits that could arise through mindfulness practice. The participant believed that mindfulness was related to physical and mental health, which could partly be achieved through a healthy balance in one's life. The participant suggested that mindfulness it could be used as a means to manage mental ill-health.

"My understanding of mindfulness is being not only physically healthy but having a healthy balance to life that you are also mentally fit; well, not fit, but mentally happy. I mean you can have mental health issues, but mindfulness would be a way of managing it, like by getting to a place where you're comfortable and happy with it."

[Participant 4]

Participant 7 related mindfulness to workplace health and safety and mentioned an awareness of one's surroundings when questioned on how they perceived mindfulness. They believed that this cultivation of awareness through mindfulness could lead to reduced incidents of injuries and therefore improved safety.

"Mindfulness... I think it's something to do with health and safety kind of things, you know whatever you're doing, you need to be mindful that you don't injure yourself or someone else while you are working on something, and you need to at least do it in a way that's safe."

[Participant 7]

Presence

Participant 1 claimed that mindfulness meant to be anchored in whatever one is doing in a moment and emphasised taking one thing at a time and not projecting too far into the future.

"Mindfulness is the ability to really be anchored in what you're doing at that moment. It's taking one thing at a time, you know, like not thinking too far ahead in terms of deadlines and objectives, you know like just focusing on the task at hand."

[Participant 1]

Like participant 1, participant 3 suggested that mindfulness involves being in the present, and not projecting into the past or the future. They went on to claim that gratitude and acknowledging all that you have in life and in each moment also formed a fundamental aspect of mindfulness. Participant 3 also believed that mindfulness involved an aspect of self-awareness, or self-focus, rather than comparing oneself to others and what they are doing or have achieved. Participant 3 claimed to have experience in mindfulness practice, suggesting that they have a deeper, more holistic understanding of mindfulness compared to participants who may never have practiced mindfulness.

"Mindfulness to me is being in the present. I know for me personally, I tend to spend a lot of time in the past, more so than I would like. And it's about being in the present and from my own meditation practices, being in the present, acknowledging what you do have, and being grateful for what you do have. Perhaps most importantly for me, is to not be distracted by what other people are doing, or what they have accomplished. It's to be very focused on yourself."

[Participant 3]

Meditation

Only one participant understood meditation to be the fundamental aspect of mindfulness. ‘Mindfulness’ and ‘meditation’ are two terms that are commonly misconstrued and used interchangeably. Mindfulness refers to focused attention and awareness of the present moment, whereas meditation is a practice that can be used to effectively enhance mindfulness (Kabat-Zinn, 2003). Participant 8 associated mindfulness with the act of meditating – a practice commonly used to cultivate mindfulness in individuals. They believed that mindfulness involved being aware of what tasks one is undertaking and what is going through one’s brain at any given moment. This suggests that the participant related mindfulness to an aspect of self-awareness, and awareness of one’s own thoughts and feelings.

“I think of meditating, but also the concept I think of is when you go through life just doing things... Like on autopilot, which I am actually on a lot unfortunately. But yes, it’s basically not being on autopilot, being mindful of whatever you’re doing, and like mindful of what your brain is thinking and everything.” [Participant 8]

Participants generally perceived awareness to be a fundamental component of mindfulness. Different types of awareness were listed, such as self-awareness, awareness of one’s body, awareness of one’s mind, awareness of thoughts and feelings, and awareness of the present moment. Only 20% of the participants suggested that presence was a fundamental aspect of mindfulness, which was fewer than expected. 20% of participants reported thought control as being an important aspect of mindfulness. Surprisingly few participants mentioned attention as a fundamental foundation of mindfulness. Attention is listed by many scholars as a key component of mindfulness (e.g. Kabat-Zinn (2003), Dane (2011), and Brown and Ryan (2003)), and the building block from which many of the benefits of mindfulness arise (Good et al., 2016). To a lesser extent, participants perceived mindfulness to involve a healthy balance in life, health and safety at the workplace, and meditation.

4.1.4.2. Perceived Benefits of Mindfulness

This section looks at the perceived benefits of mindfulness in the context of job performance. Participants were asked how mindfulness could enhance job performance as an engineer working in the South African engineering sector. 60% of the participants believed that mindfulness practice could lead to improved stress management and reduced stress levels in employees. Another 60% of participants believed that mindfulness could enhance productivity on an individual level. A range of other benefits were elicited, which related to primary themes of job performance, mental health, and well-being. This section comprises of the following themes and subthemes: Job performance: personal skills, interpersonal skills, productivity, attitude, motivation, and workplace responsibility. Mental health: Stress, fatigue, and mental state. Well-being: balance, personal life, physical health, and self-esteem.

A) Job Performance

Personal Skills

Participant 4 suggested that mindfulness practice could improve an individual’s decision making and work quality through an improvement in one’s headspace. Participant 5 shared a similar viewpoint in that mindfulness practice could enhance one’s quality of work, through cultivating awareness of what is important in the workplace, which can lead to an improvement in time management and prioritising of tasks. Participant 7 believed that when an individual is mindful, mistakes are less likely to occur, which would improve one’s quality of work. This is because firstly, being mindful increases awareness and attention in the present moment, which means one is more conscious of the task they are undertaking. Higher levels of awareness and attention mean an individual is less likely to make a mistake.

Participant 7 also claimed that mindfulness could aid individuals in foreseeing mistakes and issues before they occur, suggesting that mindfulness practice can enhance foresight and preparation for the future.

“It could definitely help – if people are in the right headspace, they’ll make better decisions, or perhaps not better, but the right decisions, which will obviously impact your work quality.” [Participant 4]

“It’s just actively being aware of what’s important; just taking a step back and saying: “Okay, it’s important to do this with high quality and not just get it done,” then maybe compromise on time, or if it’s a task that just needs kicking out, and doesn’t need to be high quality, then you can take a step back and prioritise what’s important for each specific task.” [Participant 5]

“When you make a mistake, and when you’re mindful of it, you’re unlikely to repeat the same mistake, you could foresee it even before it happens. Mindfulness would be a way to improve how you do certain things.” [Participant 7]

Participant 8 shared a similar belief to participants 4, 5, and 7, in that they believed that mindfulness could enhance quality of work by decreasing the errors that crept in. They also believed that mindfulness could lead to an improvement in time management and efficiency. Time management was classified as a personal skill, whereas efficiency was related to the subtheme of ‘productivity’. They stated that when an individual is in a mindless, ‘autopilot’ mode, they may not be doing things in the most efficient way. It is suggested that by being mindful, and therefore focusing one’s attention to the task at hand, time management and efficiency can be improved, while reducing the number of errors being made.

“I feel mindfulness could help with time management, because if you’re on autopilot, you might not be doing things in the best way, so it could be taking you longer, or you could miss something. Errors definitely creep in more, too.” [Participant 8]

Interpersonal Skills

According to participant 6, mindfulness practice could help make an individual more aware of their actions, and the effects of those actions when relating to others. The participant seems to believe that mindfulness can also be used as a means to control and manage one’s thoughts, and therefore put an end to rumination, which has the potential to lead to mental distress and heightened stress levels. Participant 6 also stated that one’s attitude towards life and people, as well as emotional intelligence could be enhanced through mindfulness practice.

“If you know yourself, you are able to question your actions and reflect on how they affect others, so then I can tick the box, and that won’t occupy my mind. And that’s got to do with how you feel about yourself, your attitude towards life, towards people, and your emotional intelligence.” [Participant 6]

Participant 9 stated that mindfulness was crucial in developing interpersonal skills and highlighted that it was especially important for managers in an organisational context to be mindful. They went on to claim that in addition to interpersonal skills, mindfulness could also enhance an individual’s learning ability. Participant 9 believed that learning was made more difficult when individuals were in a stressed state and since mindfulness practice could be used as a way to manage stress, it could be used to enhance learning ability.

“Mindfulness is very important, especially with the people skills, especially if you’re a manager. And then learning... you cannot learn or understand anything in a state of stress, like for example, in order to be productive or do well or learn, you need to have like eaten well, not worried about finances, not stressed out, worried about something else – so it’s important to take care of those fundamental things before doing anything else.”

[Participant 9]

Participant 10 related mindfulness to being calm and centred, which would assist individuals in achieving a peaceful mental state that is conducive to carrying out cognitive tasks. Firstly, the participant claimed that mindfulness could lead to a mental state that is conducive to effective communication. They believed that mindfulness could prevent individuals from being too focused on oneself, too tense, or closed off. This could lead to individuals being aware of more subtle body language cues and practicing active listening to a greater extent during conversations, allowing them to understand others on a deeper, more emotional level. Participant 10 also related mindfulness to intellectual ability, suggesting that high levels of stress and mental disarray could lead to one ‘blocking’ off one’s intelligence and intellect. Since the participant believed that mindfulness could reduce stress and calm one’s mind, they predicted that mindfulness would be able to enhance an individual’s intellectual ability.

“When I think of mindfulness, I think of calming down and centring yourself. You need to have a certain mental state to be able to communicate effectively, and if you’re so wrapped up in yourself, like if your body is so tense and you’re so closed off, and in your head, you aren’t being mindful and that then closes you off to understanding emotional things that are going on around you and in other people. Then intellectually, I think that you kind of block your intelligence if you’re not level-headed, and you’re super stressed.”

[Participant 10]

Productivity

Participant 1 believed that mindfulness practice could lead to a reduction in stress. In turn, they believed that lower stress could lead to enhanced productivity amongst employees. Participant 5 shared a similar view as they claimed that mindfulness could improve one’s productivity, quality of life, and help an individual identify ‘where they are’ in terms of their personal and professional lives. Participant 5 believed that an improvement in productivity could come about through an increase in awareness regarding *what* makes one productive (for example, what type of environment, content, or mental state is most conducive to being productive). Participant 9 also believed that mindfulness could lead to an increase in productivity through being aware of what their mind and body are feeling. When these issues are brought into one’s awareness and are addressed, the participant believes that one can ‘become a better person’, improve focus, and enhance productivity.

“Mindfulness helps with reducing stress, which can also help with productivity – it’s definitely for the better to have some mindfulness practices in place.”

[Participant 1]

“I think mindfulness is always good. It’s always good to know where you are and what makes you productive, and how things affect you. So, I don’t know if it’s any more or less important than anything else in your life, but I’m definitely a believer that mindfulness improves your quality of life.”

[Participant 5]

“It’s important to be able to know what your body is feeling, what your mind is telling you, because the minute you can address those things, you just become a better person. Therefore, you can be more productive, you can focus more.”

[Participant 9]

Participant 10 suggested that mindfulness could have promising outcomes in an organisational context. They believed that mindfulness could result in an improvement in individuals’ mental health, which would then lead to lower stress levels, enhanced self-awareness, and improved productivity as several other participants also suggested. The participant suggested that if individuals are less stressed, more fulfilled, and experiencing greater happiness, then the entire organisation could be uplifted through an improvement in company culture and productivity.

“I think it could have really good outcomes. You’d have less mental health issues – even if a company took half an hour a day for us just to sit and relax, and I don’t mean lunch. So, I think that mental health would definitely be improved; self-awareness and then productivity, I guess, if you’re in balance, if your mental health is good, if your stresses are kind of low and you’re at peace, I feel like everyone’s happier – company culture improves, productivity, everything”

[Participant 10]

Attitude

Participant 7 stated that mindfulness could lead to enhanced awareness and a better attitude toward completing tasks and going about day-to-day life. The participant spoke about being in an unconscious ‘autopilot’ mode, and how mindfulness could help individuals become more conscious of what they were doing in each moment, thereby improving their awareness and the quality of the tasks they are performing. Participant 7 related challenges in the workplace and complacency to mindlessness. They believed that if an individual enjoyed challenges in the workplace, then they would be less likely to become complacent. The participant suggested that when complacency sets in, one is more likely to make errors while being less aware of what one is doing in the moment, resulting in a mindless, ‘auto-pilot’ mode.

“Yes, it could, if let’s say you’re making coffee, if you’re doing it in a careless sort of way, and you’re not paying attention to whatever you’re doing, it affects what you’re trying to achieve basically. I mean if you like a challenge, then comes the complacency, and some things you just don’t think – you know, you’re so used to walking from your room so much that you don’t pay attention to it. If something changes, you might not even be aware of it, you know. You can be so used to doing the same things, and if you’re so used to doing one thing so much that sometimes you just don’t think about it.”

[Participant 7]

B) Mental Health

Stress

Participant 1 claimed that by having mindfulness practices in place, stress could be reduced, which, in turn, could enhance productivity amongst employees. Participant 2 reflected a similar viewpoint, although they went on to state that mindfulness practice would also help prevent burnout and improve an individual’s quality of work.

“Mindfulness helps with reducing stress, which can also help with productivity – I think it’s definitely for the better to have some mindfulness practices in place.”

[Participant 1]

“Some form of mindfulness practice, whether that’s meditation, or journaling, or going for a 5-minute walk first thing in the morning would decrease overall stress levels, decrease burnout, and therefore probably improve quality of work and productivity.” [Participant 2]

Participant 2 suggested that mindfulness could help an individual remain calm. This calmness would then result in increased productivity and stress management due to the awareness that arises over oneself, one’s surroundings, and one’s schedule. The participant also claimed that the awareness that arises through mindfulness practice could lead to an individual becoming more conscious of tasks that need to be completed. This could lead to improved time management, and fewer instances of individuals forgetting important dates or tasks.

“If you can keep yourself calm, you’re much more likely to get things done, and if you’re aware of how you’re feeling, you can take action to counteract it. So, if you know that you’re stressed out about a certain task or, you know, something that you have to do, then you know that you’re subconsciously going to avoid doing it, and that has happened to me a couple of times, where I forget something for multiple days, and it’s a challenge, and I’m stressed I won’t be able to do it properly. But if you’re conscious and aware of that, you can like, write it down, put it in your calendar, make a plan to do it properly.” [Participant 2]

Earlier in their interview, participant 3 stated that stress could often be used as a source of motivation for them, although there were cases when it would become too overwhelming to bear any further. This participant believed that mindfulness practice could be used for individuals in the position where stress becomes too overwhelming. Participants 8 and 9 shared similar views in that mindfulness practice could relieve stress among individuals by helping them become aware as to why they are stressed, thereby improving their stress management capabilities.

“I’ve seen stress as a driving factor, but I know there are cases where it’s the complete opposite, and people just succumb to the stress. So absolutely in those cases. It would mean that there’s less of those cases where stress becomes completely overwhelming.” [Participant 3]

“If something is really stressing you out, you can, instead of just going through the emotions, you can think of, for example: “Okay, why is this stressing me out? What can I do to relieve the stress?” I think it will help a lot of people.” [Participant 8]

“Mindfulness makes you more aware, so when you’re stressed, you know: “Okay, now I’m stressed, I need to get into this state of being ‘unstressed’”, whereas if you’re not mindful, you just be in that state forever and ever, and will probably do things that will make that state worse. So just being mindful of your body, how you’re feeling and everything, you’ll be able to address those things. I think awareness is the first step to improvement for everything.” [Participant 9]

Mental State

Participant 3 believed that mindfulness practice could eliminate excessive thoughts and ‘mental clutter’, which relates to mental state. They believed that this would lead to an increase in mental capacity and mental resilience, as less attention would be given to smaller, insignificant negative thoughts.

“I’d say that it diminishes the effect clutter has on your life, and if you do that, you have much more mental capacity to perform at the best of your abilities. You don’t end up getting yourself into a flat spin about some

issue that's external to what you're doing in the current workplace – no invasive thoughts that aren't welcome at that time.” [Participant 3]

Participant 4 implied a link exists between mindfulness practice and happiness. The participant believed that happiness was correlated to work quality and decision making. These traits can therefore be indirectly linked to mindfulness practice, since the participant believed that happiness could come as a result of mindfulness practice. It was stated that poor decision making could lead to financial implications, which could potentially weaken an entire organisation.

“I mean if you're not happy and you're waking up every day to go to work and you're trying to give it your best, your quality is going to start dropping and you're going to start making wrong decisions which will obviously have some financial implications. Yes, I mean I definitely think there's a link; if you're not mentally in the right headspace, you're not going to perform your job as well as you could.” [Participant 4]

C) Well-being

Self-Esteem

Participant 3 stated that mindfulness practice could enhance an individual's confidence, which is related to self-esteem and self-image. This could be achieved as individuals are less likely to compare themselves to others, and more likely to be aware of their accomplishments and success thus far.

“Even for confidence things in work, so say you don't understand something, or you start questioning your own ability at the job, it allows you to remember what you've done up until that point, and to back yourself, and to keep on going, and that it's okay to ask. And that comes from not comparing yourself to other people and thinking that they can do it, and I can't.” [Participant 3]

Balance

Balance between work and one's personal life is an important aspect of well-being. Participant 8 suggested that mindfulness could lead to a healthy lifestyle and balance in life. They also reported that the company that they worked at encouraged healthy, balanced lifestyles which included aspects such as looking after one's physical and emotional healthy and building interpersonal relationships.

“I feel like mindfulness definitely fits into the balance of healthy lifestyle, and at the company I'm at, they like to encourage that, like that healthy, balanced lifestyle, like physical exercise, mental health, socialising.” [Participant 8]

Based on the findings presented above, the predominant perceived benefits of mindfulness in the context of job performance were a decrease in stress levels and an improvement in productivity. This indicates that these are two of the most likely benefits that could be experienced by engineering professionals engaging in mindfulness practice. Most participants who proposed a decrease in stress levels believed that lower stress levels could enhance job performance and productivity as lower stress would lead to improved mental clarity, less rumination, and increased confidence within one's job. Followed by lower stress levels and increased productivity, was an improvement in time management through mindfulness practice. This view was reflected by 30% of the participants and is therefore another plausible perceived benefit that could be experienced by a wide range of practitioners.

To a lesser extent, 20% of participants suggested that mindfulness practice could bring about an improvement in the following areas: quality of work, a reduction in errors, improved quality of life, better decision making, and enhanced mental capacity and clarity. Lastly, only 10% of participants claimed that the following benefits could come about through mindfulness practice: higher levels of self-confidence and motivation, improved focus, feelings of greater fulfilment, improved interpersonal skills, and enhanced company culture.

4.1.5. Conclusion

The findings presented above reflect the perceptions, understandings, and opinions of the participants who partook in the interviews in this research study. The emergent codes from the data presented were categorised into five main deductive categories, namely job performance, mental health, well-being, workplace environment, and mindfulness. The findings that have been presented will be used to construct a discussion that will relate the emergent data from this research study to existing academic literature and will allow the researcher to construct theories and arguments for mindfulness as a tool to enhance job performance in the engineering workplace, while reducing detrimental states.

4.2. Statistical Quantitative Data Analysis of the Survey Instrument Responses

The following section deals with the statistical analysis of the quantitative data gathered through responses. Statistical analysis took place in the form of descriptive statistics and linear regression analysis.

4.2.1. Descriptive Statistical Comparison Between Latent Variables

A total of N = 101 responses were recorded in this research study. The number of responses gathered was a limitation to the study since more would be required to obtain true generalisability. With 101 responses, however, it was deemed that there were sufficient responses to gauge an idea of what the emergent trends would look like if a larger sample had been utilised. The table below highlights the scoring of the instrument, by each latent variable. The instrument made use of a Likert-type scale with a maximum score of 5 for each question. A higher score meant that a participant experienced that state (latent variable) to a greater extent (for example, a participant who scored 25 for the stress

Latent Variable	Number of Questions	Maximum Possible Score	Mean Score	Mean Score (%)	Variance	Standard Deviation
Mindfulness	12	60	40.51	67.52	51.13	7.15
Fatigue	12	60	36.85	61.42	89.26	9.45
Job Satisfaction	5	25	17.00	68.00	24.80	4.98
Productivity	5	25	17.37	69.48	12.89	3.59
Stress	6	30	17.75	59.17	30.41	5.51

section would generally be stressed more often compared to a participant who scored 15).

Responses showed that of the N = 101 participants who completed the instrument, participants were reasonably mindful. Participants were also generally less fatigued than they were mindful. Job satisfaction, productivity, and stress were all on a very similar level based on the mean scores of the respective latent variables.

The box-and-whisker plot below shows the spread of the data representing the participants' scores for each latent

Table 4: Descriptive statis

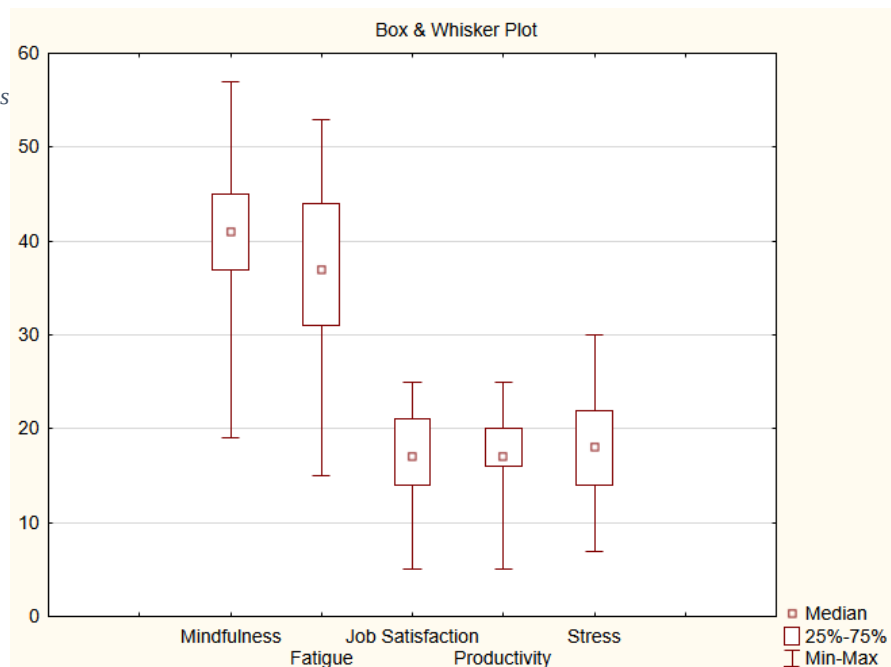


Figure 3: Comparative Box-and-whisker- plots for the survey variables

variable in the instrument:

The comparative graphic below shows the different histograms, box-and-whisker plots, and descriptive statistics for each of the latent variables measured in the instrument. The graphic has been included for the purpose of fast and

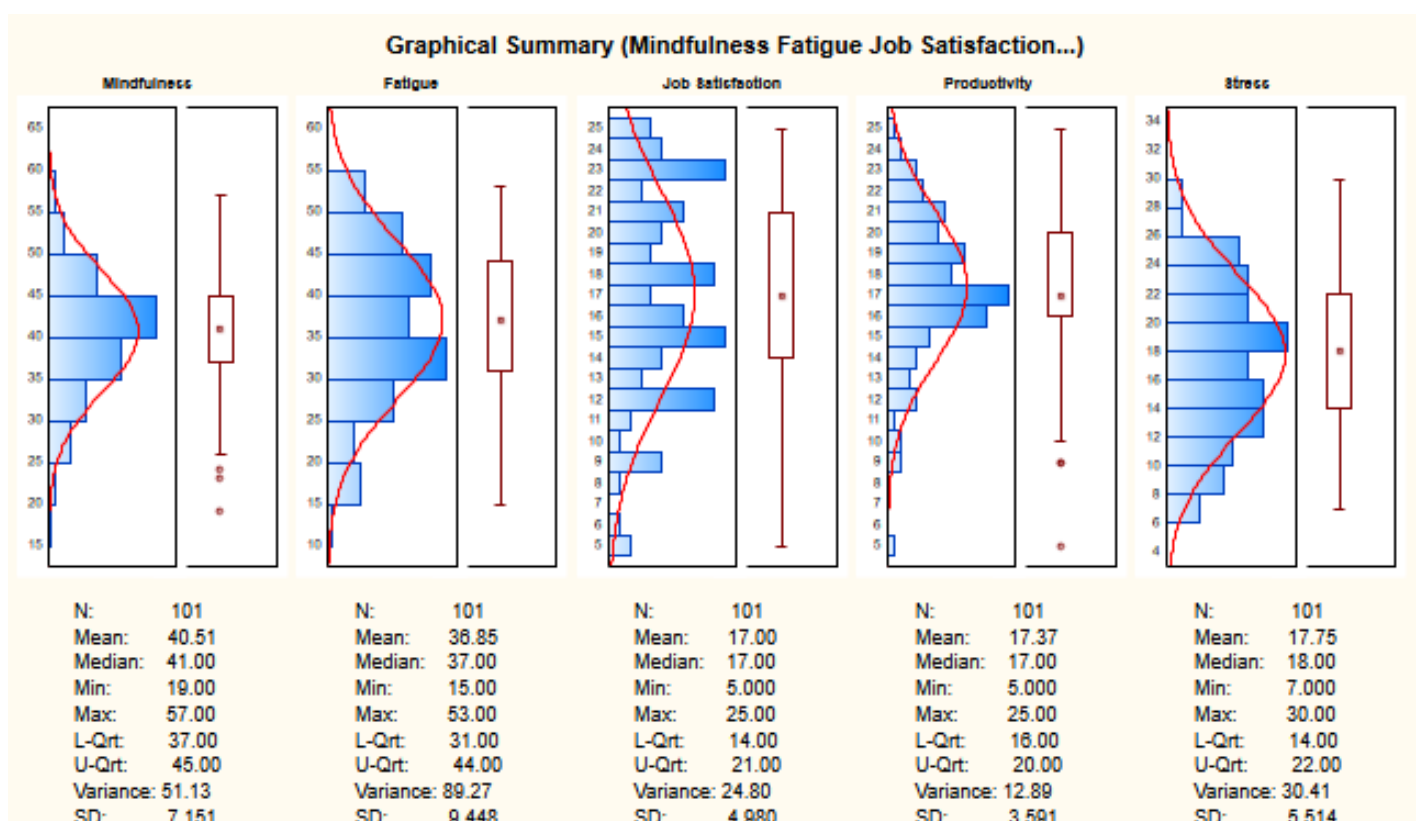


Figure 4: Descriptive statistics analysis from the survey responses

efficient comparison between each of the latent variables.

Descriptive statistics and the histogram for mindfulness revealed that the data were quite evenly spread, except for the three outliers, who scored significantly lower for the 'mindfulness' latent variable compared to the other respondents. The data were very slightly negatively skewed (-0.238), which was supported by the fact that the mean (40.51) and median (41.00) were sufficiently close to one another. The standard deviation of 7.151 suggested that the data were reasonably reliable and that responses were mostly clustered around the mean, as reflected by the histogram. If the standard deviation had been too high, it would indicate a large spread of the data, which would decrease the reliability of the data since the respondents would have had notably different sub-scores for the latent variable which would likely not have been characteristic of the population being studied. The interpretation of the data spread is that the respondents generally possessed a similar level of mindfulness, suggesting that this level is characteristic of the greater population being studied. These results indicate that the data are valid and useful, and that it was suitable to commence using the data gathered for this latent variable.

After descriptive statistics and histograms were generated for the latent variable of 'fatigue', it was revealed that the data were more widely spread compared to the 'mindfulness' latent variable. This was reflected by the standard deviation (9.448) and the histogram, which showed that the data were more widely spread than for mindfulness. This also suggests that the data obtained for this latent variable would have been slightly less reliable than for mindfulness, as it would suggest that individuals from the greater population being studied would have differing levels of fatigue – there would not be an accurate characteristic level of fatigue for the greater population. The data were slightly negatively skewed (-0.317), although the mean (36.85) and median (37.00) were sufficiently close together to ensure that the skewness was not significant. Descriptive statistics for this latent variable suggested that it was suitable to use this data going forwards in the research study.

The histogram for the 'job satisfaction' latent variable revealed a somewhat unexpected spread of the data. Upon further investigation, it was found that this latent variable only had 5 questions associated with it, whereas the 'fatigue' and 'mindfulness' each had 12 questions associated with them. Since several of the participants scored 25/25 for this latent variable in the instrument, the histogram that was generated expected there to have been data entries greater than 25, since distributions in statistics show that achieving 100% in any measure is highly unlikely. The low number of questions for this latent variable meant that achieving 100% was high, which is not reflected by the histogram. The data were slightly negatively skewed (-0.280), and the median and mean were both found to be 17.00. The standard deviation was found to be 4.980. Since the total score was only 25, the standard deviation suggested that the data were not clustered around the mean, and that the data collected were not highly reliable. This is reflected by the histogram where it could be seen that the frequency of different scores is spread across the data. The interpretation of this is that respondents experienced varying levels of job satisfaction – the population being studied did not have a dominant view of being satisfied or dissatisfied with their job. The reason for the higher standard deviation could be due to the low number of questions for this latent variable, or that respondents did not understand the questions clearly or answer honestly. Descriptive statistics for this latent variable showed that the data collected are not highly reliable, and that the data should be used with caution going forwards in the research study.

Descriptive statistics for the latent variable of 'productivity' showed that data generally behaved as anticipated, except for 2 outliers on the lower end of the spectrum. The data were slightly negatively skewed (-0.540), which was reflected by the mean (17.37) being sufficiently close to the median (17.00). The standard deviation of 3.591 suggested that the data were reliable, given that the maximum sub-score for this latent variable was 25. Unlike the histogram for 'job satisfaction', the histogram for 'productivity' showed that the data were more closely clustered around the mean, which suggests that the data are more reliable since they would more accurately characterise the population being studied. The descriptive statistics analysis of this latent variable revealed that the data collected could be utilised going forwards in this research study.

Lastly, the data for the 'stress' latent variable had negligible skewness (-0.00569). The mean (17.75) and median (18.00) were sufficiently close to one another to support this finding. Given a maximum score of 30, the standard deviation of 5.514 was higher than expected, and suggested that the data may not be highly reliable. The spread of scores for this latent variable suggests that there is a significant difference in the stress levels experienced by respondents, although there were no outliers present. Descriptive statistics suggested that the data for this latent variable could be used going forwards in this research study.

4.2.2. Statistical Regression Analysis to Establish Relationships Between Variables

Linear regression analysis was conducted on the data that were obtained from the responses. Each of the latent variables were set as the dependent latent variable so that the effects of other latent variables on the dependent latent variable could be observed.

4.2.2.1. Mindfulness as a Dependent Latent Variable

The scatterplots below show the relationship between mindfulness as the dependent latent variable and the respective independent latent variables based on the findings in the instrument:

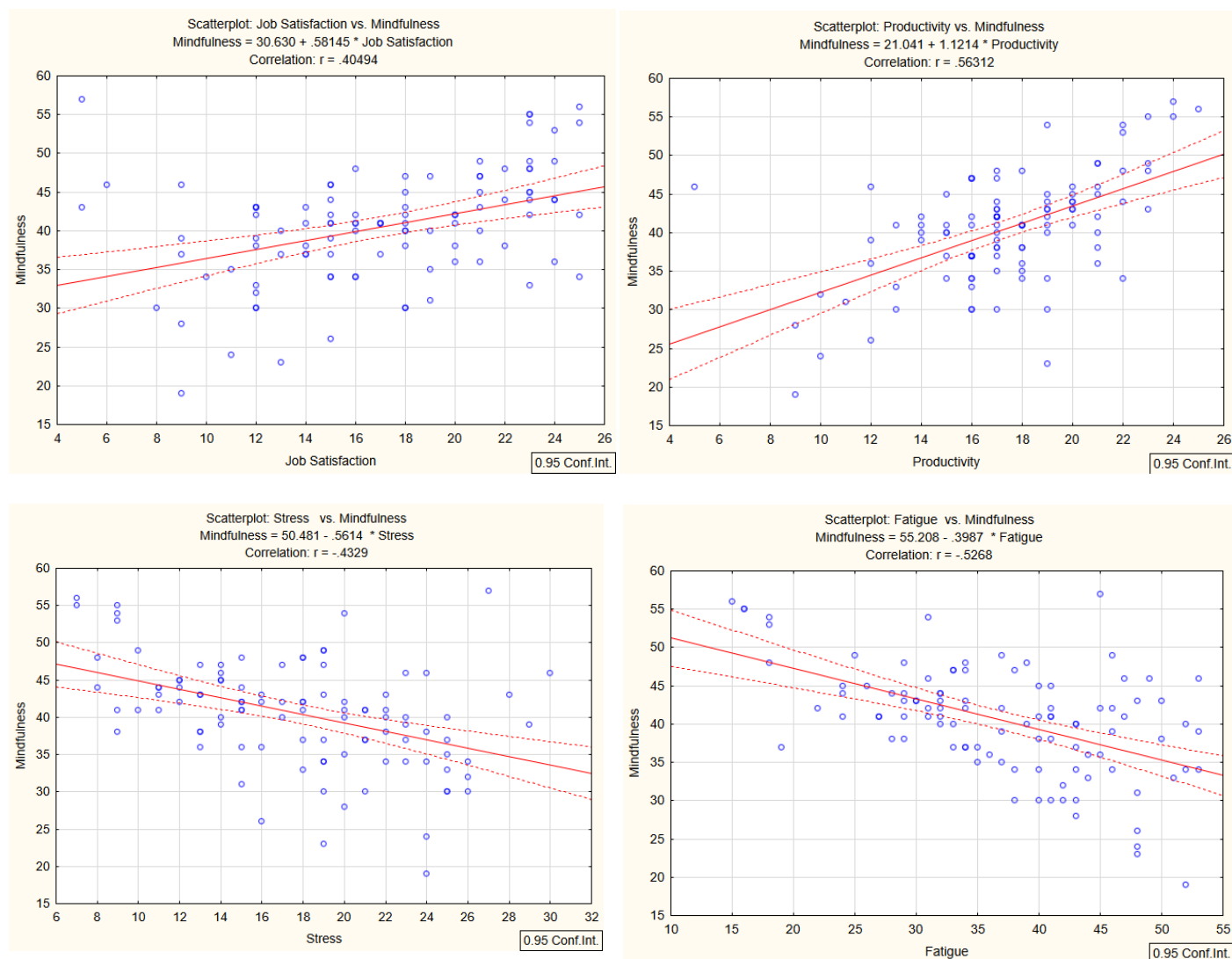


Figure 5: Scatterplots showing mindfulness as the dependent latent variable

Dependent Latent Variable	Independent Latent Variable	Correlation (R)	p-value	Correlation Type, Strength, and Significance
Mindfulness	Fatigue	-0.527	0.000	Negative, Moderate, Significant

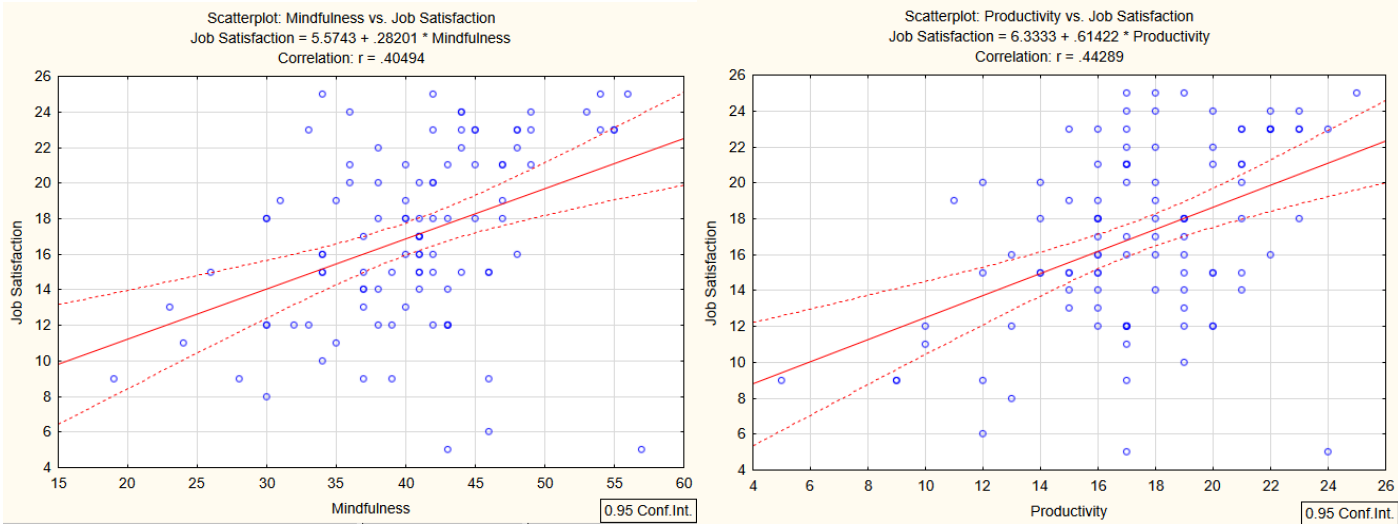
Mindfulness	Stress	-0.433	0.000	Negative, Moderate, Significant
Mindfulness	Job Satisfaction	0.405	0.000	Positive, Moderate, Significant
Mindfulness	Productivity	0.563	0.000	Positive, Moderate, Significant

Table 5: Linear regression analysis results for mindfulness as a dependent latent variable

All p-values proved that the results are statistically significant, and that the null hypothesis may be rejected.

4.2.2.2. Job Satisfaction as a Dependent Latent Variable

The scatterplots below show the relationship between job satisfaction as a dependent latent variable and the respective independent latent variables based on the findings in the instrument:



Dependent Latent Variable	Independent Latent Variable	Correlation (R)	p-value	Correlation Type, Strength, and Significance
Job Satisfaction	Fatigue	-0.468	0.000	Negative, Moderate, Significant
Job Satisfaction	Stress	-0.630	0.000	Negative, Strong, Significant
Job Satisfaction	Mindfulness	0.405	0.000	Positive, Moderate, Significant
Job Satisfaction	Productivity	0.443	0.000	Positive, Moderate, Significant

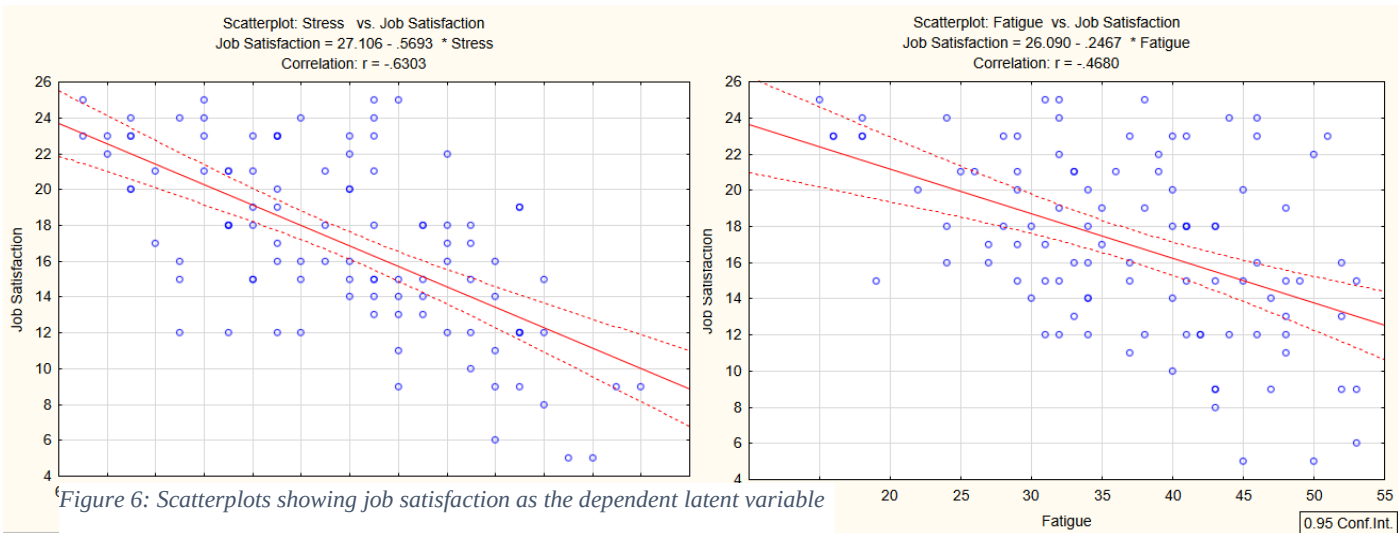


Figure 6: Scatterplots showing job satisfaction as the dependent latent variable

Table 6: Linear regression analysis results for job satisfaction as a dependent latent variable

All p-values prove that the results are statistically significant, and that the null hypothesis may be rejected.

4.2.2.3. Productivity as a Dependent Latent Variable

The scatterplots below show the relationship between productivity as a dependent latent variable and the respective latent independent variables based on the findings through the instrument:

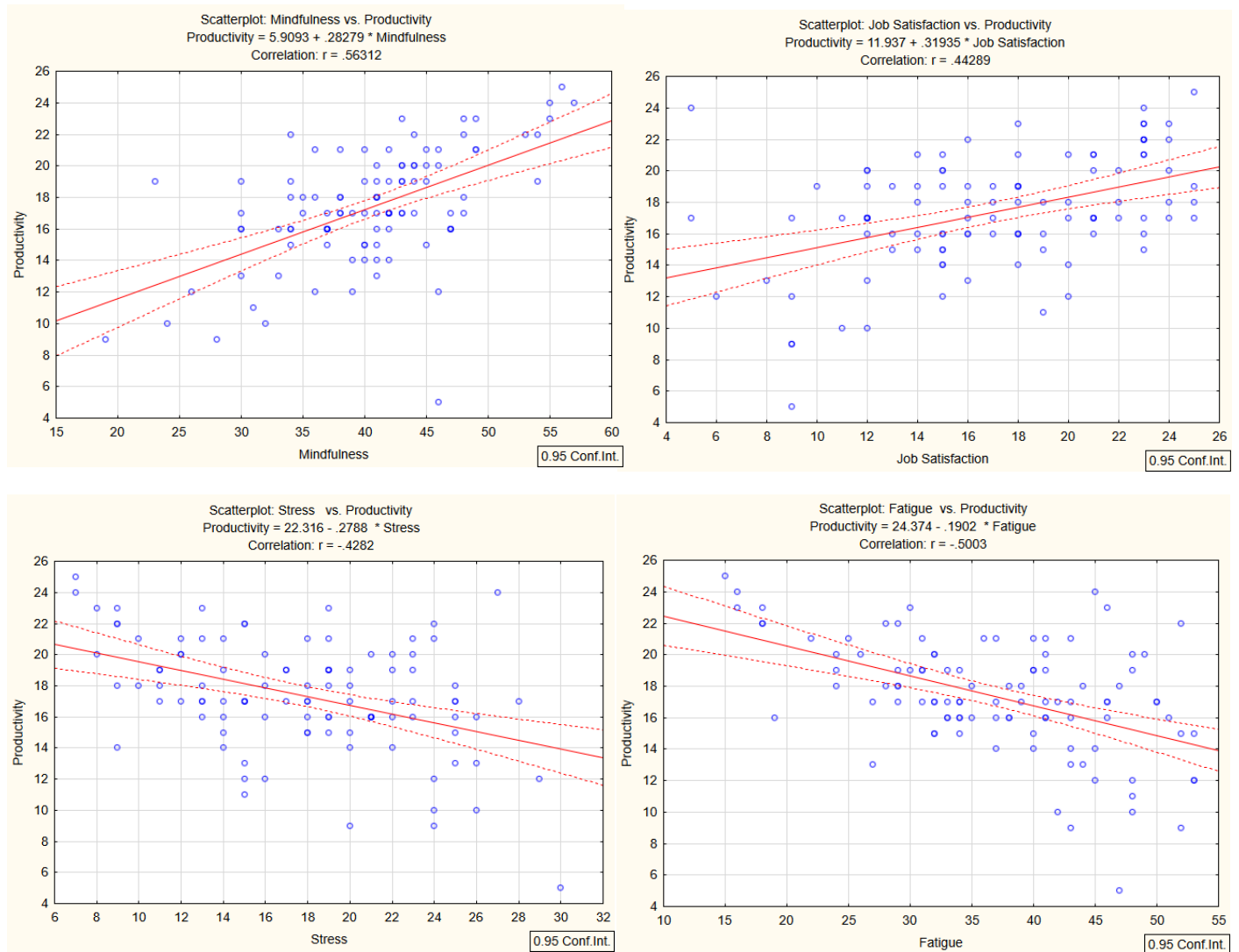


Figure 7: Scatterplots showing productivity as the dependent latent variable

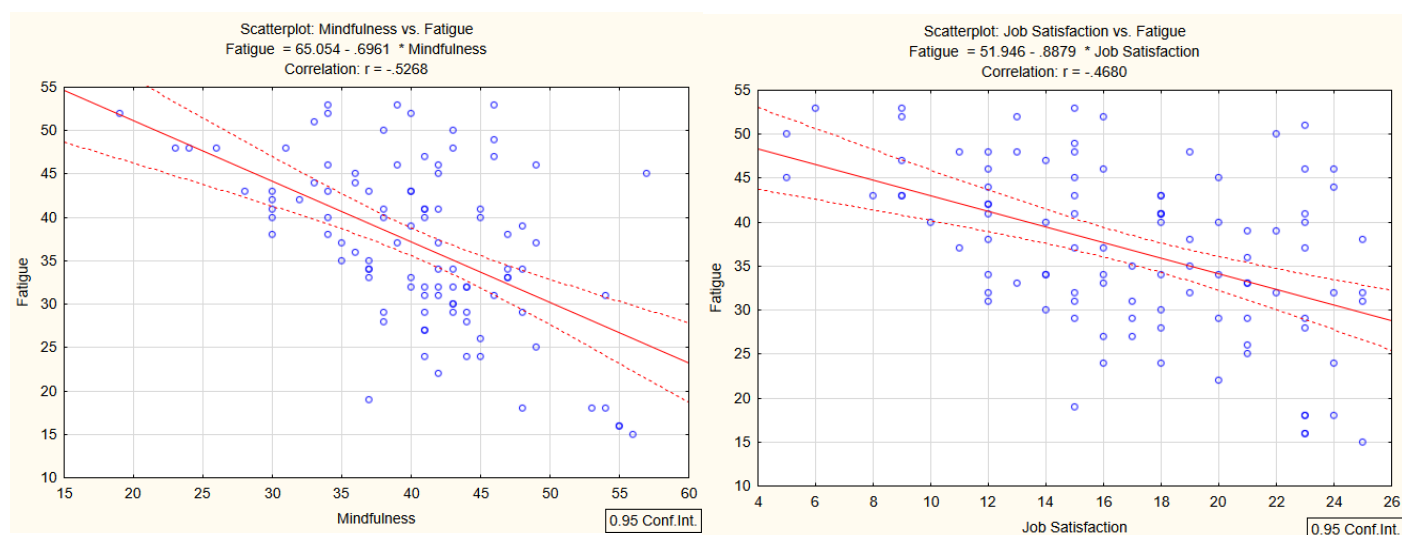
Dependent Latent Variable	Independent Latent Variable	Correlation (R)	p-value	Correlation Type, Strength, and Significance
Productivity	Fatigue	-0.500	0.000	Negative, Moderate, Significant
Productivity	Stress	-0.428	0.000	Negative, Moderate, Significant
Productivity	Mindfulness	0.563	0.000	Positive, Moderate Significant
Productivity	Job Satisfaction	0.443	0.000	Positive, Moderate, significant

Table 7: Linear regression analysis results for productivity as a dependent latent variable

All p-values prove that the results are statistically significant, and that the null hypothesis may be rejected.

4.2.2.4. Fatigue as a Dependent Latent Variable

The scatterplots below show the relationship between fatigue as a dependent latent variable and the respective independent latent variables based on the findings through the instrument:



Dependent Latent Variable	Independent Latent Variable	Correlation (R)	p-value	Correlation Type, Strength, and Significance
Fatigue	Stress	0.659	0.000	Positive, Strong, Significant
Fatigue	Job Satisfaction	-0.468	0.000	Negative, Moderate Significant
Fatigue	Mindfulness	-0.527	0.000	Negative, Moderate, Significant
Fatigue	Productivity	-0.500	0.000	Negative, Moderate, Significant

Table 8: Linear regression analysis results for fatigue as a dependent latent variable

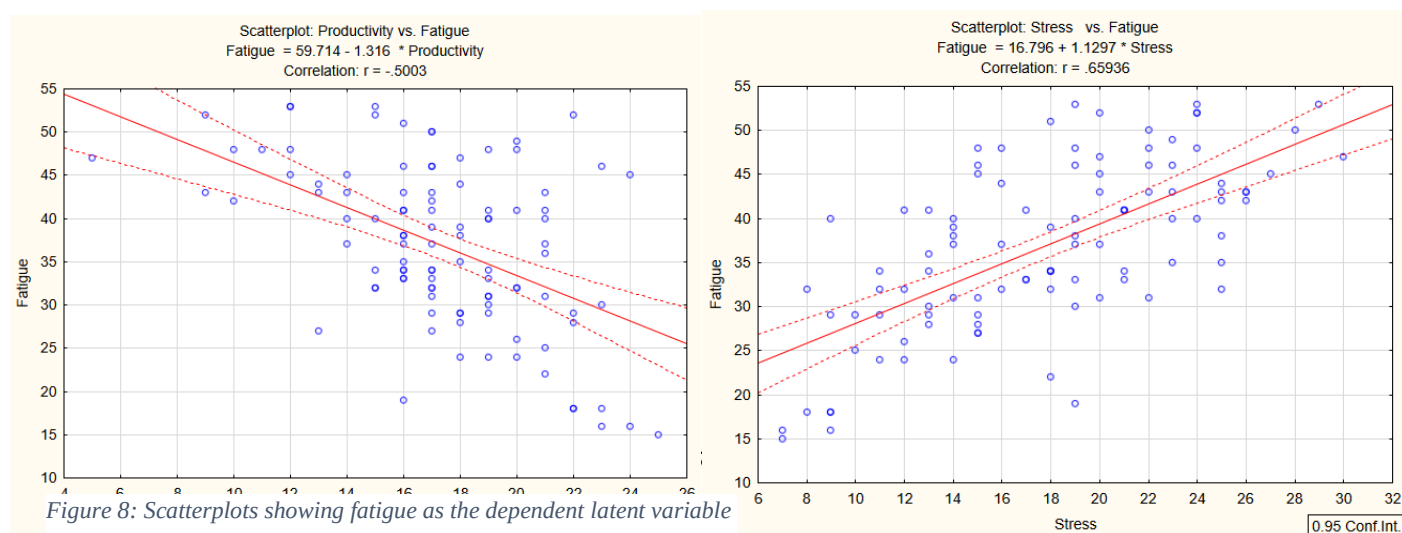
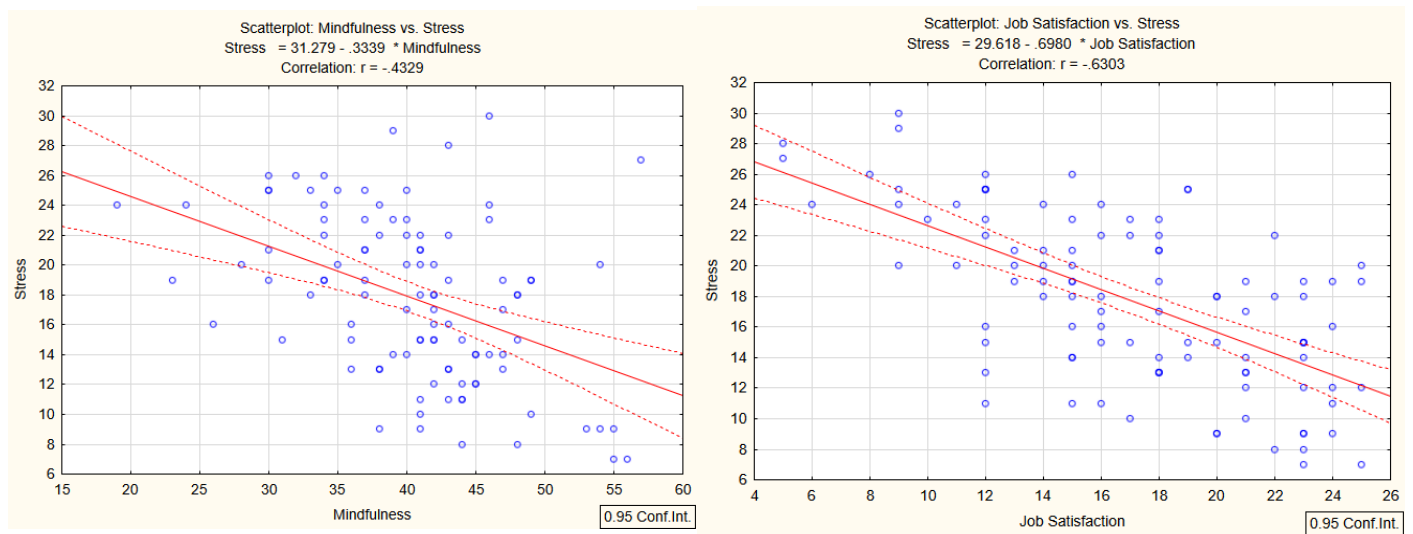


Figure 8: Scatterplots showing fatigue as the dependent latent variable

All p-values prove that the results are statistically significant, and that the null hypothesis may be rejected.

4.2.2.5. Stress as a Dependent Latent Variable

The scatterplots below show the relationship between stress as a dependent latent variable and the respective



independent latent variables based on the findings through the instrument:

Dependent Latent Variable	Independent Latent Variable	Correlation (R)	p-value	Correlation Type, Strength, and Significance
Stress	Fatigue	0.659	0.000	Positive, Strong, Significant
Stress	Job Satisfaction	-0.630	0.000	Negative, Strong, Significant
Stress	Mindfulness	-0.433	0.000	Negative, Moderate, Significant
Stress	Productivity	-0.428	0.000	Negative, Moderate, Significant

Table 9: Linear regression analysis results for stress as a dependent latent variable

All p-values prove that the results are statistically significant, and that the null hypothesis may be rejected.

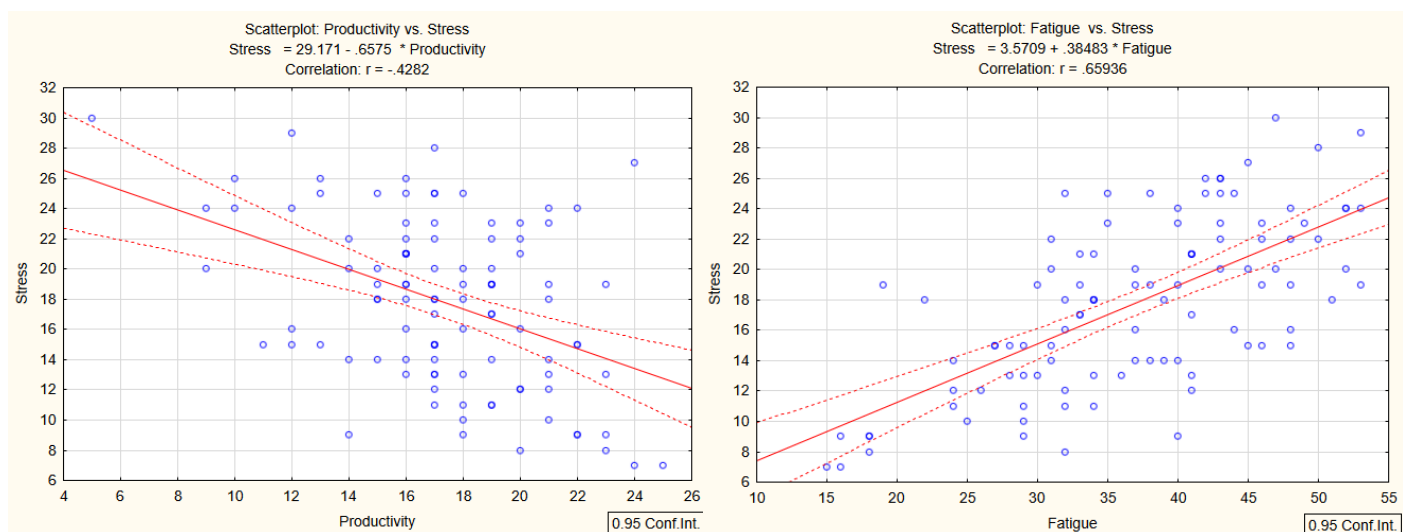


Figure 9: Scatterplots showing stress as the dependent latent variable

4.2.3. Conclusion

Responses underwent quantitative analysis by using descriptive statistics and linear regression analysis of the latent variables. The latent variables used in the instrument (survey) were: Stress, fatigue, well-being, job satisfaction, and mindfulness. Descriptive statistics were used so that the latent variables and their corresponding data could be understood to a greater extent, since the mean, variance, standard deviation, range, box-and-whisker, and scatterplot graphs gave insights into the quality of the data and allowed for a brief overview of each latent variable. Of each of the variables, productivity had the highest mean score of 69.48%, followed by job satisfaction (68.00%), mindfulness (67.52%), fatigue (61.42%), and stress (59.17%). A higher score indicated a higher rating for the respective latent variable. Results therefore indicate that participants were generally more productive than they were satisfied at their job, mindful, fatigued, or stressed. On the other end of the spectrum, participants were generally less stressed than they were productive, satisfied with their job, mindful, or fatigued, which was a positive indicator.

Linear regression analysis was used to identify and explain relationships between latent variables based on the instrument results. All relationships were found to be statistically significant with a p-value of <0.05 , indicating that the null hypothesis could be disregarded in each case. Strong correlations ($0.6 < |R| < 0.8$) were found between Stress and Fatigue, and Stress and Job Satisfaction, while all other relationships were moderately correlated ($0.4 < |R| < 0.6$). The table below shows a summary of the correlation results between each of the latent variables:

Latent Variables	Correlation
Mindfulness and Productivity	0.563
Mindfulness and Job Satisfaction	0.405
Mindfulness and Fatigue	-0.527
Mindfulness and Stress	-0.433
Job Satisfaction and Productivity	0.443
Job Satisfaction and Fatigue	-0.468
Job Satisfaction and Stress	-0.630
Productivity and Fatigue	-0.500
Productivity and Stress	-0.428
Stress and Fatigue	0.659

Table 10: Summary of correlations between latent variables from linear regression analysis

While the correlations can give an indication of the extent to which latent variables can affect one another, it is important to note that these are not highly accurate. Firstly, the latent variable sub-scores are elicited through asking a relatively low number of questions, which would decrease the quality of the statistical analysis. Furthermore, the sample of $N = 101$ was likely too small to be truly representative of the greater population being studied, which may have reduced the accuracy of the statistical findings to a greater extent. Lastly, respondents may not answer the individual questions completely truthfully, or they may have misunderstood some of the questions, which may have affected results. Based on the reasons listed above, it was decided that the quantitative data in this research study would be used to a lesser extent than originally proposed. As such, the qualitative interview data was perceived to be

dominant over the quantitative data collected through the survey instrument. Quantitative data were used to supplement and support findings, rather than to develop findings from scratch.

5. Discussion

This chapter aims to interpret and evaluate the findings from the previous chapter by comparing and contrasting the results of this research study and existing peer-reviewed literature. While the analysis and evaluation of the findings progressed, causal loop diagrams were developed using a systems approach to explain how the phenomena and latent variables that were studied during this research study related to one another. This offered valuable insights into how seemingly unrelated latent variables and categories were more closely related than they initially appeared to be. The causal loop diagrams (CLDs) were colour-coded to correspond to the subtheme headings in the following sections 5.1, 5.2, and 5.3. Detailed CLDs showing the synthesis of the smaller CLDs for each section are included in Appendix F.

The findings and results from this research study were critically compared to existing literature that was relevant to the field of study. The literature review was used to support and confirm findings in this research study, and any new data that emerged from the findings that were not present in the literature review, were investigated further. Drawing from both the findings and the literature review, causal loop diagrams were constructed to offer a systems perspective of the variables, codes, categories, and relationships that made up this research study.

The discussion is presented by revisiting the research questions and the aims that were initially set out at the start of the project. The research questions that were posed in the introduction chapter are restated below for ease of reference:

1. How is mindfulness perceived to affect job performance in the engineering sector in South Africa?
2. How can mindfulness contribute to mental health and well-being amongst employees in the engineering sector?
3. How can mindfulness affect organisations in the engineering sector in South Africa?

The aims of the research study were:

- To gain insight into the mental health situation amongst engineering practitioners in South Africa,
- To investigate the perceptions of mindfulness among engineers working in the engineering sector in South Africa,
- To understand which stressors contribute to stress and mental health problems in the engineering sector in South Africa.

5.1. How is Mindfulness Perceived to Affect Job Performance in the Engineering Sector in South Africa?

The findings present the analysis of the perceptions of mindfulness from both the qualitative interview and the quantitative survey instrument. The qualitative interview elicited responses from participants that explained their perceptions and understandings of mindfulness, as well as the benefits of mindfulness in the context of job performance. The quantitative survey instrument elicited responses from participants who rated their level of mindfulness, which was useful when comparing this rating to the ratings of the other latent variables, namely stress, fatigue, job satisfaction, and productivity.

5.1.1. Perceptions and Understandings of Mindfulness

Awareness

The general perception of mindfulness amongst engineers was that it was an awareness-based practice that could potentially bring about numerous beneficial outcomes in various aspects of an individual's life, even when one is not actively engaging in mindfulness practice. The participants were generally open to discuss the topic of mindfulness, and generally did not perceive it as an esoteric, 'new-age' approach. Interview participants believed that awareness was one of the fundamental components of mindfulness, which was in agreement with a numerous scholars who had previously included awareness as a component of their models, conceptualisations, and definitions for mindfulness (e.g. Kabat-Zinn (2003), Brown and Ryan (2003), Das (1997)). The term 'awareness' is used generally in this context – different participants referred to different types of awareness, including awareness of oneself, one's mind, thoughts, body, feelings, and surroundings. Brown et al. (2007) describes awareness as "*the conscious registration of stimuli, including the five physical senses, the kinaesthetic senses, and the activities of mind*" (p. 45). This demonstrates that while different participants may have listed different objects of awareness, they were aligned with Brown et al.'s definition, which encompasses the five physical senses as well as activities of the mind, which would include awareness of thoughts, feelings, and emotions.

Presence

Several participants reported that mindfulness involved an aspect of presence – another common view amongst many scholars in the field of mindfulness (e.g. Kabat-Zinn (2003), Brown et al. (2007), Dane (2011), and Brown and Ryan (2003)). A relatively low proportion of participants referred to presence as an aspect of mindfulness when compared to the high proportion of scholars who regarded presence as being a fundamental component of mindfulness.

Meditation

Others believed that meditation was a fundamental aspect of mindfulness. Meditation is not a component of mindfulness, but rather a practice through which mindfulness can be cultivated. Kabat-Zinn (1993) explained that meditation is the 'scaffolding' through which mindfulness can unfold and develop. Participant 4 suggested that a healthy balance to life would contribute towards mindfulness. The control of one's thoughts was also perceived to be an important aspect of mindfulness, and that this could be improved through mindfulness practice. While thought control itself is not a fundamental aspect of mindfulness (e.g. Shapiro et al. (2006), Kabat-Zinn (2003), Bishop et al. (2004)), existing literature supports the claim above in that mindfulness practice can lead to enhanced thought control amongst practitioners (Brown et al., 2007).

Attention

Many scholars argue that the basis for mindfulness is attention, and that all definitions of mindfulness should include attention at the forefront (e.g. Kabat-Zinn (2003), Dane (2011), Shapiro et al. (2006), and Good et al. (2016)). Surprisingly few of the participants suggested that attention was a fundamental aspect of mindfulness, with only one participant referring to attention in their perception of mindfulness.

Based on the participants' understandings and perceptions of mindfulness, awareness emerged as the key factor when defining mindfulness. This goes against the common perceptions among many scholars, who argue that attention is the fundamental aspect of mindfulness, with some scholars holding the belief that all benefits of mindfulness arise through

the cultivation of attention. To a lesser extent, interview participants referred to presence, thought control, and a healthy balance as being important factors when defining mindfulness.

5.1.2. Salutary Effects of Mindfulness in the Context of Job Performance

Participants reported a range of benefits relevant to job performance which they believed could potentially come about through regular mindfulness practice. Participants were specifically asked how mindfulness practice could enhance job performance in the workplace environment.

A) Personal Development

Productivity and time management, attention, focus, creativity, innovation, and learning were all personal skills and traits which participants believed could lead to improved job performance. In some instances, participants believed that mindfulness practice held the potential to enhance these skills and traits. They are discussed in further detail below:

Productivity and Time Management

Findings suggested that mindfulness practice could potentially lead to enhanced productivity in the workplace. The belief shared by participants that mindfulness practice could enhance productivity in employees, as well as decrease stress levels and instances of burnout, is confirmed by findings from Kersemaekers et al. (2018). Furthermore, findings presented from the statistical regression analysis showed a positive, statistically significant correlation between an individual's level of mindfulness and their level of productivity ($R = 0.563$), which supports the findings by Kersemaekers et al. (2018), findings in this research study. Similarly, participants suggested that mindfulness practice could lead to improved awareness. Through improved awareness, individuals would be more aware and conscious of the tasks that needed to be completed and how to manage their time effectively in order to complete their tasks by the deadline. This improvement in time management could potentially lead to improved efficiency and productivity. An improvement in productivity would contribute to improved job performance, as demonstrated through findings by Grant (2008). Since it has been shown that mindfulness practice holds the potential to enhance productivity and time management, it can be proposed that mindfulness can potentially boost job performance indirectly, since these variables are linked to job performance according to participants in this research study, as well as existing research (e.g. Grant (2008)).

As indicated in figure 10 below, the variables time management, productivity, task completion, and meeting deadlines form a reinforcing loop, R1, in the CLD. As was found in this research study, mindfulness practice can lead to an improvement in time management, which, in turn, could lead to an improvement in productivity. A higher rate of productivity could result in a higher rate of task completion, which could result in more deadlines being met. As more deadlines are met, time management improves, and the reinforcing loop is completed. This could have positive implications for job performance since it can be improved through both productivity (Grant, 2008) and time management.

An interesting finding from this study was that moderate stress in the workplace was related to an increase in productivity. The reasoning behind this belief was that moderate stress could put positive pressure on an individual to complete their tasks if deadlines were approaching. Participants did state, however, that sufficiently high levels of stress would be detrimental to job performance and could potentially decrease productivity as employees were

considered more likely to encounter a panicked or distressed state when they were highly stressed. An interesting conflict arises here: it has been shown through existing research (e.g. Kersemaekers et al. (2018), Matee (2018)) and the findings of this research study that mindfulness leads to a decrease in stress. Simultaneously, findings demonstrated that a commonly held belief is that moderate stress boosts productivity. The claim by Kersemaekers et al. (2018), that mindfulness led to an increase in productivity, does not clarify that, for example, it could be context dependent. It is likely, though, that the mindfulness would generally lead to an increase in an individual's productivity, and that the productivity that is gained through obtaining greater awareness, mental clarity, and time management through mindfulness practice, would outweigh the loss in productivity resulting from complacency through a lack of positive stress.

Attention and Focus

It has been well-established that mindfulness leads to improved attentional capabilities in practitioners (e.g. Good et al. (2016), Smallwood and Schooler (2015), Shapiro et al. (2006)). This comes about through an improvement in three key areas of attention itself, namely attentional stability (Good et al., 2016), attentional control (Ocasio, 2011), and attentional efficiency (Neubauer and Fink, 2009). Findings from this research study showed that improved focus could lead to a reduction in errors being made, since individuals are more deeply absorbed in the task that they are engaging with and are more consciously aware of the work they are producing. Existing research supports these claims and has shown that mindfulness improves focus, and can therefore reduce the number of errors made (e.g. Good et al. (2016), Smallwood and Schooler (2015), Brown et al. (2007), Carbonetto et al. (2019)). These relationships are included on in the CLD in figure 10. A greater concentration of errors while performing tasks would result in lower quality of work, while also decreasing the efficiency with which one can work, since more time would need to be spent correcting the errors. Findings showed that quality of work was linked to job performance, suggesting an increase in errors (and therefore a decline in quality of work) could lower an employee's job performance. As mindfulness enhances attention, a subsequent improvement in focus could occur too. This is followed by a decrease in errors made, which could lead towards higher quality of work, resulting in improved job performance. Therefore, mindfulness can be proposed to hold the potential to enhance job performance through increased attentional capabilities and focus.

Creativity and Innovation

Rieken et al. (2019) found that mindfulness has been shown to improve divergent thinking amongst engineers, which can subsequently enhance creativity, problem solving skills, and innovation – variables that contribute towards successful job performance according to findings in this research study. This claim is supported by Kuncel et al. (2004), who reported that creativity contributed towards work performance. Additionally, Ostafin and Kassman (2012) showed that mindfulness can directly contribute towards insight problem solving – another important aspect of successful job performance as an engineer. As technology and scientific knowledge evolves, and as new societal problems present themselves, engineering challenges become increasingly complex, thus requiring a higher level of innovation (Sheppard, 2009). If engineers position themselves to contribute towards solving complex problems faced in technological fields and society, then their job performance would significantly be enhanced given the value they could potentially be contributing. Since mindfulness can potentially enhance divergent thinking and problem-solving abilities in individuals, creative and innovative skillsets could also potentially be improved upon. An improvement in these abilities could all contribute towards successful job performance as an engineer.

The findings in this research study identified learning as an important driver of successful job performance as an engineer. Learning has generally been noted as important for employees (Reb and Choi, 2014). Mindfulness has been shown to enhance learning directly (Reb and Choi, 2014), and indirectly, as mindfulness holds the potential to promote psychological safety, which Edmondson (1999) found could lead to enhanced learning. Mindfulness has also been shown to hold the potential to enhance learning indirectly through stress reduction (Hülshager et al., 2013), which supported findings in this research study, which found that learning contributed towards productivity. This reinforcing relationship is noted in the CLD below (figure 10) with influencing variables.

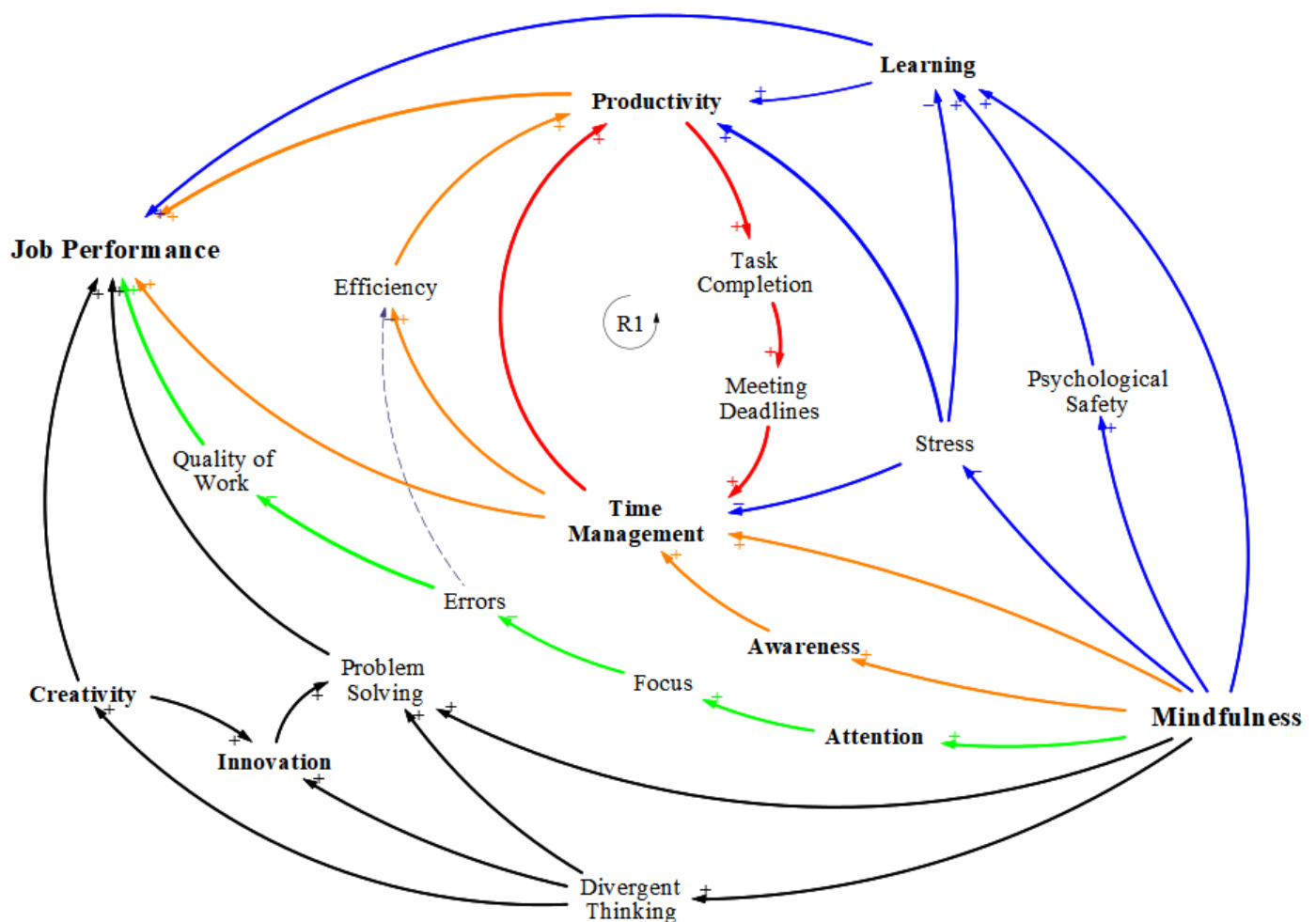


Figure 10: CLD showing systems model of the personal development variables related to successful job performance as an engineer

B) Social Development: Interpersonal Traits and Skills

Emotions, teamwork, communication, and management were all interpersonal skills that were identified that could lead to improved job performance. Each of these traits and skills were found to be enhanced through mindfulness practice. They are discussed in more detail below:

Emotions, Teamwork, and Communication

Emotional intelligence was found to be an important aspect of engineering job performance, and mindfulness was found to be able to enhance emotional intelligence in individuals. Schutte et al. (2001) confirmed this claim, and a

similar relationship was reported by Hülshager et al. (2013), who demonstrated that a positively correlated link exists between mindfulness and emotional regulation. Communication was an important factor that was found to contribute towards successful job performance. Mindfulness has been shown to enhance communication (e.g. Goleman (2006), Fast et al. (2014), and Brown et al. (2007)), which, in turn, has been shown to likely enhance effective team and organisational functioning (Good et al., 2016). Findings demonstrated that teamwork (the ability to operate in a team) was a significant factor that could help predict successful job performance amongst engineers. Additionally, Edmondson (1999) found that psychological safety could enhance feeling of trust, which could further improve teamwork and communication between employees. Bond and Bunce (2003) found there to be a causal link between employees' emotional regulation, and their mental health state and work performance one year later, which suggests that as mindfulness can potentially improve an individual's emotional regulation, their work performance could improve too. Furthermore, it was found that better mental health could lead to improved well-being in individuals, and findings claimed that mindfulness could directly boost mental health. As mindfulness improves an individuals' emotional intelligence and emotional regulation, their communication and teamwork could potentially be improved upon too, which could hold promising outcomes for individual job performance.

Management

Mindfulness practice was found to enhance people skills and was noted as being important for those in managerial or supervisory positions within organisations. Shonin et al. (2014) demonstrated that mindfulness could be used as an effective tool for enhancing the job performance of managers, while Reb et al. (2014) found that mindful supervisors had a positive impact on the well-being and work performance of their employees. In this way, mindfulness holds the potential to improve job performance of employees through enhancing the job performance of managers, which was shown to have a positive impact on the well-being and performance of their employees and subordinates. In figure 10 below, this relationship is depicted as an influence diagram with mindfulness as a driving variable indirectly influencing job performance.

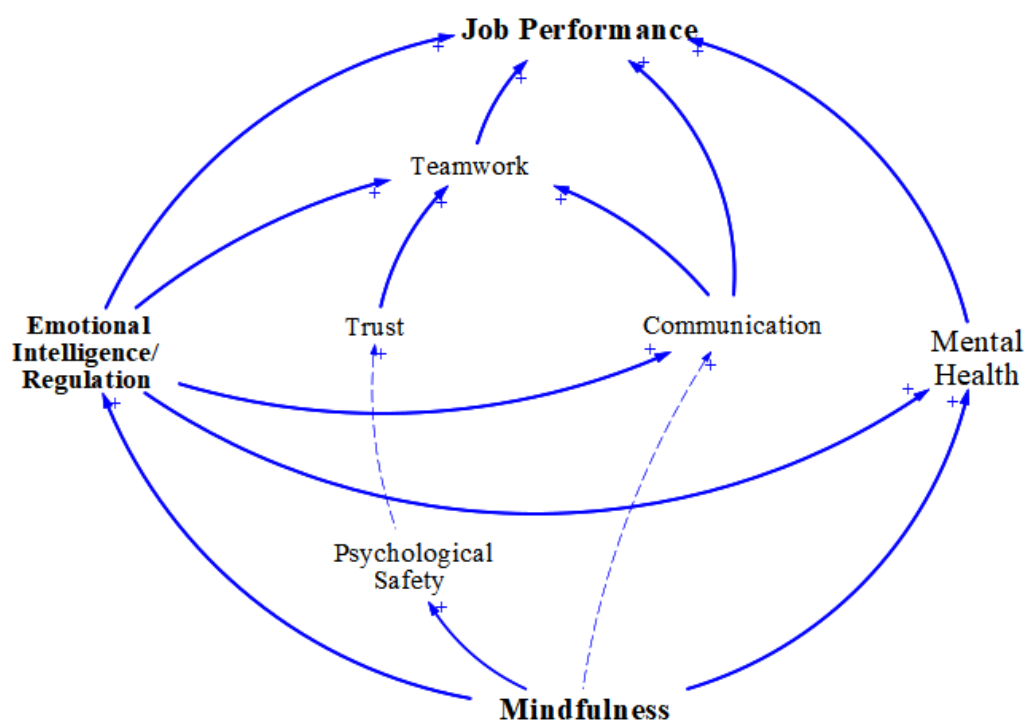


Figure 11: Influence diagram showing systems model of the social development variables related to successful job performance as an engineer

C) Emotional Management

Awareness, well-being, stress, physiology, and health were all factors that were perceived to potentially influence an individual's mental, physical, and emotional states, while also being perceived to enhance job performance. Findings suggested that mindfulness practice could enhance each of these factors, as discussed in greater detail below:

Awareness

Findings suggested that awareness was a fundamental component of mindfulness, and that mindfulness practice could potentially lead to greater levels of awareness in individuals. It was found that an increase in awareness could help individuals become more aware of their own state, enabling them to become aware of their stress levels, energy levels, thoughts, time management, and tasks at hand. Through bringing awareness to these issues, participants believed that individuals would be able to position themselves to make personal changes and improve their state such that it would be more conducive to successful job performance. For example, if an individual was stressed, and they were aware of their stress and the source of the stress, then they would be in a position where they could make changes to manage their stress. The same can be said for the other states and activities mentioned above. This is confirmed by Brown and Ryan (2003), who showed that mindfulness was associated with greater general awareness of phenomena passing by from moment to moment.

Well-being

Findings showed that mindfulness practice could lead to an improvement in an individual's well-being. Deci and Ryan (1985) supported this claim as they demonstrated that mindfulness could enhance personal well-being directly by adding clarity and vividness to current experiences, while encouraging closer sensory, moment-to-moment contact with life without first interpreting, analysing, and judging passing phenomena. Additionally, Deci and Ryan (1985) found that closer sensory, moment-to-moment contact with life, free of judgement would lead to an enhanced sense of personal well-being, and found that lower instances of judgment and discrimination towards current events unfolding led to a state of peaceful equanimity – which Deci and Rya (1985) found can significantly enhance one's sense of well-being; as indicated in the causal loop diagram. Danna and Griffin (1999) and Medina-Garrido et al. (2017) both reported that employee well-being leads to improved job performance. As mindfulness enhances personal well-being amongst employees, findings suggest that a subsequent improvement in job performance would follow. Brown and Ryan (2003) backed up this claim as they found significant correlations between mindfulness and higher levels of subjective well-being (higher positive effect and satisfaction with life), and eudemonic well-being (vitality and self-actualisation). This implication suggests that mindfulness practice can indirectly enhance an individual's job performance through improved personal well-being. Dane and Brummel (2014) showed that when individuals experience higher levels of well-being, they were more likely to feel motivated and satisfied at their workplace, which could lead to improved job performance. Statistical analysis in this research study revealed a positive, moderate relationship between mindfulness and job satisfaction ($R = 0.405$) to further support the evidence that mindfulness practice holds the potential to enhance job performance through improved job satisfaction.

Stress Reduction and the Stress-Productivity-Job Performance Relationship

Findings in this research study revealed that mindfulness practice could be used as an effective tool in managing and dealing with stress. This perception was confirmed by various scholars through existing research (e.g. Kersemaekers

et al. (2018), Matee (2018)), and it has been observed on multiple occasions that reduced stress is one of the key benefits attainable through mindfulness practice (Kabat-Zinn, 1990). This finding is supported by Brown et al. (2007), who found that mindfulness could assist individuals in altering their perspective towards a situation, allowing them to experience greater clarity and objectivity, and therefore decreasing their stress levels. Deci and Ryan (1985) also showed that mindfulness encouraged closer sensory, moment-to-moment contact with life, without first interpreting any phenomena or experiences. They found that this could also help reduce stress in individuals since they were less inclined to form immediate judgments towards phenomena as they occur.

Baer et al. (2006) demonstrated that mindfulness enhanced positive experience, which was negatively correlated to psychological distress, further supporting the findings in this research study that mindfulness could reduce stress. Findings showed that stress could lead to increased fatigue, which in turn, could exacerbate stress. The stress – fatigue relationship is represented by loop R1 in the causal loop diagram (CLD) in figure 12. Findings reported that fatigue could lead to a decrease in productivity, whilst productivity had a direct, positively correlated impact on job performance. This relationship between productivity and job performance is confirmed by Grant (2008), who found a strong, positively correlated relationship between the two variables. Findings suggested that moderate stress could lead to an increase in productivity, whereas excessively high levels of stress could lead to a drop in productivity. The relationship in the CLD represents the case where moderate stress is present, which would result in increased productivity.

Findings revealed that financial stress was a significant source of stress in the engineering sector. Lower financial stress could result in lower stress in general for employees (assuming no other significant stressors arose), and lower stress could lead to lower fatigue, which could then contribute towards increased productivity. Findings report that an increase in productivity improves job performance, and that improved job performance is likely to result in greater workplace responsibilities over time. Workplace responsibility can result in increased salaries, which can reduce financial stress assuming there are no external financial factors that arise. A reinforcing loop (R2) emerges in the CLD in figure 12 between these variables. A similar balancing loop (B1) emerges between the variables of stress, productivity, job performance, job security, and financial stress. Findings show that as moderate stress is increased, so too is productivity, which could contribute to improved job performance. It was found that improved job performance (especially when recognised by managers and supervisors) holds the possibility of bringing about greater incentives, such as improved job security, responsibility, and potential salary increases or bonuses. This is reported to potentially reduce financial stress, which could lower an individual's overall stress. Findings suggested that lower moderate stress could lead to complacency and decrease productivity.

Physiology and Health

It was found that sleep, burnout, and fatigue could be more effectively managed through mindfulness practice, which was supported by existing research that showed that mindfulness practice has been shown to improve sleep quality (Hulsheger et al., 2018) and reduce instances of burnout (Flook et al. (2013), Kersemaekers et al. (2018)). Mindfulness has also been shown to reduce burnout indirectly, as Hulsheger et al. (2013) found that mindfulness can lead to improved emotional regulation, while Maslach et al. (2001) found that emotional exhaustion was a key factor in job burnout. Therefore, by improving emotional regulation and reducing emotional exhaustion through mindfulness practice, burnout could also be reduced. Burnout has a negative impact on health, and often results in employees needing to take time off work (absenteeism) to recover fully and return to full health and working capacity. The

findings of this study identified that mindfulness could have a direct, positive impact on individuals' health, which is confirmed by Matee (2018), who demonstrated that mindfulness could lead to enhanced health-related quality of life, as well as a reduction in stress levels and cortisol after an 8-week mindfulness-based intervention. Findings suggested that stress could lead to health problems and burnout if left unchecked. Mindfulness is therefore proposed to improve physical health and reduce burnout through a reduction in high stress and fatigue levels. As instances of unhealthy stress and burnout are reduced, employees' productivity could increase, which may contribute to improved job performance. The reduction in absenteeism and improvements in physical health could also lead to enhanced job performance amongst employees.

Another study, conducted by Creswell and Lindsay (2014), found that mindfulness could decrease both psychological stress and physiological stress. Creswell and Lindsay (2014) found that the neurobiological mechanisms produced lower levels of cortisol (stress hormone) in mindful individuals during a stress response, as well as returning the cortisol levels to baseline levels in a shorter timeframe, indicating that regular mindfulness practitioners could manage stress more effectively even on a physiological level. High cortisol levels over an extended period of time has been shown to cause multiple health problems such as obesity, Cushing's disease, diabetes, digestive problems, and detrimental changes to the structure of one's brain (McEwen, 2008). Findings revealed that stress could be a possible cause of physical health problems, such as stomach problems, illness, and muscular pain in the back and neck.

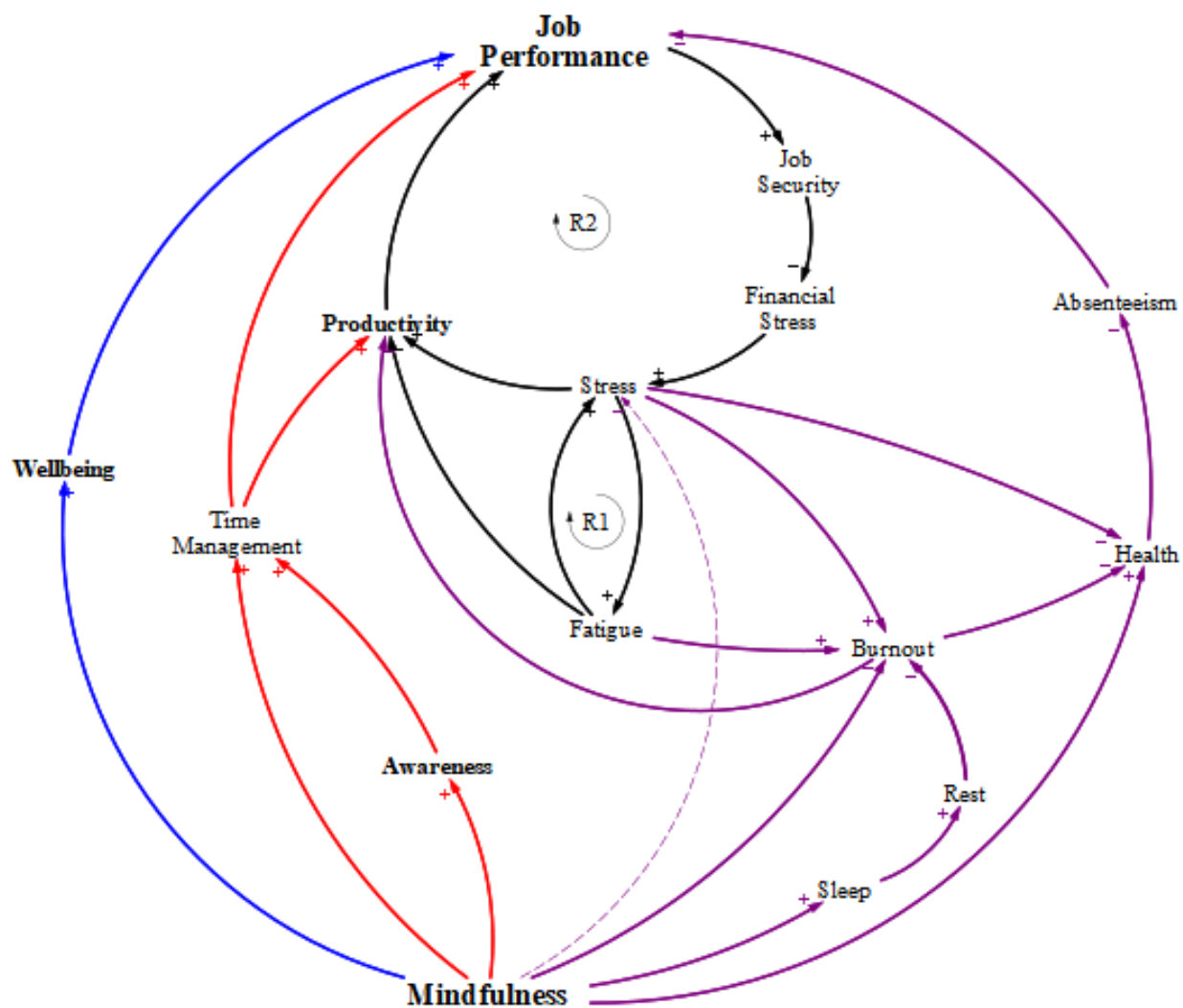


Figure 12: CLD showing systems model of the emotional management variables related to successful job performance as an engineer

Conclusion for Section 5.1

Based on the arguments presented above, mindfulness is shown to hold the potential to enhance the job performance of engineers as a practice for developing at an individual level, socially, and managing emotions in the workplace. Firstly, regular mindfulness practice was found to bring about a reduction in stress and fatigue, while enhancing employee well-being – all of which were shown to contribute towards successful job performance. Increased attention and focus could also be obtained through mindfulness practice. This could result in fewer errors being made, thereby improving an employee's efficiency and quality of work, which could contribute further towards successful job performance as an engineer. Additionally, mindfulness can lead to an improvement in time management and productivity, which were two traits that found to improve job performance on an individual level. Mindfulness has also been shown hold potential to boost creativity, innovation, learning, and problem solving, all of which were shown to be important factors given the complex, challenging, and dynamic work environments that engineers may work in. An improvement in innovative, creative thinking, and problem-solving skills could potentially equip engineers to deal with complex challenges more effectively and are therefore conducive to successful job performance as an engineer. Mindfulness was shown to lead to an improvement in physiological health, and it was found that frequent mindfulness practice could lead to beneficial changes in the neural pathway, size, and structure of the brain, which could contribute towards cognitive ability, memory, and intelligence. This could significantly benefit job performance as an engineer. Lastly, mindfulness was shown to improve the work performance of managers, who had previously been shown to have a beneficial impact on the job performance of their employees. A detailed CLD presenting the discussion of section 5.1 can be found in Appendix F.

5.2. Mental Health and Well-being

A primary motivation for conducting this research study was the emerging reports about the mental health situation in the engineering sector, with sources suggesting that engineering professionals were experiencing a mental health crisis around the globe (e.g. Lang (2019), McCabe (2019)). The findings from this research study did not necessarily reflect a mental health crisis in the South African engineering sector, with some participants even claiming that the mental health situation had improved when compared to the situation in the mid-2000s. The findings reported that the mental health situation was average to fair within the sector, which contradicted sources in the literature review that stated there was a worldwide mental health crisis amongst engineering professionals. Findings elicited insights into the experiences of practicing engineers regarding their personal mental health in the context of their workplace, as well the broader mental health situation in the South African mental health sector. Using the findings from this research study and literature, a CLD was constructed to understand the mechanisms through which mindfulness practice could potentially improve mental health and well-being amongst engineering employees, which assisted in answering the research question: “*How can mindfulness improve mental health and well-being?*” Employee well-being and mental health were found to be important factors that contribute towards individual and organisational work performance, making it an important field of research in this study.

5.2.1. Perceptions of Mental Health and Stress in the Engineering Sector

Mental Health in the Engineering Sector

Findings in this research study revealed that the broad mental health situation in the South African engineering sector was adequate – the mental health situation was not reported to be either exceptionally good or bad. Findings suggested that mental health in the engineering sector in South Africa had improved since the mid-2000s, despite the COVID-19 pandemic, which was found to have had a detrimental effect on the well-being and mental health of individuals, as it brought about rapid change, fear, and panic to populations around the world. Ren et al. (2020) found that pandemics could lead to fear, anxiety, panic, and closedmindedness in individuals, while Usher et al. (2020) confirmed that fear, discrimination, panic, and sudden change could lead to a collective decline in the population’s mental health, supporting the findings in this research study. Levin (2019) found that individuals and communities were subject to experiencing feelings of hopelessness, despair, grief, bereavement, and a profound loss of purpose due to pandemics – factors that could threaten an individual’s mental health. Mindfulness has been shown to contribute towards the cultivation of an openminded, non-judgmental attitude in practitioners (e.g. Kabat-Zinn (1990), George and Zhou (2001), and Bishop et al. (2004)), which suggests that mindfulness could be used as an effective tool in managing one’s closedmindedness, fear, anxiety, and stress due to a pandemic.

Stress in the Engineering Sector

Findings reported that although the mental health in the engineering sector in South Africa was adequate, engineers were still working in a high stress, high pressure environment with large volumes of work and tight deadlines to meet. This finding may suggest that engineers have a resilient nature, since overall mental health was perceived to be adequate in the face of a high stress, high-pressure working environment. On the other hand, it may suggest that engineers are less likely to admit to struggling with mental health issues (as suggested by findings in this research study and Lang (2019)). Jensen and Cross (2021) suggested that the normalisation of high stress in the engineering sector may start from an undergraduate level while prospective engineers are still studying, and that it was likely that

this filtered through into the workplace environment too upon graduation. This loosely supported findings from this research study that undergraduate engineering programs equipped engineers with a good work ethic and the ability to cope with high-pressure situations.

A survey conducted by Flaig (2020) supported the claims that the engineering workplace was a high stress environment, as the survey found that 77.8% of engineers perceived their work as being too stressful. A further 53.7% claimed that workplace stress had had a negative impact on their mental and emotional well-being. Since stress is commonplace and the workload is often high in the engineering sector, engineering professionals are more likely to encounter fatigue and burnout at some point in their career. Findings revealed that it was not unusual for practicing engineers to develop health problems after prolonged periods of high stress, or taking time off work to manage severe fatigue, stress, and burnout. Findings also reported that measures needed to actively be taken by employees to ensure they did not encounter severe fatigue or burnout. Solutions that were proposed included being more aware of one's current stress and fatigue state, limiting the amount of work that one takes on, dedicating time to rest, cultivating a healthy work-life balance, and improving one's time management.

5.2.2. Sources of Stress in the Engineering Sector

a) Job -Related Stress

The workload, organisational culture, and type of organisation were all aspects of the environment in which engineers worked that had a potential impact on their perceived stress. Each of these will be discussed below:

Workload

Findings identified several stressors that could exacerbate stress levels, fatigue, and mental health issues within the engineering sector. The most common source of stress and mental health issues was reported as having a high workload. Findings revealed that when an employee overworks themselves, they become more susceptible to higher levels of stress and fatigue – firstly, because they have less available time to rest, and secondly, due to a higher volume of work which would require more energy to complete. According to findings, a high workload could lead to stress and fatigue. It was found that there was a causal relationship between stress and fatigue, with rising stress levels leading to increased fatigue. Simultaneously, increasing fatigue was perceived to contribute to higher stress levels. Findings showed that fatigue, if left unmonitored, could lead to burnout, and it was found that stress and fatigue could lead to physical manifestations in one's body. Flaig (2020) suggested that the leading source of stress in the engineering workplace was due to executives and management not accepting the limitations of the organisation and making unrealistic delivery demands while expecting employees to deliver unrealistic workloads. This reinforced the claims that overworking was the primary threat to mental health in the engineering sector. A similar view was reflected by McCabe (2019), who found that the poor mental health in the engineering sector was mostly due to the high pressures on employees, as well as issues with masculinity in the workplace.

Organisation Type and Culture

Findings in this research study revealed that masculinity in the workplace was a threat to the industry's mental health. It was found that men would often overwork themselves and push themselves too hard, which could lead to unhealthy stress levels, fatigue, and a greater risk of burnout. One participant stated that men in the engineering sector '*did not know when to stop*' and that they '*would never ask for help*' if they needed it, suggesting that they would rather

experience burnout and suffer in silence than appear vulnerable. Findings suggested that masculinity, and a lack of inclusivity and diversity in the engineering workplace, had caused women to overwork themselves too. This was because they felt undervalued as women in the engineering workplace, and that they needed to produce an exceptional standard of work in order to feel as if they were being taken seriously and treated equally. It was also found that women would generally take on more of the family-related responsibilities. Because of this, women were at a greater risk of burning out and suffering from mental health problems due to the demands of trying to prove themselves in a male-dominated workplace while also taking care of family responsibilities.

McCabe (2019) reported that there were beliefs and stigmas surrounding men displaying their emotions and seeking help in a professional environment, which had had a detrimental impact on the collective mental health in the industry. A survey conducted by Lang (2019) found that there is a lack of inclusivity in the engineering workplace, which is still a male-dominated industry – only 31% of respondents indicated that they felt included at their place of work. To further highlight the lack of inclusivity and diversity in the engineering workplace, Seron et al. (2018) found that engineering culture still strongly reflects masculine culture, while Froyd and Lohmann (2014) showed that there was a significant underrepresentation of women and people of colour in engineering. The lack of inclusivity and the fact that the engineering industry remains male-dominated suggests that the industry's mental health may be struggling due to the strong presence of masculinity in the workplace environment.

Findings in this research study showed that the contracting and construction engineering industries were far less accommodating and caring towards employees compared to the consulting engineering industry. This led to higher instances of mental ill-health amongst employees in the construction industry, with one participant reporting that they were so stressed and overworked that they developed a nervous twitch under their eye. When approaching their line manager with concerns about their mental health, the manager *“laughed them out of the office, saying that their previous employee had gone bald due to stress”*. The same participant believed that one's mental health state in the workplace environment was largely dependent on one's line manager or supervisor, which is loosely supported by Reb and Choi (2014), who found that mindful managers had a positive impact on the well-being of their subordinates. Findings also showed that within the consulting engineering industry, employees had had positive experiences dealing with their line manager, who reportedly treated their employees with care and respect – a strong contrast to the reported environment within the construction and contracting industries.

Existing research has shown that supervisors and managers who received mindfulness training demonstrated improved job performance as well as a beneficial impact on the well-being and work performance of their employees (e.g. Shonin et al. (2014), Reb and Choi (2014), Dane and Brummel (2014)). Furthermore, contracting and construction-based work was found to involve greater risk to human health and safety compared to consulting engineering, where employees spent more time in an office. Findings suggested that mindfulness could lead to enhanced health and safety in the workplace context, as it would lead to increased situational awareness and attention to the task at hand, resulting in fewer careless errors which may threaten one's safety. Good et al. (2016) presented findings that supported this claim, demonstrating that there exists a positively correlated relationship between mindfulness and workplace safety. This information further argues for the case of introducing mindfulness practice to contracting and construction engineering professionals, who spend significantly more of their time on 'high risk' sites with more hazards and threats to one's safety compared to consulting engineering professionals.

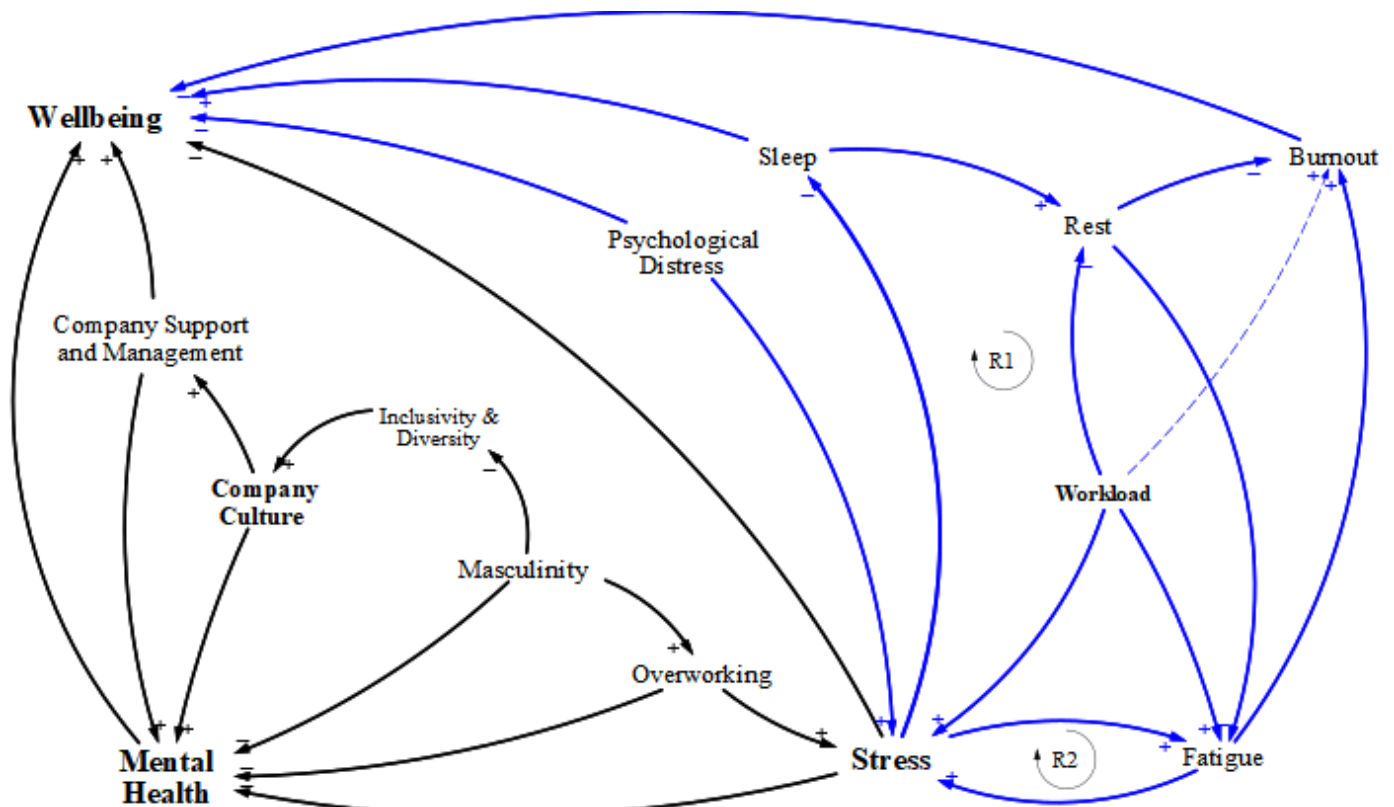


Figure 13: CLD showing job-related sources of stress

b) Personal Factors impacting on the workplace

Findings from this research study revealed that the age and experience of practicing engineers, as well as their experiences of financial and job security stress, were significant personal factors that impacted on their stress levels in the workplace, as discussed below:

Age and Work Experience

One variation in the sample was the range of experience and the age of participants. Younger engineers (under the age of 30) in the workplace were found to be more aware of their mental health and they exhibited higher levels of emotional intelligence compared to older engineers in the workplace. Findings identified the influx of younger, more emotionally intelligent and aware engineers entering the workplace as a key reason that mental health in the engineering sector had reportedly improved since the mid-2000s. Younger engineers were found to be more likely to show vulnerability and to ask for help, admitting when they were struggling mentally or emotionally. Younger engineers who had less experience were more found to be more open when discussing their mental health in the workplace environment compared to the older generation of engineers. Findings showed that junior engineers were more eager to learn and did not enter the workplace with ‘chips on their shoulders’, while exhibiting “fewer toxic masculine traits than the senior engineers”. On the other hand, findings also reported that junior engineers had less responsibility in the workplace compared to senior engineers, meaning they were in a position where it was more ‘acceptable’ to show vulnerability and ask for help. The reasoning for this was that senior engineers generally had more responsibility and supervised multiple employees, and their position and job title usually had greater implications with regard to the organisation’s well-being and performance. Therefore, older engineers were less likely to exhibit signs of ‘weakness’ or take time off work to manage their mental health state, stress levels, fatigue, or even

burnout given their responsibility. The topic of age and mental health, well-being, or emotional intelligence in the engineering sector highlights a gap in the literature and may offer opportunities for further research. Lastly, findings revealed that senior, more experienced engineers reported financial stress and job security as being notable sources of stress, particularly when approaching retirement. The following paragraph looks at financial stress and job security in greater detail.

Financial Stress and Job Security

Findings in this research study claimed that job security and financial stress were two significant sources of stress in the engineering sector, particularly amongst more senior engineers. The participants who reported this had been working in the engineering sector for at least a decade. Findings also revealed that retrenchment was a real risk in the current sector climate, and reports emerged of colleagues being retrenched due to a lack of work and high competition in the industry over the past few years. The fear of retrenchment and loss of financial security was found to be a very real threat and source of stress to many engineers in the industry, particularly those who were approaching retirement. A loss of income after retrenchment could potentially threaten the livelihoods, financial health, and living comfort of individuals as well as become a major source of stress.

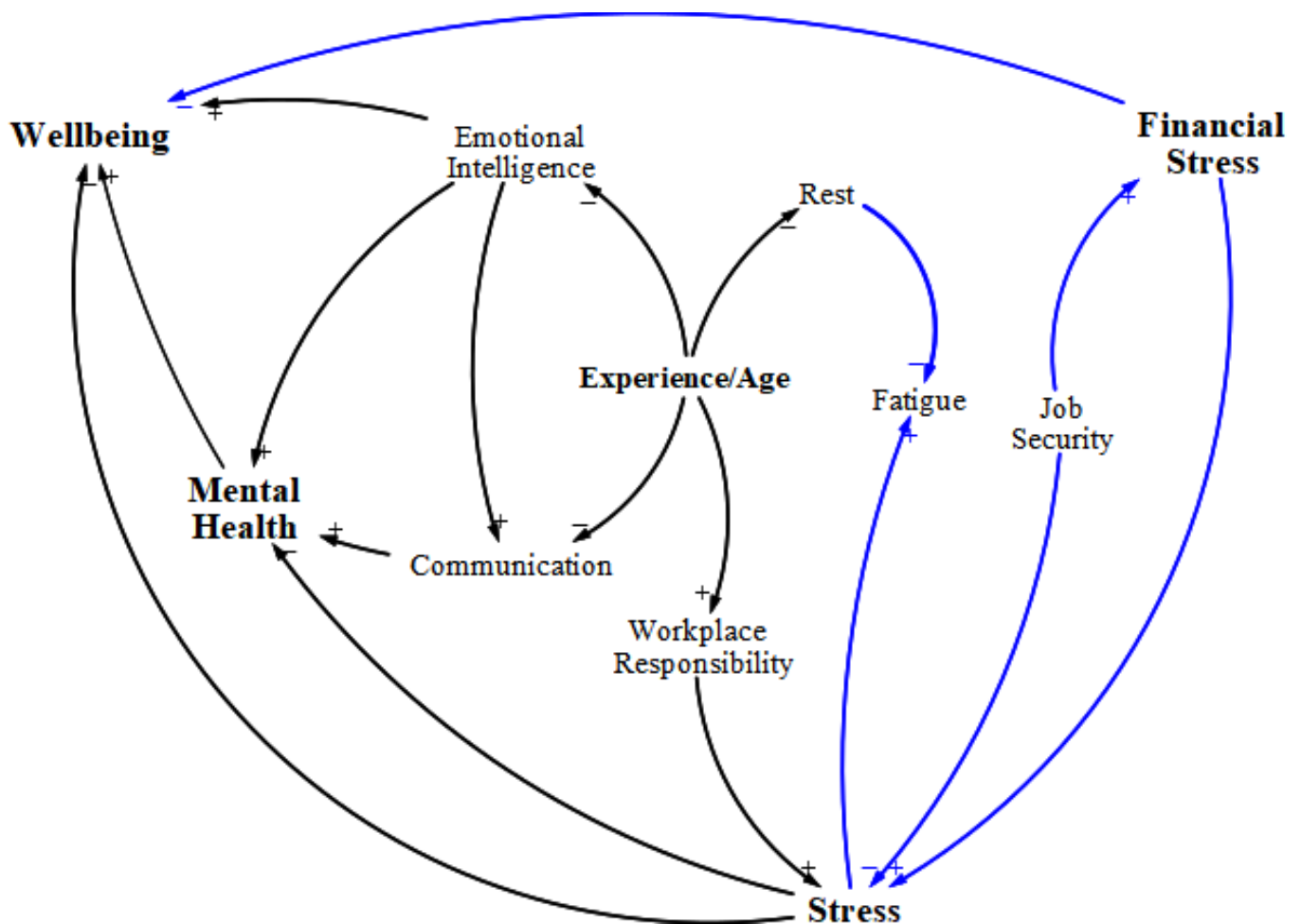


Figure 14: Influence Diagram showing personal factors that impact on job stress

5.2.3. How Can Mindfulness Improve Mental Health and Well-being in the Engineering Workplace?

a) *Personal Factors*

Stress and Fatigue

Stress and fatigue are two states that were found to frequently arise amongst engineering employees working in organisations. Findings in this research study revealed that stress and fatigue were related to each other, and that they could significantly exacerbate one another. This finding was supported by the statistical regression analysis of the survey instrument, where it was found that there was a strong, positive relationship between stress and fatigue ($R = 0.659$). Findings showed that there was a causal relationship between stress and fatigue, with stress being the primary causal variable. It was found that employees were likely to experience higher stress when there was a greater workload and tighter deadline, which could increase fatigue too. Fatigue has previously been shown to negatively affect job performance (Hulsheger et al., 2018), suggesting that it is a detrimental state that should be avoided. This is partly confirmed through the statistical regression analysis in this research study, where it was shown that a moderate, negative correlation exists between fatigue and job satisfaction ($R = -0.468$). Once fatigue had set in, findings showed that employees were likely to stress more over being fatigued and not being able to complete the tasks due to the fatigue. In turn, this was found to lead to increasing fatigue due to the feelings of exhaustion that accompany high stress levels. If an employee experienced stress and fatigue over a prolonged period, findings revealed that they were at a higher risk of experiencing burnout, higher rates of absenteeism, and increased risk of health problems, which could potentially threaten their mental health and well-being.

Mindfulness has been shown to reduce stress in individuals (e.g. Hulsheger et al. (2018), Creswell and Lindsay (2014), and Carbonetto et al. (2019)) while findings also suggested that mindfulness may hold promising benefits in reducing fatigue in individuals. Existing research by Brown and Ryan (2003) support this claim, as they suggested that mindfulness may be able to reduce fatigue by bringing about greater awareness of oneself and one's limitations. Therefore, an individual could prevent fatigue by taking a step back when they feel like they are overworking themselves and are disregarding their health. Findings showed that through a reduction in stress, the risk of experiencing fatigue could be significantly reduced. Therefore, by managing stress through mindfulness, employees are more likely to restrict the risk of experiencing fatigue and burnout. This could enhance the well-being of employees, which may be able to contribute to improved personal health and lower instances of absenteeism.

Sleep, Rest, and Burnout

To maintain a satisfactory level of well-being, it is important that employees are well-rested and that they get sufficient sleep. A reinforcing loop can be observed in the CLD in figure 15. Stress was found to lead to poorer sleep quality, which was confirmed by Ross et al. (1999). Lower sleep quality would result in less rest for individuals, which could then contribute towards fatigue. Just as stress is a causal factor of fatigue, findings also reported fatigue as being a contributing factor to higher stress levels, thereby completing the reinforcing loop in the CLD. This reinforcing loop could potentially be interrupted through the introduction of mindfulness practice. Firstly, mindfulness has been shown to hold the potential to reduce stress (Creswell and Lindsay, 2014) and improve sleep quality (Alberts

and Hülshager, 2015). Improved sleep quality could contribute towards more rest for individuals, which could then help reduce instances of fatigue. Lower fatigue was found to contribute to lower stress; thereby demonstrating how mindfulness can be introduced to attempt to disrupt the reinforcing effect of loop R1 in the CLD.

Findings in this research study demonstrated that another detrimental side effect of high stress and fatigue is the risk of burnout, and that mindfulness could help reduce the risk of burnout. This is confirmed by Flook et al. (2013) and Kersemaekers et al. (2018). Burnout was found to contribute to health problems and higher rates of absenteeism, which could threaten both the well-being and job performance of individuals, and potentially disrupt organisations. Reb and Choi (2014) found that absenteeism could be reduced through mindfulness practice. If this benefit were widespread within an organisation, it is likely that organisational performance would be enhanced.

Balance and Personal Life

Findings revealed that finding a healthy work-life balance was important in maintaining good mental health as an engineer. A balanced life, according to one of the participants, meant that an individual could dedicate their time towards working, physical exercise, interpersonal relationships, socialising, and self-care. It is important for individuals to find balance between work and their personal life so that they can avoid fatigue and burnout as far as possible (Maslach et al., 2001), while enjoying a good quality of life which is enhanced through physical exercise, healthy interpersonal relationships, and self-care. As employees find greater balance in their lives, they would have more time to dedicate towards cultivating meaningful relationships, exercise, rest, and personal interests. It was found that work-life balance could contribute towards happier, more fulfilled individuals with lower instances of mental health problems.

Findings from this research study suggest that mindfulness can improve work-life balance, which would contribute towards their well-being as they would have time to dedicate towards activities that are conducive to their happiness, mental, and physical health. It was found that mindfulness could also improve work-life balance through improving one's time management, as time could be efficiently allocated so that activities such as exercise and rest could be included. Since increased work-life balance was found to contribute towards well-being, mindfulness can be proposed to enhance well-being through an improvement in time management and the subsequent improvement in work-life balance.

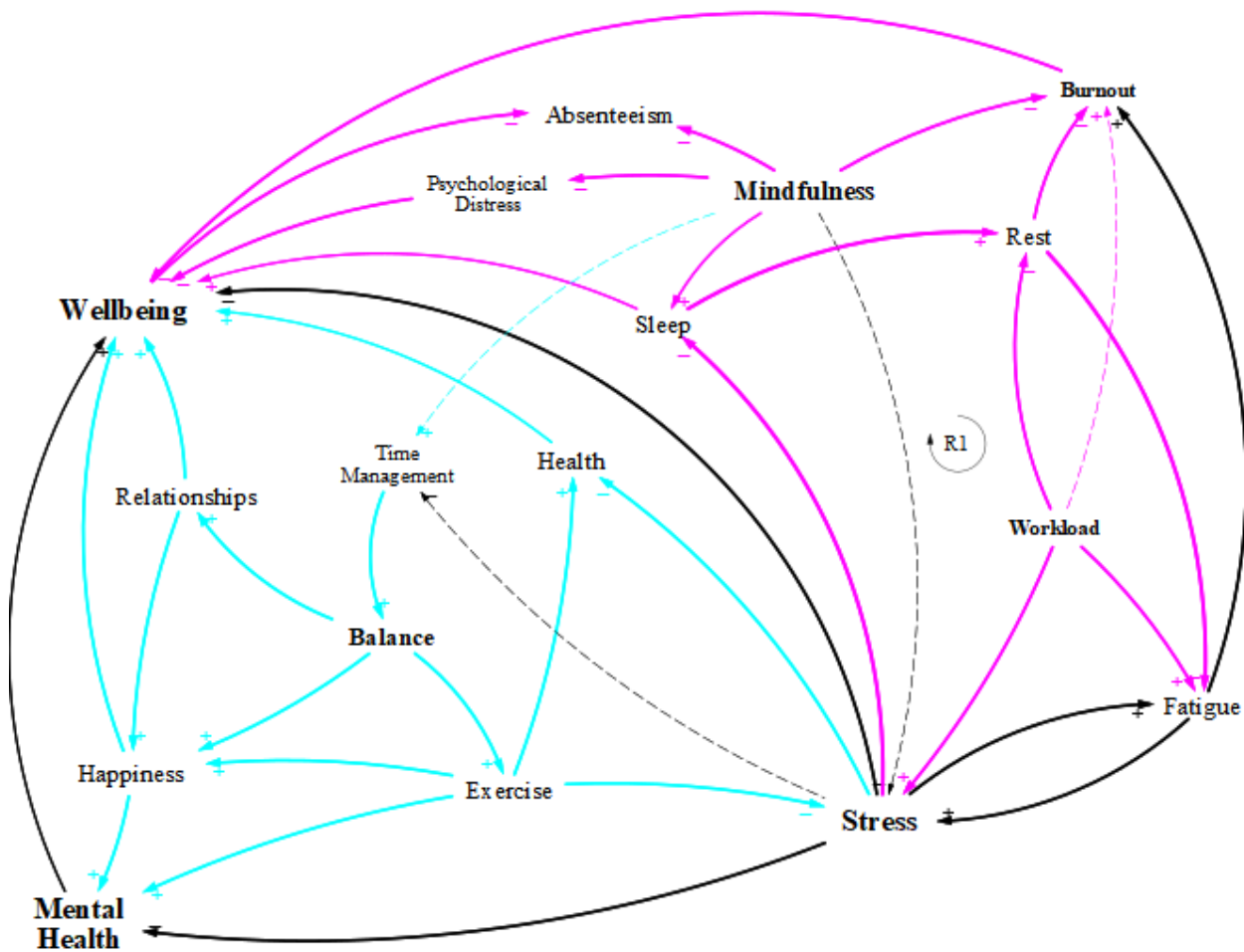


Figure 15: CLD showing how mindfulness can improve personal factors that contribute to well-being and mental health

b) External Factors

Organisational Performance and Incentives

It was found that employee well-being could be enhanced through effective incentivisation, such as bonuses, salary increases, and greater responsibility in the workplace, which was argued would make employees feel more valued at their workplace. Findings showed that sufficient organisational finances were required in order to incentivise employees effectively, and that economic factors had resulted in the engineering sector struggling financially in recent years in South Africa. It was found that this financial struggle had begun to threaten the well-being of employees since incentives such as salary increases and bonuses were becoming more limited. A reinforcing loop, R1, emerges in the CLD in figure 16 that links organisational finances and employee well-being. Employee well-being was found to contribute towards both individual job performance and organisational performance, while individual job performance also contributed towards organisational performance. As organisational performance improves, there is a greater chance of organisational finances increasing (Richard et al., 2009), which could allow for greater incentives to be offered to employees. Findings reported that a decrease in employee well-being could result in greater instances of absenteeism, which could threaten organisational performance (Reb and Choi, 2014). Mindfulness can be proposed to interrupt this reinforcing loop in the negative case, since it has been shown to enhance well-being (e.g. Deci and Ryan (1985)) and reduce absenteeism (Reb and Choi, 2014).

Company Culture, Management, and Organisational Support

The findings from this research study revealed that engineering organisations generally displayed some level of support and care towards employees. The support came in the form of regular check-ins with HR personnel, line managers, or supervisors; open-door policies where employees were encouraged to talk about their problems at any time; and wellness services offered by external organisations through the company. It was found that many organisations were reasonably lenient when employees requested to leave work to attend to personal matters (including training, therapy, and grieving). Findings claimed that the support and care from their organisation was beneficial to engineering employees, and that their well-being was enhanced as a result.

It was found that mindfulness could help managers improve their people skills. This claim was supported by Shonin et al. (2014), who found that managers who had received mindfulness training showed significant improvements in their job performance. Furthermore, Reb et al. (2014) found that mindful supervisors had a positive influence on the well-being and job performance of their employees, which suggests that mindfulness could enhance employee well-being through an improvement in the job performance and awareness of managers and supervisors. As managers and supervisors become better equipped to enhance the well-being of their employees, company culture and organisational support was found to potentially be improved.

Mental Health Challenges Transferred from an Undergraduate Level to the Workplace

It was found that mental health challenges and threats to well-being amongst engineering professionals already begin at an undergraduate level. This is supported by Godfrey and Parker (2010), who suggested that from an undergraduate level while studying, engineers were subjected to excessively high workloads which could lead to stress and suffering. Findings reported that when starting a new job in the engineering sector, poor mental health was common. A reason for this was the poor habits that were learned while studying and then carried through into the workplace. This provides evidence for the claim that stress management practices and mental health challenges may be carried through from an undergraduate level and into the workplace.

A study conducted by Ross et al. (1999) found that high stress levels were commonplace among engineering students, who also reportedly suffered from a lack of sleep, fear of low grades, unhealthy competition between peers, and the normalisation of stress, which was often passed on to incoming students. The normalisation of stress can increase students' stress levels further, while exacerbating other mental health issues and challenges (Jensen and Cross, 2021). Danowitz and Beddoes (2018) found that engineering students had double the chance of developing mood or anxiety disorders compared to the general student populace, while also reporting that marginalised groups (such as women and people of colour) within engineering faculties were particularly at risk. Marra et al. (2012) found that the primary reason for engineering students leaving the program was due to feeling a 'lack of belonging'. This supports the findings that stated that the engineering workplace lacks inclusivity and diversity.

Regehr et al. (2012) reported that cognitive, behavioural, and mindfulness-based intervention methods were most effective in reducing the significant stress encountered by student. It is therefore proposed that by introducing mindfulness practice at an undergraduate level, students' stress can be decreased while their mental health would be improved. Since it was found graduates are likely to carry habits learnt during their engineering degree into the workplace, it is suggested that by learning effective stress management strategies and having good mental health from

an undergraduate level, graduates would be better equipped to deal with stress and mental health challenges in the workplace.

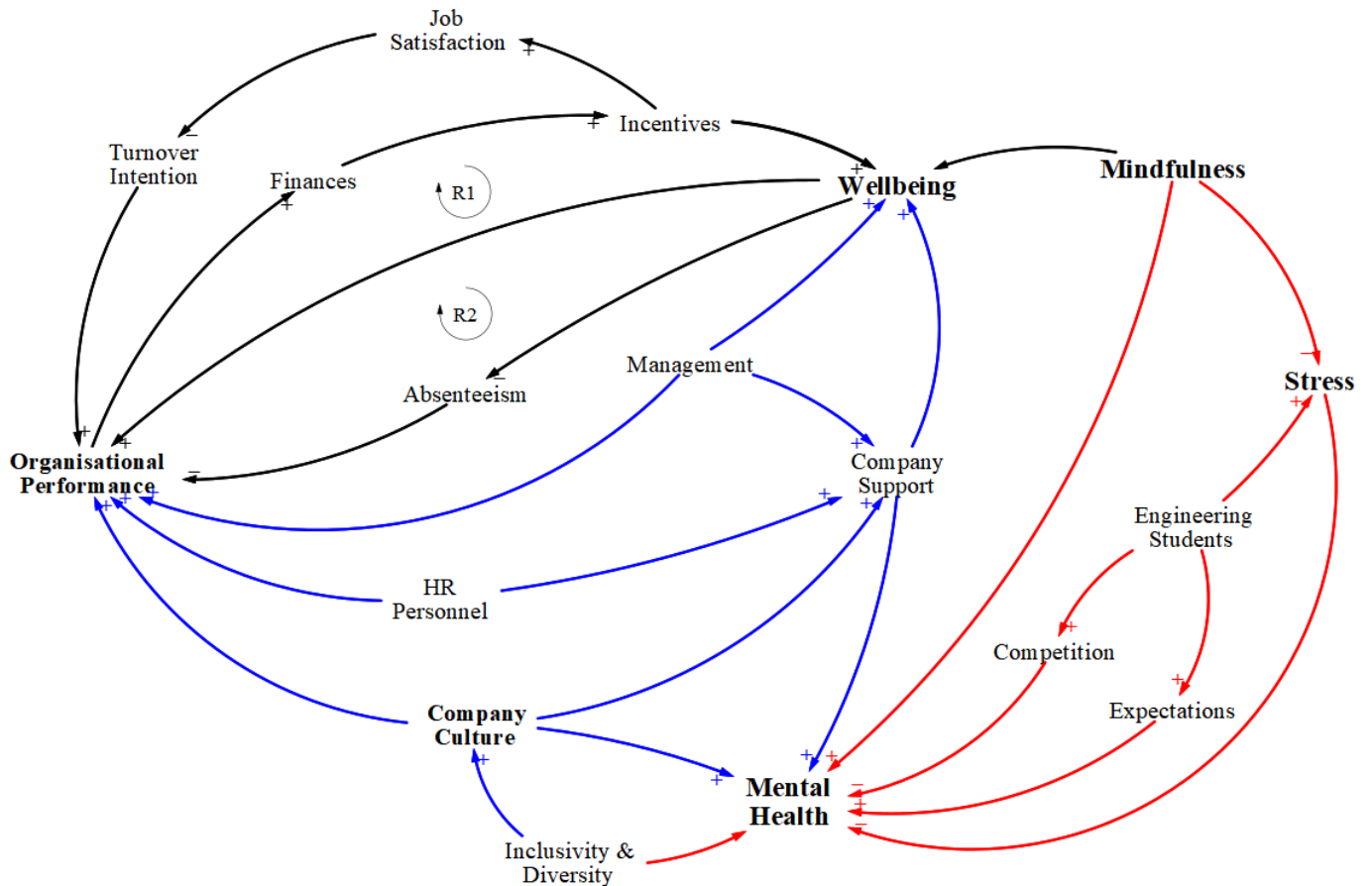


Figure 16: CLD showing how mindfulness can improve well-being and mental health through dealing with external factors

Conclusion for Section 5.2

It has been claimed that mindfulness can lead to an improvement in well-being both directly and indirectly. Indirectly, mindfulness can boost well-being through a reduction in stress and fatigue, and a subsequent reduction in burnout while sleep quality and rest are improved. As mindfulness enhances job performance and well-being, organisational performance can be improved, which can lead to a further improvement in employee well-being as the organisation would be able to offer employees greater incentives, with the aim of improving their job satisfaction and well-being. Furthermore, mindfulness has also been found to improve work-life balance, as well as personal happiness, better interpersonal relationships, and mental health, all of which contribute towards well-being. Lastly, mindfulness has been shown to reduce stress and improve mental health at an undergraduate level. Through the improvement of engineering students' stress management abilities, it is proposed that these skills could be transferred to the engineering workplace too, as healthy, effective habits could be learned and implemented at an earlier stage. A detailed CLD presenting the discussion of section 5.2 can be found in Appendix F.

5.3. Mindfulness in an Organisational Context

This section aims to identify how mindfulness can improve organisational performance through various mechanisms, with the aid of a CLD to observe this section from a systems perspective.

5.3.1. How Can Mindfulness Affect Organisations in the Engineering Sector in South Africa?

Through findings presented in this research study and through reviewing literature, it was found that mindfulness could act as a driver towards offering promising outcomes not only on a personal level for engineering employees, but also on an organisational level. Singh et al. (2016) reported that organisational performance was fundamental to a firm's survival, and that it was recognised as a central outcome variable of interest. This highlights the importance of aiming to enhance, maintain, and uphold organisational performance, especially for engineering organisations who are tasked with finding solutions to complex challenges that present themselves as technology evolves, and new societal problems emerge as natural resources begin to dwindle. Since mindfulness is a low-cost and effective practice based on evidence presented, it is proposed that mindfulness can offer promising outcomes for organisational performance.

A) Organisational Factors

Incentives, Performance, and Organisational Finances

Findings in this research study highlighted the importance of offering incentives to employees in order to maintain a suitable level of employee well-being and job satisfaction. It was found that through offering incentives to employees, they were more likely to feel valued and appreciated at their workplace and could therefore enjoy a greater sense of well-being. Findings reported that organisations required sufficient financial resources in order to offer incentives such as salary increases, bonuses, and greater responsibilities to employees, which could contribute towards employee well-being and job performance. Bjorkman and Budhwar (2007) suggested that although there are subjective measures (e.g. managers reports and ratings) and objective measures (e.g. financial performance), objective measures were a more robust metric to measure organisational performance. Financial indicators such as financial performance, product market performance, and shareholder return are proposed to be an accurate metric for organisational performance (Richard et al., 2009).

Employee well-being is a key factor in organisational performance, and mindfulness can contribute towards employee well-being (Reb et al., 2014). Additionally, job performance can be improved through mindfulness practice (as explained in Section 5.1.) As incentives may lead to improved job performance, organisational performance can also be enhanced further, as it was found that improved individual job performance could contribute towards organisational performance. As organisational performance is improved, it is likely that there would be greater finances available to direct towards incentivising employees. A reinforcing loop (R1) emerges in the CLD in figure 17 below.

Management

Management plays an important role in the functioning and operation of an organisation and can therefore have a significant impact on organisational performance. Findings reported that mindfulness could improve people skills and emotional intelligence, which were perceived to be particularly important for managers overseeing a team. This was partially confirmed by Reb et al. (2014), who found that the more mindful a manager was, the greater their employees' well-being and work performance. Since employee well-being and job performance both contribute towards

organisational performance, it is proposed that as mindfulness improves management, a subsequent improvement in the employees' well-being and job performance follows, which has been shown to contribute towards better organisational performance. Shonin et al. (2014) also found that mindfulness improved the job performance of managers themselves. As the job performance of managers are improved, organisational performance is likely to be enhanced.

Teamwork, Communication, and Psychological Safety

Good et al. (2016) demonstrated that mindfulness could have beneficial organisational outcomes through enhancing team and organisational dynamics, workplace relationships between employees, and emotional intelligence. Findings in this research study revealed that mindfulness could boost emotional intelligence and communication. Fast et al. (2014) supported this claim, by demonstrating that mindfulness could lead to psychological safety, which could lead to better communication. Additionally, psychological safety has also been shown to build trust amongst employees (Mayer et al., 1995). Kay and Skarlicki (2020) found that mindfulness improved conflict management, an important skill in the organisational context, while Yu and Zellmer-Bruhn (2018) showed that mindfulness was associated with lower levels of conflict. Improved communication, enhanced trust, better relationships, and improved conflict management are all variables that contribute towards successful teamwork – a crucial aspect of organisational performance. Therefore, as mindfulness practice enhances the abovementioned variables, which contribute to successful team dynamics and teamwork in an organisation, it may indirectly uplift organisational performance.

Findings also claimed that communication, emotional intelligence, and teamwork contributed towards successful job performance as an engineer. Since individual job performance was found to be an important organisational outcome, it can be theorised that mindfulness can indirectly improve organisational performance through an improvement in individual job performance, which is brought about by improved communication and emotional intelligence, and teamwork.

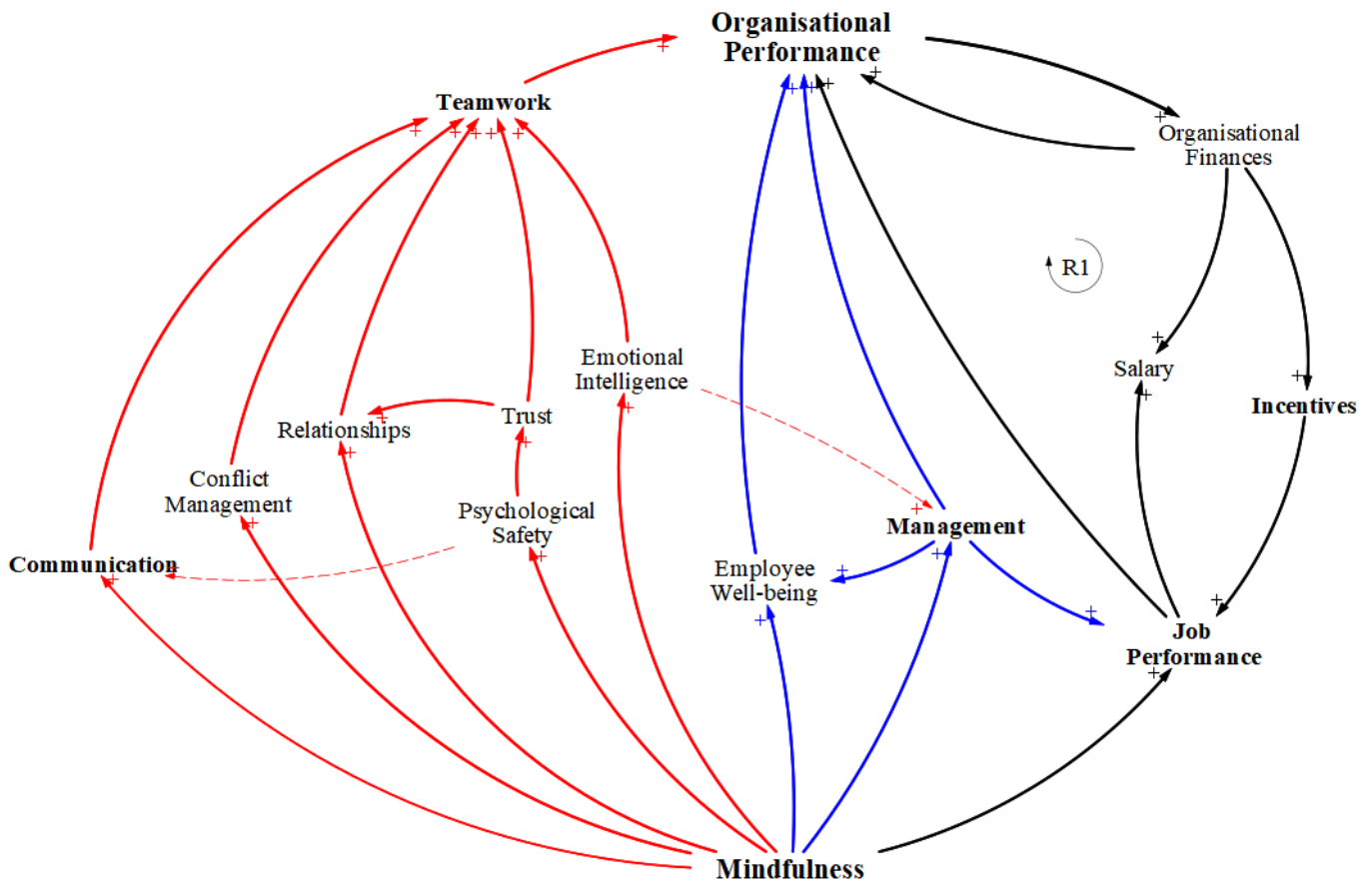


Figure 17: CLD showing how mindfulness can improve organisational performance through influencing organisational factors

B) Individual Factors

Turnover Intention, Job Satisfaction, and Employee Well-being

Existing research showed that employee well-being leads not only to improved organisational performance, but also to reduced turnover intention (Danna and Griffin, 1999). Turnover intention has been reported by Halbesleben and Bowler (2007) as an important organisational outcome, suggesting that higher rates of turnover intention can threaten organisational performance. As employee well-being is enhanced through increased incentives, turnover intention is likely to be reduced. Since turnover intention is an important organisational outcome, it can lead to enhanced organisational performance. Mindfulness has been shown not only to improve employee well-being (Brown and Ryan, 2003), but also to reduced turnover intention (Dane and Brummel, 2014). Therefore, mindfulness holds the potential to contribute towards organisational performance through an improvement in employee well-being and reduced turnover intention.

As mentioned above, mindfulness has been found to reduce turnover intention directly, although this can also be achieved indirectly. Mindfulness has been shown to enhance job satisfaction (Hülshager et al., 2013), while job satisfaction has been shown to reduce turnover intention in employees (Reb and Choi, 2014). Both turnover intention and job satisfaction have been shown to be important organisational outcomes (Halbesleben and Bowler, 2007), suggesting that mindfulness can enhance organisational performance indirectly through an improvement in job satisfaction and reduction in turnover intention.

Productivity and Job Performance

Mindfulness has been shown to improve job performance and productivity through various mechanisms, as reported in Section 5.1.1. of this research study. As an individual's productivity is improved through mindfulness (based on findings in this research study, with the claim supported by Kersemaekers et al. (2018)), so too is the employee's job performance improved (Grant, 2008). As an employee's job performance increases, their salary and workplace responsibilities are also likely to increase over time. An increased salary may lead to a reduction in financial stress, which findings showed was a significant source of stress to employees in engineering organisations. Findings in this research study claimed that mindfulness is an effective practice to reduce stress in individuals, which is supported by Brown and Ryan (2003). Findings suggested that high stress could lead to a decrease in productivity, while moderate stress could *boost* productivity amongst employees. In this case, productivity may be *reduced* (due to complacency) if the moderate stress is no longer acting as a motivating factor for employees to engage with their work. A balancing loop (B1) emerges between the variables financial stress, stress, productivity, job performance, and salary in the CLD in figure 18 below.

The COVID-19 pandemic and subsequent lockdown threatened job security for many, and it was found that retrenchment was a common threat in the engineering sector in South Africa. Not only did the COVID-19 pandemic threaten the job security and financial well-being of many engineers, but it also impacted organisational performance directly as organisations were forced to adapt to the changing workplace environment brought about by global lockdowns and restriction on movement and trade. The pandemic resulted in a worldwide disruption to supply chains, which had a direct, negative impact on organisational productivity, and therefore organisational performance (Udofia et al., 2021). Therefore, as organisational performance was threatened by a decrease in organisational productivity, organisations were more likely to have struggled financially. This was found to have led to retrenchments, lower job security, and greater financial stress.

Absenteeism, Fatigue, and Stress

Mindfulness has been shown to improve sleep quality (Hulsheger et al., 2018), while also reducing stress (Matee, 2018). As sleep quality is improved, employees would feel more rested and could enjoy a higher level of well-being (Alberts and Hulsheger, 2015), with reduced risk of burnout and fatigue. Findings suggested that mindfulness could reduce instances of burnout, which was confirmed by Flook et al. (2013). It was found that burnout has a negative impact on both job performance and productivity, which have both been shown to impact organisational performance. Furthermore, burnout can also lead to increased instances of absenteeism. Since employee well-being and absenteeism are also linked to organisational performance (Reb and Choi, 2014), along with job performance and productivity, mindfulness can be proposed to enhance organisational performance through improving employees' sleep quality, reducing stress and burnout, and enhancing job performance and productivity.

A reinforcing loop (R1) emerges between the variables stress, fatigue, burnout, job performance, and job security listed above. As stress contributes to feelings of fatigue, the chances of employees encountering burnout are exacerbated. Greater instances of burnout contribute towards a higher frequency of absenteeism amongst employees, which has a negative impact on organisational performance. As organisational performance is threatened, there is a higher chance of lower job security, retrenchments, and financial stress. As financial stress is increased, feelings of fatigue are more likely to arise. It is therefore important that this reinforcing loop does not continue over time, as it

may have detrimental effects on organisations. It is therefore important that disrupting factors are introduced to improve variables such as stress, burnout, and absenteeism in the reinforcing loop.

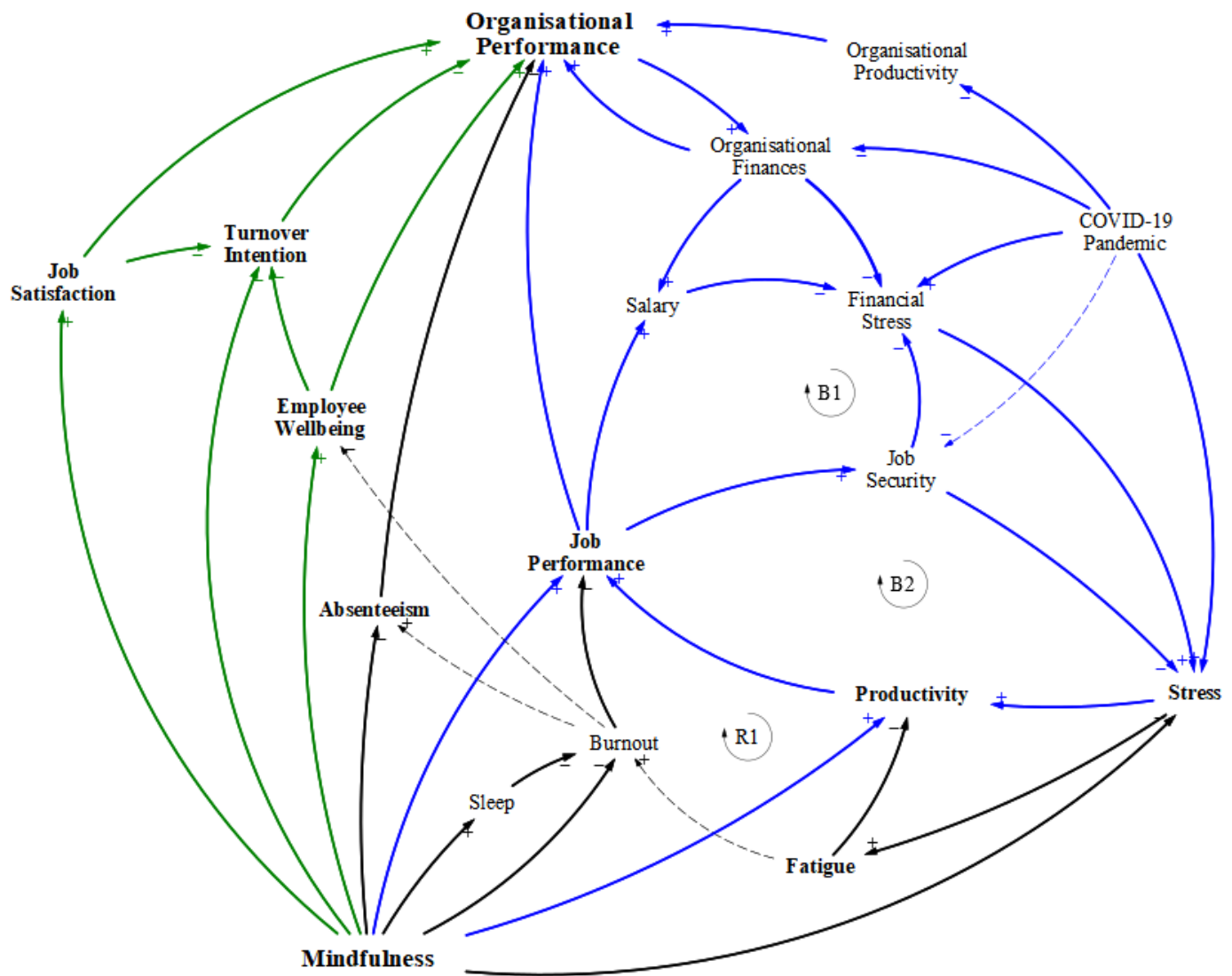


Figure 18: CLD showing how mindfulness can improve organisational performance through enhancing individual factors

Conclusion for Section 5.3

As shown in Section 5.1, mindfulness can enhance individual job performance amongst engineers. Findings revealed that individual job performance can contribute towards organisational performance. As mindfulness enhances organisational performance through improved individual job performance, it may also contribute to improved organisational performance. Incentives can contribute towards employee well-being, which was found to improve organisational performance, as well as reduced financial and job security stress amongst employees. Lower stress would lead to lower fatigue, and lower fatigue would reduce the chances of burnout. Since burnout is linked to absenteeism, lower instances of burnout would result in fewer instances of absenteeism amongst employees, which could boost organisational productivity and performance as individual productivity and job performance are enhanced amongst individual employees. Furthermore, mindfulness has been found to be an effective practice in enhancing teamwork, which would significantly improve organisational performance. Mindfulness can improve teamwork through better communication and social skills, effective conflict resolution, increased emotional intelligence, and

enhanced psychological safety. In addition to improved teamwork, mindfulness was also found to enhance the job performance of managers. If the job performance of managers were improved, it is likely that the organisational performance would improve too. A detailed CLD presenting the discussion of section 5.3 can be found in Appendix F.

6. Conclusion

This section concludes the research study and starts by summarising the key findings that emerged from the research. The key findings will then be evaluated in relation to the research aims and questions, with the goal of addressing the aims and answering the research questions. Thereafter, the value and contribution of this research study will be addressed, before reviewing the limitations of the study and making recommendations for future research.

6.1. Key Findings of the Research Study

This study sought to investigate mental health in the South African engineering sector, as well as common sources of stress, and the perceptions of mindfulness amongst engineers. Additionally, mindfulness in the context of job performance and organisational performance was investigated.

Participants for the interviews were asked what they perceived the top three skills or traits to be when defining successful job performance as an engineer. The emergent subthemes were categorised into primary themes of personal skills, interpersonal skills, productivity, attitude and motivation, and workplace responsibility. Under the primary theme of personal skills, the most frequently reported skill was time management, followed by attention to detail and learning. With regard to interpersonal skills, communication, teamwork, and emotional intelligence perceived as being important when defining successful job performance as an engineer. Participants generally reported their personal productivity as being satisfactory, while the general perception of participants of the South African engineering sector was that employees were extremely hardworking and amongst the most productive in the world. Lastly, the subtheme of attitude and motivation included codes such as self-image, fulfilment, and finding purpose in one's work.

The emergent subthemes under the mental health section were categorised into primary themes of personal mental health, collective mental health, and stress and fatigue. On a personal level, participants suggested that their mental health in the context of their job could be threatened by high workloads and deadlines, stress, company support, and company culture. It was found that establishing a healthy balance in life, managing stress, and receiving support from their company would employees' mental health. Most participants reported that their organisation either arranged third party companies, who offered wellness- and mental health-related services to the employees; or held regular meetings and check-ins with employees to ensure their well-being. It was found that the contracting and construction engineering industries were less considerate and caring towards employees when compared to the consulting engineering industry, and that working in the contracting and construction industries was a notable threat to the well-being and mental health of employees.

The collective mental health situation was found to be fair, which contradicted many of the emerging reports on a widespread, global mental health crisis in the engineering sector. It was reported that the mental health in the sector had improved since the mid-2000s; despite the COVID-19 pandemic, which was found to be a threat to the collective mental health in the engineering sector. Additionally, unusually high competition was reported in the industry due to a struggling economy. It was found that collective stress had increased in the industry due to financial instability and threats to the job security of employees, which had been partly exacerbated by the COVID-19 pandemic. Stress was found to contribute to fatigue, and fatigue was perceived to exacerbate stress. Findings revealed that the risk of

Figure 19: Causal loop diagram showing how mindfulness affects organisational performance

burnout was very real to many engineers, and it was found that it was common to witness health problems or burnout manifesting amongst engineers due to high stress, fatigue, and workloads. A common perception was that stress and

fatigue could have detrimental effects on job performance and organisational performance, although a widely expressed view was that moderate stress could be beneficial and in fact *boost* their productivity.

It was also found that there are issues relating to masculinity in the engineering sector. It was found that the masculine culture in the engineering workplace could lead to employees overworking and disregarding their well-being, while simultaneously limiting communication, not expressing emotions, and refusing to ask for help when needed. Similarly, findings revealed that older engineers with more experience tended to be less communicative, less emotionally intelligent, and more closed-minded compared to younger engineers entering the workplace.

Existing literature was combined with findings from this research study to construct hybrid causal loop diagrams (CLDs) to develop a systems model for how mindfulness could affect job performance, mental health and well-being, and organisational performance. Findings showed that mindfulness practice could lead to improved job performance through indirect means. Firstly, it was found that mindfulness could lead to a reduction in stress and an increase in awareness. A reduction in stress and increase in awareness was found to contribute to improved focus, time management, learning, quality of work, attention to detail, productivity, interpersonal skills, physiological health, mental health, and self-esteem, while also reducing errors being made. Since mindfulness was found to be able to enhance individual job performance, it was also perceived to be able to enhance organisational performance. Additionally, findings in the research study suggested that mindfulness practice was also able to enhance personal well-being and mental health amongst practitioners, through a decrease in stress and fatigue, and increased awareness, emotional intelligence, and work-life balance.

The instrument was completed by 101 respondents, which was not considered a sufficiently large sample to obtain true representability of the entire population being studied. The instrument was still used in this research study so that the validity could be improved through triangulation, although the interview data was chosen to be dominant over the instrument data, which was intended to supplement the interview data. Descriptive statistics were obtained for each of the latent variables to assess the quality and applicability of the instrument results. After linear regression analysis had been conducted between the latent variables, it was found that there were strong correlations between stress and fatigue (0.659) and job satisfaction and stress (-0.630). Moderate correlations existed between mindfulness and productivity (0.563), mindfulness and fatigue (-0.527), mindfulness and job satisfaction (0.405), mindfulness and stress (-0.433), job satisfaction and productivity (0.443), job satisfaction and fatigue (-0.468), productivity and fatigue (-0.500), and productivity and stress (-0.428). All correlations were found to be statistically significant ($p < 0.05$). The findings from the instrument supported the data that were gathered in the structured interview. There were no cases of contradiction, except in the case of productivity and moderate stress, which several interview participants suggested could increase productivity, rather than decrease it as the instrument suggests.

6.2. Addressing the Research Questions

The research questions were answered in detail in Section 5. This section aims to summarise the key points that arose when answering the research questions.

6.2.1. How is mindfulness perceived to affect job performance in the engineering sector?

Based on the findings and discussion in this research study, it is proposed that mindfulness practice can be used to effectively manage stress amongst practitioners. Through a reduction in stress, it was found that numerous potential benefits could be experienced by the practitioner, including their job performance. It was found that through lowering

stress, employees were less likely to encounter fatigue or burnout, which were found to negatively impact job performance. Additionally, a reduction in stress was also found to contribute to improved learning ability, productivity, health, and time management – all of which were found to boost job performance amongst employees. Mindfulness was also found to enhance well-being directly and indirectly amongst employees, which was shown to contribute towards successful job performance in an organisational context. Existing research (e.g. Carbonetto et al. (2019), Schaufenbuel (2015)) demonstrated that mindfulness can lead to improved attention and focus, which can contribute towards beneficial outcomes, for example, a reduction in errors and subsequent improvement in quality of work, efficiency, and productivity. Participants in this research study agreed with Carbonetto et al. and Schaufenbuel that mindfulness could lead to improved focus, fewer errors being made, better quality of work, and better productivity. Findings also revealed that moderate stress was beneficial to productivity, highlighting a potential downfall of mindfulness – if mindfulness decreased stress in employees, sufficiently low stress levels could contribute towards complacency, and a subsequent drop in productivity in the workplace. However, this was deemed unlikely since the reduced stress, boosted well-being, and enhanced time management was found to be more likely improve an employee's productivity rather than to decrease their productivity brought about by lower stress and complacency.

Existing research has shown that mindfulness can lead to improved divergent thinking abilities amongst engineers (Rieken et al., 2019). Divergent thinking is an important skill required for creativity, innovation, problem solving, and learning. Participants in this research study perceived problem solving and technical ability to be important contributing factors towards job performance. Given the complex, dynamic, and challenging work environment engineering employees constantly face, they may be required to demonstrate problem solving skills that can be executed in a creative, innovative way. As their problem solving, innovation, and creative thinking skills are developed, engineering employees would likely be more suitably equipped to solve complex problems and adapt to changing work environments. Doing so could allow engineers to demonstrate a higher level of job performance, which would likely lead to them becoming a more successful engineer.

In an organisational setting, it is important that employees can function effectively in a team. Mindfulness was found in this research study to lead to improved communication, interpersonal skills, teamwork, and emotional intelligence, which is supported by existing literature on mindfulness and: communication (Fast et al., 2014), emotional regulation (Hülshager et al., 2013), conflict resolution (Good et al., 2016), interpersonal relationships (Beckman et al., 2012), and psychological safety (Edmondson, 1999) amongst practitioners, which could enable employees to thrive in a team environment within an organisation. Findings in this research study suggested that teamwork and better interpersonal skills could contribute towards successful individual job performance, particularly when assistance was required. Therefore, mindfulness can be proposed to enhance individual job performance through improving teamwork and interpersonal skills within an organisation.

6.2.2. How can mindfulness improve mental health and well-being amongst employees in the engineering sector?

Findings in this research study suggested that mindfulness practice can lead to improved well-being amongst practitioners. This was supported by Deci and Ryan (1985), who found that well-being could be improved through enhancing the vividness and clarity in one's life, reducing mental judgment and discrimination, lowering emotional disturbance and psychological distress, and improving levels of subjective well-being. Mindfulness can also be seen to enhance well-being and mental health as findings in this research study proposed that regular practice could

significantly reduce stress levels. Participants believed that high stress could contribute to fatigue, burnout, and health problems. By limiting unhealthy stress levels through mindfulness, participants believed that employees would be less likely to experience fatigue or burnout. Findings revealed that through the self-awareness that is cultivated through mindfulness practice, practitioners were less likely to become fatigued or burnt out since they could become more aware of when they needed to step back and prioritise their well-being. It was found that stress could lead to problems sleeping, and that a lack of sleep contributed to fatigue. Existing literature reported that mindfulness could improve the quality of one's sleep (Alberts and Hülshager, 2015), which could contribute towards an individual's rest and physical health.

Findings in this research study revealed that many organisations offered support or care towards the employees, in the form of regular meetings with line managers or supervisors or contracting third party wellness groups to manage employee well-being. It was found that this had a positive impact on the well-being and mental health of employees. Reb and Choi (2014) showed that managers who received mindfulness training demonstrated a high level of job performance, as well as improved well-being and job performance of their subordinates, which supported findings in this study. Therefore, by introducing mindfulness practice to managers, employee well-being within an organisation can be uplifted, which may contribute to organisational performance.

Findings suggested that finding a suitable work-life balance was important in maintaining good mental health and well-being as an engineer. Mindfulness was shown to help individuals find balance through improved awareness and time management, which would allow practitioners to become more effective at setting aside time for activities that they know would bring them fulfilment, rest, and enjoyment, while contributing towards their mental health and well-being. Such activities include exercise, active relaxation, socialising, and the pursuit of personal interests and hobbies.

Findings in this research study claimed that poor habits learned while studying could be transferred to the workplace after graduation, and that this could threaten one's mental health once working. It was found that engineering students were particularly at risk of encountering excessively high workloads, high stress, lack of sleep, unhealthy competition between peers, anxiety or mood disorders, and feelings of isolation (Ross et al., 1999). Existing research (Regehr et al., 2012) showed that mindfulness-based intervention methods were among the most effective in reducing the stress encountered by engineering students. Through introducing undergraduate engineering students to practices like mindfulness, it is possible that they would continue to practice these beneficial habits once they start working. This could contribute towards employees' mental health and well-being, which subsequently, is likely to enhance their job performance.

6.2.3. How can mindfulness affect organisations in the engineering sector in South Africa?

Findings presented in Section 5.1 showed that mindfulness could improve individual job performance amongst engineers. Individual job performance is linked to organisational performance (Section 5.3), which suggests that mindfulness can enhance organisational performance through improving job performance on an individual level. It was also found in Section 5.2 that mindfulness could enhance employee well-being, which was found to improve organisational performance. Improved organisational performance could potentially contribute to more business and greater financial resources at the organisation's disposal, which could result in greater financial incentives (such as bonuses and salary increases) being offered to employees. Incentivisation was found to be a method through which

organisations aimed to improve employee well-being. As incentivisation improves employee well-being over time, organisational performance would be improved too.

Existing research has showed that mindfulness can enhance psychological safety, trust, communication, emotional regulation, conflict resolution, and interpersonal relationships (Edmondson, 1999). All these factors contribute towards successful teamwork and functioning in an organisational context, given the interpersonal nature of working in an organisation. Participants suggested that teamwork was important to individual job performance as well as working in an organisation, and that it was particularly important for managers to possess interpersonal skills in an organisation. This highlights another mechanism through which organisational performance can be improved through the implementation of mindfulness practices. Mindfulness practice has also been shown to enhance the job performance of managers in organisations (Reb and Choi, 2014). Managers' job performance has been linked to the well-being and job performance of their employees, as well as better organisational performance. Therefore, through improving the job performance of managers in organisations through mindfulness, organisational performance can be improved too.

Since mindfulness was found to improve employee well-being (Section 5.2), mindfulness could lead to reduced turnover intention and greater job satisfaction, both of which are related to employee well-being (e.g. Danna and Griffin (1999)). Existing literature revealed that mindfulness can also directly reduce turnover intention, and that turnover intention and job satisfaction are both important organisational outcomes and predictors of organisational performance (Dane and Brummel, 2014). Similarly, mindfulness has been shown to reduce absenteeism (Reb and Choi, 2014), instances of burnout (Flook et al., 2013), and stress (Good et al., 2016), while improving sleep quality (Alberts and Hülshager, 2015) and general health. Improved sleep quality and health would lead to lower instances of burnout and lower fatigue levels, and therefore lower rates of absenteeism. Since absenteeism is linked to organisational performance, it can be proposed that mindfulness can enhance organisational performance through reducing absenteeism and burnout amongst employees if they engaged in regular mindfulness practice.

6.3. Contributions of this Research Study

Through this research study, a conference paper titled '*Mindfulness for Enhancing Learning in Engineering Education*' was published after being presented at the Annual 2022 SEFI Conference in Barcelona, Spain. The conference paper aimed to investigate the effects of mindfulness on lifelong learning, innovation, creativity, and problem solving for engineering students and professionals.

Emerging reports from around the world (e.g. Flaig (2020), McCabe (2019), Lang (2019)) suggested that there was a mental health crisis in the engineering sector, and that this was affecting the productivity and work performance of engineering employees and engineering organisations alike. This research study aimed to gain a better understanding of mental health in the South African engineering sector, as well as common sources of stress and the perceptions of mindfulness amongst engineers. Through gaining insights into mental health and common sources of stress, solutions could be proposed to improve the reported mental health crisis in the engineering sector. Findings in this research study suggested that the implementation of mindfulness-based interventions would improve the mental health and well-being of employees, while reducing their stress, fatigue, and risk of burnout (Schaufenbuel, 2015). Through gaining insights into the perceptions of mindfulness amongst engineers, a clearer understanding was gained as to how mindfulness could be marketed to engineers, given the widespread misconceptions and preconceived ideas about mindfulness being an 'esoteric, new-age' practice. Since this research study aimed to address the research problem

described above, if the recommended implementations were made and organisations began offering their employees the option to partake in mindfulness-based interventions, engineering employees' mental health and well-being could begin to improve, along with their productivity, quality of work, time management, emotional intelligence, teamwork, and overall job performance. If the job performance of individual employees is enhanced, organisational performance would be enhanced too. This could have benefits for society and the economy, given the contributions that engineering employees and organisations can make to the economy.

Existing research in the field of mental health in the engineering sector, mindfulness and engineering, and employee well-being in the engineering sector was limited, highlighting a gap in the literature. This study aimed to contribute to understanding mental health in the South African engineering sector, as well as the effects of mindfulness on mental health, well-being, and job performance of engineering employees. The findings suggested that the broader mental health situation may not have been as serious as some of the reports suggested. However, research revealed that the engineering profession was perceived as a high stress, dynamic, demanding, tiring, and high-workload profession, which has the potential to exacerbate the instances of mental ill health in the sector as the reports suggested. Another key finding from this research study was that engineers generally did not admit to struggling and would not ask for help when needed or when they were experiencing difficulties mentally or emotionally. This ties into issues with masculinity in the engineering sector.

Findings suggested that mindfulness can be used as an effective tool (in terms of cost and salutary outcomes) to enhance individual job performance, organisational performance, employee well-being, and mental health. Based on the findings of this research study, it is recommended that engineering organisations and universities offer mindfulness-based interventions to employees and students. In the workplace, a mindfulness intervention could offer employees better stress and time management, enhanced productivity, better emotional intelligence, improved communication and teamwork, and better overall job performance. It has also been proposed that habits learned while studying at university can be transferred over to the workplace, and findings suggested that stress and poor habits could be carried over to the workplace from university. It is therefore proposed that if engineering students were to learn beneficial habits that enabled them to manage their stress more effectively, improve their time management and productivity, and enhance their communication and teamwork, that they would be able to carry these valuable skills and habits over to the workplace, setting them up for a more enjoyable, fulfilling, and successful career.

6.4. Limitations of the Research Study

As with any research, there were limitations that were imposed or arose. In the interests of maintaining the validity and trustworthiness of this research study, it was important to identify the limitations and explain how they may have influenced the data collection and findings of the research.

The most significant limitation was the relatively low number of instrument responses that were obtained in this research study. The process of collecting a sufficiently large number of instrument responses can be time consuming and costly to execute. Despite having sent out the instrument several months prior to the interviews being conducted, only 101 responses were gathered. Out of the entire engineering population in South Africa, the response rate was not sufficiently high to obtain true representability, suggesting that the instrument results may not have been truly representative of the greater engineering sector. For this reason, the data gathered through the quantitative instrument

were used to a lesser extent than originally intended. This resulted in the qualitative interview data being chosen as dominant over the quantitative instrument data.

The COVID-19 pandemic, and subsequent regulations and protocols, were a limitation to the research study. Firstly, it posed challenges during the data collection, as none of the research could be conducted face-to-face given the governmental restrictions imposed on individuals and organisations. This meant that fewer interviews could be conducted, and fewer instrument responses could be collected since there was no option of going to engineering organisations in person and distributing instrument or conducting interviews face-to-face. Furthermore, the fact that the interviews were forced to take place in a virtual setting through MS Teams meant that some of the more subtle body language cues, facial expressions, and eye movements may not have been observable through the camera. It is unlikely that this would have had a significant impact on the results and findings since the participants' spoken words were of far more importance compared to their behaviour and mannerisms during the interview. In the event that the research study was inquiring into, for example, mindfulness and body language, then the participants' movements, facial expressions, and mannerisms would have been of greater importance.

Since a significant proportion of this research study was comprised of qualitative data collected through structured interviews, the impact of researcher bias may have been a limitation to the research. Since the effect of research bias is unavoidable to an extent in qualitative research, it was important to address this as a potential validity threat to this research study. Care was taken on the part of the researcher to be mindful of bias and to be reflexive of interview process.

6.5. Recommendations for Future Research

While one of the initial aims for this research study was to investigate the effects of a mindfulness-based intervention in an engineering organisational context, time constraints meant that it would not have been possible to develop, implement, and analyse such an intervention. It is therefore recommended that in a future study, an existing mindfulness-based intervention (such as MBSR, developed by Jon Kabat-Zinn) be used, rather than developing an entirely new intervention from scratch. This would save significant amounts of time, and the credibility of an existing intervention such as MBSR has already been proven, implying there would be fewer validity issues that arise. Developing a new intervention may have presented credibility issues since there would have been no empirical evidence supporting its credibility or effectiveness.

Another recommendation for a future research study is to collect a greater number of instrument responses. This could be achieved through the utilisation of third-party services to ensure that a sufficiently high number of instrument responses from the desired population could be attained. A higher number of instrument responses would mean that the data collected from the sample would be more representative of the greater population being studied. A further recommendation with respect to the instrument could be to cover a greater area and expand the reach outside of the cities where the larger engineering firms are based. Again, this would require a greater research budget to implement correctly.

The data collection could have taken place over a longer period of time such that it could be classified as a longitudinal study. This could minimise validity threats and provide more complete data (Maxwell, 2013). The recommendation would therefore be to continue this study as a PhD, which would allow for the timeframe to complete a longitudinal study.

This study could additional data collection and analysis of absenteeism records and annualised job performance reports for employees. If a longitudinal study were to be conducted through several engineering organisations, the organisations may have been willing to offer absentee records and annualised job performance reports. Insights could be gained into how absenteeism and job performance relate to the variables of interest in this research study, such as mindfulness, organisational performance, stress, fatigue, and productivity. By diversifying the data sources and triangulating the research study, the overall validity of the research study could have been improved.

Further inquiries should be conducted into the effects of age in the engineering sector, and how an engineer's age may influence their stress levels, mental health, well-being, emotional intelligence, and communication abilities. The theme of age was mentioned by several participants, where the general narrative that emerged was that younger engineers were far more emotionally intelligent, communicative, open to discussing mental health and stress, and aware compared to more senior engineers, especially those who were nearing retirement. While this research did not aim to study the effects of age in engineering, the findings suggested that this may be an interesting field of inquiry, especially given the fact that no existing literature could be found on the topic.

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Appendix

A. Sample Consent Form

Mindfulness and Job Performance: How is mindfulness perceived to affect job performance, employee well-being, and organisational performance in the engineering sector in South Africa?

Hello, my name is Kai Forster, and I am conducting research towards a Master's degree. I am researching the perceived effects that mindfulness has on working engineers and would like to invite you to participate in the project.

The perceived effects that mindfulness has on job performance for engineers in South Africa.

I am interested in finding out about how mindfulness can improve job performance of engineers in South Africa, by looking at job performance indicators such as stress levels, employee well-being, productivity, fatigue, and job satisfaction. I would like to interview people who have worked in the corporate engineering sector in South Africa.

Please understand that you do not have to participate (your participation is **voluntary**). The choice to participate is yours alone. If you choose not to participate, there will be no negative consequence. If you choose to participate, but wish to withdraw at any time, you will be free to do so without negative consequence. However, I would be grateful if you would assist me by allowing me to interview you.

The interview will consist of several questions, and interviews should not last longer than 10 minutes. For research purposes, I am requesting that the interviews be recorded (audio only). Note that the interviews are entirely confidential and at no point will your identity be revealed. The interview can be conducted at a time that is convenient for you and can be done virtually via Zoom or MS Teams. There is no requirement to travel, nor will there be any reimbursement for your time. You will, however, be granted access to final dissertation once it is complete.

Warnings: Some of the questions in the interview and/or surveys may elicit an unforeseen emotional response in participants. While this is unlikely, please be advised of the risk and note that you may withdraw from the interview process at any time if you wish to do so.

Confidentiality: At no point will your identity be revealed or included in research data. Your privacy will be respected by transcribing the interview and assigning code numbers to the transcribed data. Interviews will be referred to by their code numbers, so no real identities will be exposed.

Sharing and use of data: The data collected will be used to understand the effects that mindfulness has on job performance of engineers in South Africa. Qualitative data analysis will be conducted to develop the dissertation fully. Participants may be granted access to this dissertation upon completion, and a copy of your interview can be sent to you following the transcribing process. To ensure validity of the data, you are welcome read through the analyses of the interviews and clarify any misinterpretations should they arise.

By signing below, you are agreeing to:

- Your voluntary participation in this research project
- Your permission to record the interviews (audio only)
- Having read through this document, and agreeing with everything that is said

Name of the

participant: _____

Date: _____

Signature of participant: _____

B. Notice of Ethics Approval

ETHICS APPLICATION FORM

Please Note:

Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: <http://www.ebe.uct.ac.za/ebe/research/ethics1>

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Kai Forster
Department		Mechanical Engineering
Preferred email address of applicant:		FRSKAI001@myuct.ac.za
If Student	Your Degree: e.g., MSc, PhD, etc.	MPhil (Engineering Management)
	Credit Value of Research: e.g., 60/120/180/360 etc.	180
	Name of Supervisor (if supervised):	Corrinne Shaw
If this is a research contract, indicate the source of funding/sponsorship		N/A
Project Title		Mindfulness and Job Performance: How is mindfulness perceived to affect job performance in the corporate engineering sector of SA?

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Kai Alexander Forster		23/05/2021

SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	Dr Corrinne Shaw		26 May 2021

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (including Honours).			
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.	Prof H von Blottnitz		30/06/2021

C. Interview Questions

1. How would you describe your own mental health in the workplace environment?
 - 1.1. How would you describe the broad mental health situation in the engineering sector?
2. What do you consider the three most important indicators to determine job performance in the engineering sector?
3. What can you comment on stress and fatigue levels in this sector?
 - 3.1. Do you think they are related to one another?
 - 3.2. How would these states affect job performance in your opinion?
4. What can you say about employee well-being in the engineering sector?
 - 4.1. Do you feel as if companies do enough to ensure the well-being on their employees?
 - 4.2. Are you satisfied at your place of work? Do you expect to find new employment in the next 2 years?
5. How would you describe your own productivity in the workplace?
 - 5.1. What do you understand by the term ‘productivity’?
 - 5.2. What is your general perception of productivity in the engineering sector in South Africa?
6. What does the term “mindfulness” mean to you? What do you understand by it?
7. How do you think mindfulness could affect the three most important job performance indicators mentioned above?
8. How do you think mindfulness could affect job performance in the engineering sector, if at all?
9. Please add any additional comments or reflections on the questions posed in this interview.
10. Would you be interested in partaking in a mindfulness intervention running over 8 weeks, to observe what effects it has on your job performance?

D. Example of Verbatim Transcribed Interview

Interviewer: *So first of all, what do you consider to be the 3 most important traits to determine job performance in the engineering sector?*

Participant 9: Yoh, um... definitely attention to detail, I'm not sure if that's a personality trait? Engineering... um... obviously good understanding of science, scientific principles, those things, and... this is not really for engineers, but... is this usually hard for people? <Laughs>

I've interviewed some people who misunderstand the question and think I'm referring to KPIs, some understand it as personality traits. It's really open to interpretation.

Definitely people skills, in terms of working in a team. I don't think you can be an engineer without that.

People skills, okay that's fantastic. So, when you said good understanding of science, would you say that ties in to learning as well?

I guess so, because I mean it's a field where technology can change and everything, and you must be willing to learn. I get very angry when people are still building things the same way we did it in 1960. Even though it might work, there's new and better ways, so definitely be able to learn.

One hundred percent, couldn't agree with you more there. Then what can you comment on stress and fatigue levels in the engineering sector, and do you think stress and fatigue are related to one another?

Stress and fatigue... Yes I think maybe stress can cause fatigue? Um... but definitely high levels of that in engineering. I do think it's a very high stress environment, because it's always about deadlines and the client. I don't know if this is true across all disciplines or fields, but the client is the most important person here, and if they say: "We need it next week," it needs to be done next week, you know, even if you're going to not sleep, eat, and all of those things. Engineers are not huge complainers – they just do it, which really frustrates me because I'm not that person, but obviously when you're in this environment, you just adapt.

Unfortunately it's like that – I think university also kind of prepares us for that high-intensity, high-paced job, which I guess is a bit unfortunate, but I guess it's also good to learn those skills at some point. How would you say stress and fatigue can affect job performance?

Definitely in the long run there's burnout – we all know about burnout. People here definitely have experienced burnout. I mean I don't think stress is bad, but you just need to find ways to manage the stress. And fatigue, I don't think anyone should be fatigued – we should all be getting normal hours of rest and stuff, but I think stress is more normal than fatigue.

Okay, and you said stress isn't always bad – how can stress be a beneficial thing?

I don't think stress is bad, like generally in the world, but I don't think people have enough ways to manage that stress. Stress pushes us, it helps us, it takes you out of your... not takes you out of your comfort zone, but it lets you know that there are deadlines approaching, or you're not caught up with your work, and that's like good stress, but you cannot be in that state for too long. You need to rest, or tell your boss: "Hey, this is too much for me, can we swap out with someone else?" I don't you should stress for long periods of time, because that's when it's damaging.

Completely – because beyond just a psychological impact, you know the cortisol can literally change our bodies in physical ways, so too much of it isn't a good thing, but I hundred percent agree with you that stress can be a driving force or driving factor to get back on track. So then moving on, how would you describe the broad mental health situation in the engineering sector?

Yes, mental health is quite a broad term, but I can say in this industry, a lot of people just push themselves over the limit. I mean I guess it's like any other sector – you want to perform well, you want to look good in the eyes of your boss get great performance reviews, maybe increases; but people here really push very hard, and you feel like when you're resting, or even if you are completing your work, you feel like you still need to stay a bit longer and stuff like that. There's very few people who are very calm in knowing that "I've finished my work, I've completed it, I can leave now." Some of us still feel like we need to prove ourselves... more. I think the mental health situation is probably worse than other industries, but also engineers are the last people to look at that and be like: "I have a problem." I mean the company has a lot of support structures, but nobody really knows about them or anything, or uses them. I mean even myself, my cousin passed away 2 weeks ago, and I told my boss that I'm going to go to Joburg for the funeral, and then work the one day – I'm going to take 2 days to go to Joburg, and I'll work from home the one day. And he said: "Dude! You need to go grieve, take 2 leave days." He also informed me to phone iCaz (they're like the well-being people that our company have hired). But the thing is, in my company, your experience really depends on your line manager, so there's not many line managers who are like that, and others wouldn't have suggested that. They would have been like: "Yes, you can work the other one from home," and they probably wouldn't have told me to call iCaz.

Okay, that's very interesting. It's also fascinating to hear that the line manager can have such an impact on your experience, because my Master's is specifically in engineering management, so that's very, very interesting, thank you for sharing that. Then also not entirely related, but you said that some people feel like they need to prove themselves more, would you say that as a woman (I assume that you identify as a woman?), do you feel that being in an engineering, masculine sort of sector makes you feel like you need to prove yourself to a higher extent? I've read a lot of literature on masculinity in engineering and how it can mess with people's identities.

Yes, hundred percent! I mean I can go on and on about this. And also, like <sighs>, I feel like, what can I say... if I can just speak about women in general, they usually take on more care-taking responsibilities in general – it's not so bad anymore, but it's still bad. So what I see here, especially with directors and stuff, maybe they have wives at home that can take care of most of the home-making things, and taking care of the children, so the directors can sit here and push. But for maybe women, or maybe men who are more involved in the care-taking, they can't do that, so you can just see the directors here, especially the directors who are more involved at home, and the others that have most of the home things taken care of, therefore they can usually work the long hours and other things. But for most women, I guess they do take on more of that. Sometimes, a lot of people say women who leave the company, especially after maternity leave, because it's really difficult to juggle the two things – I find it quite sad that caretaking responsibilities are not shared equally or fairly in today's age.

No, one hundred percent, that's a really interesting observation. What can you say about employee well-being in the engineering sector? I know that you touched on it a little bit, about the wellness programme, or company. And do you feel as if companies do enough to ensure their employees' well-being?

I think for a big company like the one I work for, they definitely have to have those things in place, and they do. But when you speak to friends in much smaller companies, especially construction companies, there is no such thing, you know, as those wellness things. They don't have those support systems, they don't even consider them. So I'm just lucky to be in this company that's huge and has those things, but I know most people don't. And most people... I didn't even know I could call iCaz if I was going through something like that, so even if the support systems are there, you barely use them or know about them. They do have refreshers like once a year or whatever, but the thing with engineers, they'll never admit that they need help!

<Laughs> Are you satisfied with your place of work? Do you expect to find new employment in the next 2 years?

I'm looking for new work in the next 2 years, but I think it's because I realised that this line of work is not for me – I do enjoy engineering, but I want to go more in to planning than engineering; I don't know if you understand the difference, but there are transport engineers and transport planners. I don't think I'm not an engineer, but I think I need to go more in to transport planning, so that's why I'm leaving.

Okay, interesting. How would you describe your own productivity in the workplace, and what do you understand by the word 'productivity'?

Productivity would be like... how well are you using your time? So when you sit at work, like outputs – how much output can you get from sitting here at work, and I'm guessing if your output is low, you have a low productivity, and if your output is high, you have a higher productivity. My productivity varies – obviously approaching a deadline it's much higher, but when it's not, it's a bit lower, but yeah, I don't know, I answered the question I hope?

Spot on. And your general perception of productivity in the engineering sector in South Africa, based on what you've seen in the workplace?

Engineers are definitely productive, I think the problem is the government and that stuff that holds us back. But we meet the deadlines pretty quickly. If we don't have enough people on our team, we quickly pull on other people from other teams to make things work. Like I said, the client is always right here, so we'll always do something to meet the deadline.

Then on to the last section, this will be a bit about mindfulness, so first of all, what does the term 'mindfulness' mean to you, what do you understand by mindfulness?

Um... being aware, like sometimes you can operate in like a robotic state, but just being aware of your body, your mind, your feelings, um... I think it's that.

And how do you think mindfulness could affect the 3 job performance traits that you mentioned? So that was attention to detail, good understanding of science (kind of related to learning), and people skills.

Mindfulness is very important, especially with the people skills, especially if you're a manager. And then learning... you cannot learn or understand anything in a state of stress, like for example, in order to be productive or do well or learn, you need to have like eaten well, not worried about finances, not stressed out, worried about something else – so it's important to take care of those fundamental things before doing anything else. The thing with engineers is that they'll push themselves through a horrible state, so I guess you do have to be kind of mindful to pay attention to detail, but engineers will push through anything.

Okay, cool. How do you think mindfulness could affect job performance in the engineering sector, if at all?

I think it's important to be able to know what your body is feeling, what your mind is telling you, because the minute you can address those things, you just become a better person. Therefore, you can be more productive, you can focus more. I've been listening to a lot of podcasts about focus, and I think with being mindful and knowing your state, and having taken care of your state, you'll definitely be more focused with any task.

Fair enough. One of the first things that mindfulness will really do is improve your focus. Some people even argue that all of the benefits from mindfulness are just through improved focus and cultivating that in pretty much every aspect of life. Then lastly, how do you think mindfulness could affect stress and fatigue?

Uh... well mindfulness makes you more aware, so when you're stressed, you know: "Okay, now I'm stressed, I need to get into this state of being 'unstressed'", whereas if you're not mindful, you just be in that state forever and ever, and will probably do things that will make that state worse. So just being mindful of your body, how you're feeling and everything, you'll be able to address those things. I think awareness is the first step to improvement for everything. And then fatigue... same thing, like if you know you're fatigued, you're aware of it, you'll find ways to rest, and probably go speak to your boss and say: "I can't continue, can we get someone else on board?" It's better to admit that, than just push through, but then again engineers will never do that! <Laughs>

Okay, brilliant! Those are all the questions from my side, so if you have any extra comments or reflections on the questions that I asked, or if you have any questions of your own, then please feel free to ask away.

I wanted to just speak about the topic of men and women – I think men tend to push themselves really hard at their job, because obviously with men, your job means a lot, and it says a lot about you, and you obviously want to get a high position, so I would think that... I don't know if I have the correct definition of mindfulness, but women can sense that state more quickly, and find ways. But men... if no one tells them, they can really just push themselves to the limit, and that's probably why mental health is worse with men than women. So I really hope they get the help and support they need, and they realise their identity is not just their job, and there's a lot more to life. I think men really push themselves.

That's a really interesting observation, drawing that juxtaposition between men and women in the workplace. I think amongst men as well, I think something like hustle culture is quite problematic – like you'll see these faux inspirational YouTube videos titled something like: "Sleep is for losers", or just like toxic stuff like that – they go on about how you're always supposed to be motivated, you have to work 16 hours a day if you want to be successful – and that's obviously just not sustainable at all. I really enjoyed chatting to you, thank you for taking the time. Would you be interested in taking part in a mindfulness intervention to observe the effects that it has on your job performance?

<Enthusiastically> Hundred percent, I'm all about this stuff!

E. Instrument (Survey) Questions

Mindfulness Latent Variable

1. I am able to appreciate myself.
2. I see mistakes and difficulties without judging them.
3. I accept unpleasant experiences.
4. I am friendly to myself when things go wrong.
5. In difficult situations, I can pause without immediately reacting.
6. I am patient with myself and others.
7. I rarely break or spill things due to carelessness, not paying attention, or thinking of something else.
8. I find it easy to stay focused on what's happening in the present.
9. I always remember a person's name after I've been told it for the first time.
10. I am aware what I'm doing, and always feel in control.
11. I take time when engaging in activities, and am fully attentive to them.
12. I listen to someone fully, without doing anything else at the same time.

Fatigue Latent Variable

1. Work brings on fatigue.
2. Fatigue interferes with carrying out certain duties and responsibilities.
3. Stress brings on my fatigue.
4. My motivation is lower when I am fatigued.
5. Long periods of inactivity bring about my fatigue.
6. Resting does not reduce my fatigue.
7. Sleeping does not lessen my fatigue.
8. Positive experiences do not lessen my fatigue.
9. I am easily fatigued.
10. Fatigue causes frequent problems for me.
11. Fatigue interferes with carrying out certain duties and responsibilities.
12. Fatigue interferes with my work, family and social life.

Job Satisfaction and Turnover Intention Latent Variable

1. I am satisfied with my job.
2. I feel valued, and my contribution appreciated, at my place of work.
3. I look forward to going to work.
4. My managers always value my feedback and contributions.
5. I am likely to remain with the same employer for the next next 2 years.

Productivity Latent Variable

1. I am productive at my workplace.
2. My mood has little effect on my levels of productivity.
3. Others would describe me as being productive and hardworking.
4. Being at work increases my productivity.
5. Stress has little effect on my productivity levels.

Stress Latent Variable

1. I am frequently stressed at work.
2. I often find myself worrying about things that have not happened yet and are not likely to happen.
3. After a stressful situation arises, it takes me a long time to no longer feel stress.
4. I find it difficult to feel relaxed.
5. I struggle to find a healthy work-life balance.
6. I feel like I have little control over my life at work.

F. Detailed CLDs

Detailed, Synthesised CLD from Section 5.1.

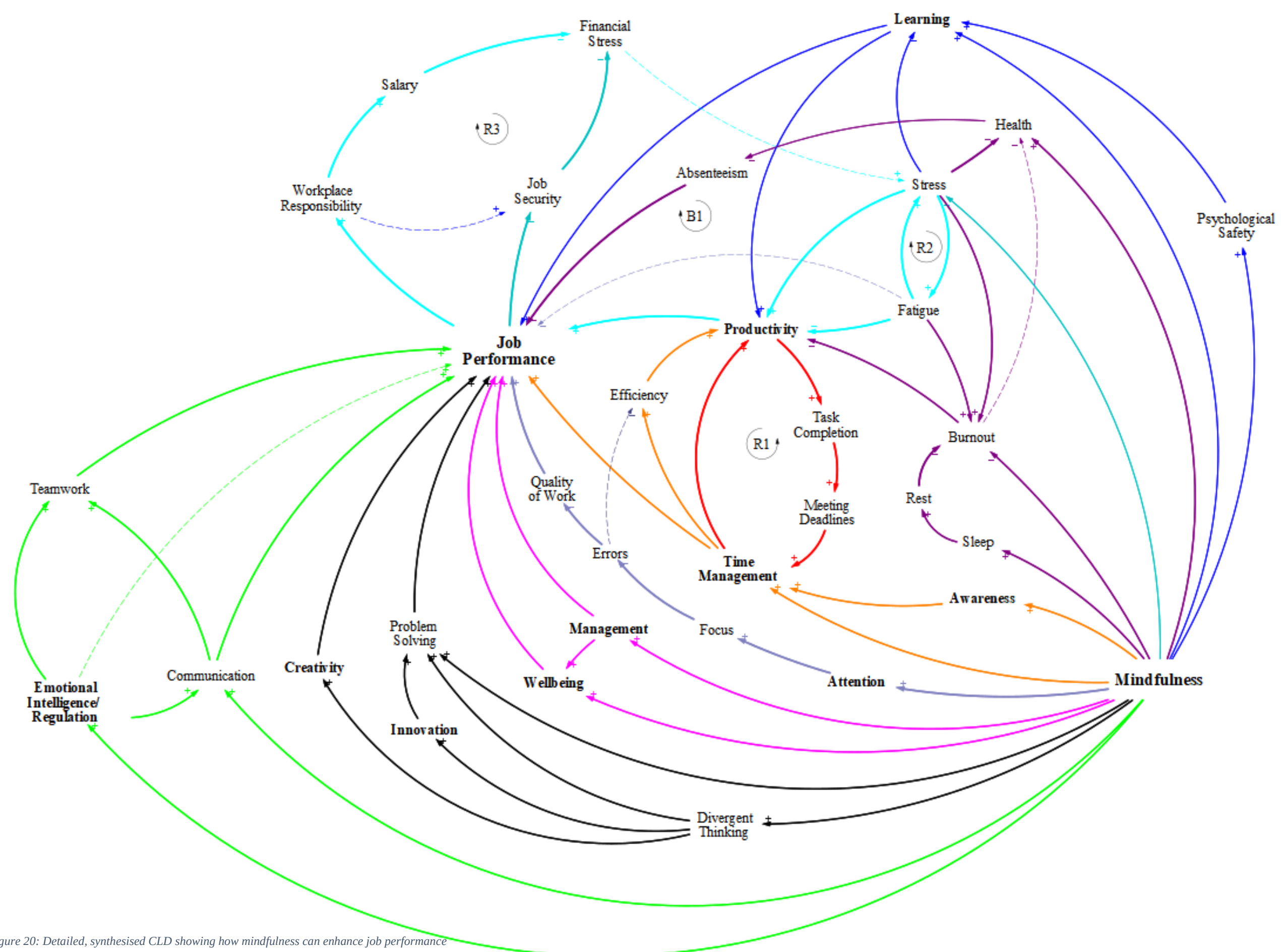


Figure 20: Detailed, synthesised CLD showing how mindfulness can enhance job performance

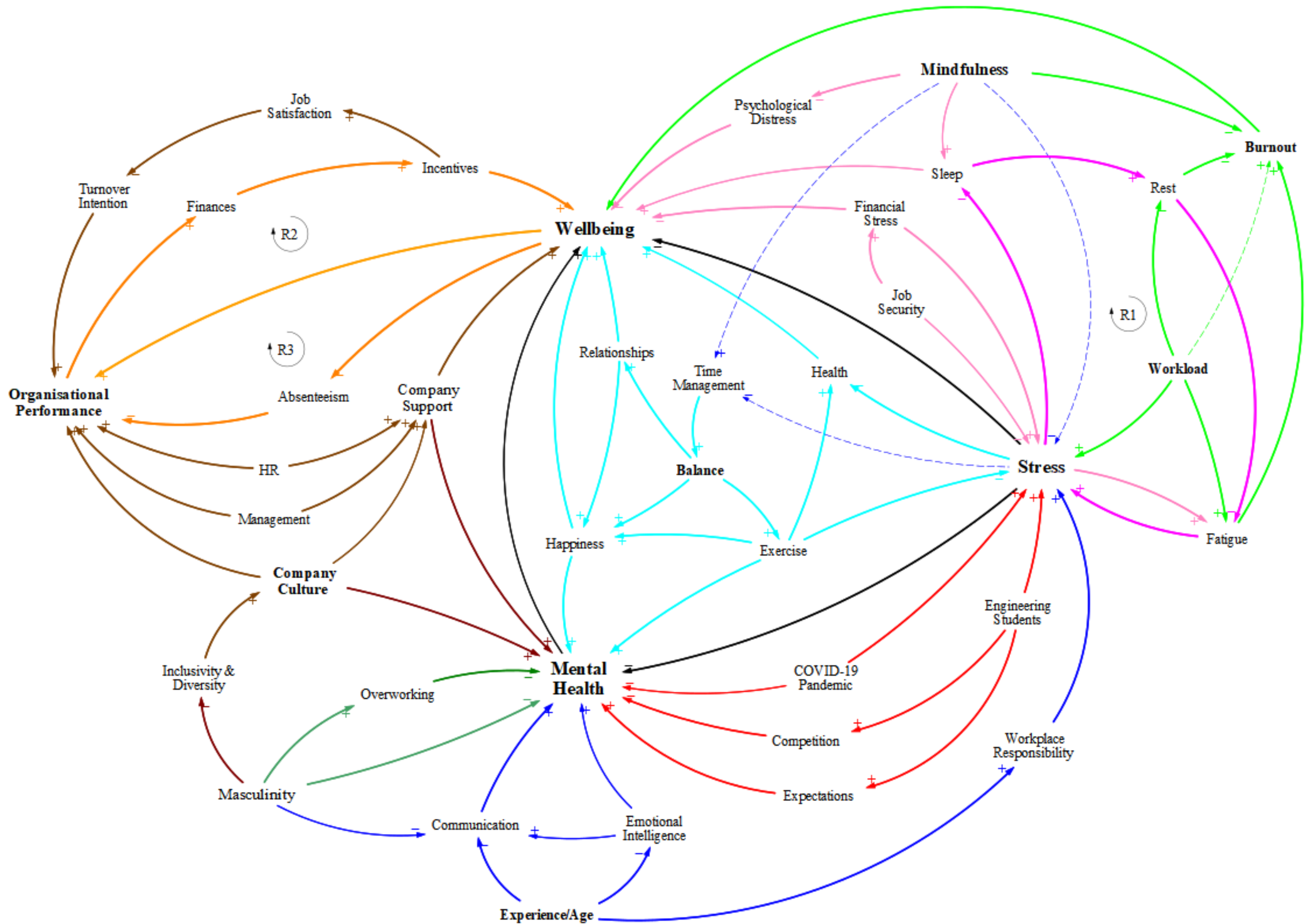


Figure 21: Detailed, synthesised CLD showing how mindfulness can improve employee well-being and mental health

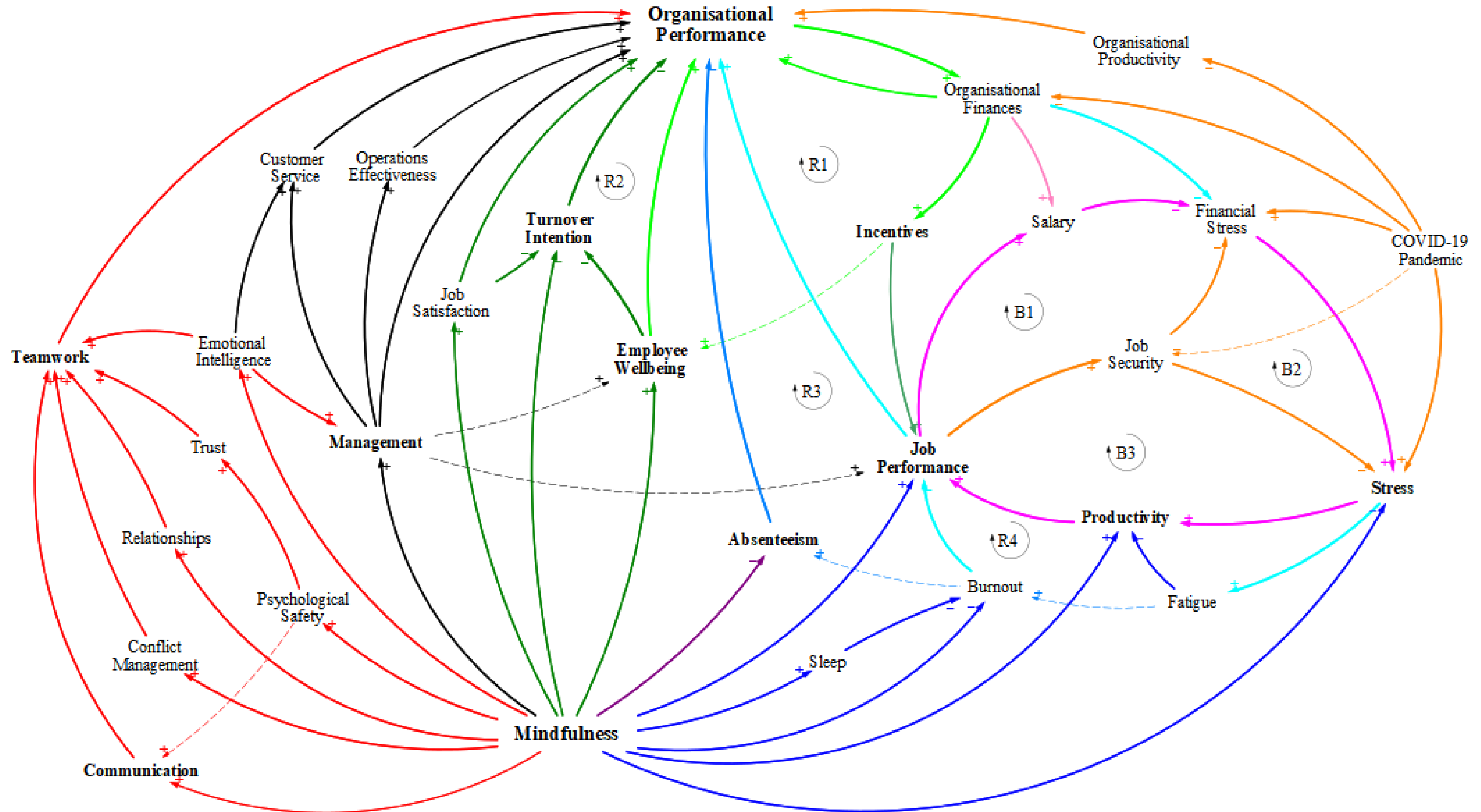


Figure 22: Detailed, synthesised CLD showing how mindfulness can improve organisational performance